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PART 1 – GENERAL

1.1 Work Included	.1	This section specifies requirements for construction water mains, and service connections. Work includes supply, installation and testing of pipe, fittings and related appurtenances.	
1.2 Related Sections	.1	Earthwork	Section 31 20 00
	.2	Precast Manholes, Catch basins, and Valve Chambers	Section 33 39 00
	.3	Reinstatement	Section 32 98 00
	.4	Concrete	Section 03 30 00
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	.6	Standard Details	Section 39 00 00

1.3 Reference Standards	.1	ANSI/ASME B16.1-2005	Fittings, Flanges and Valves
	.2	AWWA B300-04	Hypochlorites
	.3	AWWA B301-04	Liquid Chlorine
	.4	ANSI / AWWA C104 / A21.4-08	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
	.5	ANSI / AWWA C105 / A21.5-05	Polyethylene Encasement for Ductile Iron Pipe System
	.6	ANSI / AWWA C110 / A21.10-08	Ductile Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm) for Water and Other Liquids
	.7	ANSI / AWWA C111 / A21.10-07	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

.8	AWWA C115	Flanged Ductile Iron Pipe and Ductile Iron or Gray Iron Threaded Flanges
.9	ANSI / AWWA C151 / A21.51-02	Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
.10	ANSI / AWWA C153 / A21.53-06	Ductile Iron Compact Fittings 3 in. through 24 in. (76 mm through 610 mm) and 54 in through 64 in. (1,400 mm through 1,600 mm), for Water Service
.11	AWWA C500	Gate Valves for Water and Sewage Systems
.12	ANSI / AWWA C502-05	Dry-Barrel Fire Hydrants
.13	ANSI / AWWA C504-06	Rubber-Seated Butterfly Valves
.14	ANSI / AWWA C509-01	Resilient Seated Gate Valves, for Water and Sewerage Systems
.15	ANSI / AWWA C600-05	Installation of Ductile Iron Water Mains and Their Appurtenances
.16	ANSI / AWWA C606-04	Grooved and Shoulder Joints
.17	ANSI / AWWA C651-05	Disinfecting Water Mains
.18	ANSI / AWWA C800-05	Underground Service Line Valves and Fittings
.19	ANSI / AWWA C900-07	Polyvinyl Chloride (PVC) 150 mm – 300 mm diameter Pipe

	.20	ASTM A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
	.21	ASTM A183-03	Carbon Steel Track Bolts and Nuts
	.22	ASTM A276-08a	Stainless and Heat-Resisting Steel Bars and Shapes
	.23	ASTM B 62-02	Composition Bronze or Ounce Metal Castings
	.24	ASTM B 88-03	Seamless Copper Water Tube
	.25	ASTM B 418	Cast and Wrought Galvanic Zinc Anodes
	.26	CAN/ULC S701-05	Thermal Insulation, Polystyrene, Boards and Pipe Covering
	.27	CAN/CSA B64.10M	Backflow Prevention Devices - Selection, Installation, Maintenance and Field Testing
	.28	CAN/CSA B137.3M	Polyvinyl Chloride (PVC) Pipe
	.29	ASSE 1060	Performance Requirements for Outdoor Enclosures for Backflow Prevention Assemblies

1.4 Shop Drawings .1 Submit shop drawings in accordance with Section 01 10 00 for all pipe, fittings, valves and all other items necessary for a complete water main installation.

1.5 Certificates .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00.

1.6 Handling and Storage .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables

passing through pipe bore. Do not damage coatings or linings.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

.3 Store hydrants and valves to prevent retention of water and damage by freezing.

1.7 Scheduling of Work

.1 Coordinate and organize work to minimize interruptions to existing services.

.2 Notify HRWC and building occupants a minimum of 24 hours in advance of planned interruptions in service.

.3 Do not interrupt water service except between 9:00 a.m. and 4:00 p.m. local time, unless otherwise authorized.

.4 Notify Fire Department of any planned or accidental interruption to water service.

PART 2 – PRODUCTS

2.1 General

.1 Diameter, material and strength class of pipe and fittings: as indicated.

2.2 Ductile Iron Pipe and Fittings

.1 Pipe: Special Class 52, to AWWA C151 latest revision.

.2 Fittings: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 1035 kPa for cast-iron, 1720 kPa for ductile-iron.

.3 Hydrant Tee: to AWWA C153 and AWWA C111 c/w ductile-iron rotatable mechanical joint gland on plain end branch.

.4 Pipe Coatings:

.1 Interior: cement mortar lining with asphaltic seal coat to AWWA C104.

.2 Exterior: manufacturer's standard coating.

.5 Joints: mechanical or push-on to AWWA C111; flanged where indicated, to AWWA C110 or C153 with Class 125 flanged ends to ANSI B16.1 (grooved type coupling joint with malleable iron couplings and gaskets).

2.3 Polyvinyl Chloride Pipe

.1 Pipe and joints: to be certified to CAN/CSA B137.3 m and conform to AWWA C900 class 150, ductile iron outside diameter gasketed bell-end joint.

2.6 Hydrants

.1 Dry barrel type: to AWWA C502 and as follows:

.1 Depth of bury: as per pipe specification.

.2 Barrel: two-piece with safety break-away flange stem.

.3 Main valve: compression type, 134 mm minimum diameter.

.4 Inlet connection: mechanical joint, 150 mm diameter.

.5 Nozzles: two hose and one pumper. East Region – two 2.5 inch hose nozzles nominal size 3 7/32 inch with 5 threads/inch, and one pumper nozzle nominal size 4 29/32 inch with 6 threads/inch. West/Central Regions - two, 2.5 inch hose nozzles nominal size 3 7/32 inch with 5 threads/inch, and one pumper nozzle nominal size 4 15/16 inch with 5 threads/inch. **Note**: For further clarification, refer to HRWC Standard Drawing No. 2401.

.6 Direction of opening: counterclockwise.

.7 Operating nut: 32 mm square.

.8 Colour: As below with nozzle caps and tops as defined by operations.

.1 Hydrants on Pockwock Lake Supply System – Safety Orange – Glidden DevGuard No. 4308

.2 Hydrants on Lake Major Supply System – Fire Engine Red

.3 Private Hydrants – Safety Yellow – Glidden DevGuard No. 4338

.4 Hydrant tops and caps to be colour coded as follows:
Pressure Boosted - Safety Yellow
Gravity - Grey
Pressure Reduced - As per the body of the hydrant
Note: For further clarification, refer to HRWC Standard Drawing No. 2401. Confirm hydrant top colour requirements with HRWC prior to painting**.**

.9 Acceptable products:

.1 Clow Brigadier ‘M67’
.2 Canada Valve ‘Century’
.3 Mueller ‘Centurion’

2.7 Gate Valves

.1 Standard buried type: to AWWA C509 up to and including 300 mm, minimum working pressure rating 1380 kPa and as follows:

.1 Body: cast-iron with mechanical joint ends.

.2 Mechanism: solid resilient wedge, epoxy coated, bonnet, ss. packing gland nuts and bolts, non-rising spindle, and O-ring seals.

.3 Direction to ***close:***

- All serviced areas within the former City of Halifax: counterclockwise.
- All other areas: clockwise.

Note: For further clarification, refer to HRWC Standard Drawing No. 2400.

.4 Operating nut: 50 mm square.

.5 Acceptable products:

.1 Clow McAvity F-6100 Resilient Seat Valve
.2 Mueller A2360-23 Resilient Wedge Valve
.3 AVK Series 25/00 Resilient Seat

.2 Tapping valve: to AWWA C509 up to 300 mm, minimum working pressure rating 1380 kPa and as follows:

.1 Body: cast-iron with flanged by mechanical joint ends.

.2 Mechanism: solid resilient wedge, epoxy-coated, ss. bonnet, ss. packing gland nuts and bolts, non-rising spindle, and O-ring seals.

.3 Direction to ***close***:

- All serviced areas within the former City of Halifax: counterclockwise.
- All other areas; clockwise.

Note: For further clarification, refer to HRWC Standard Drawing No. 2400.

.4 Operating nut: 50 mm square.

.5 Acceptable Products:

.1 Mueller A2360-19 Resilient Wedge
.2 Clow F-6114 Resilient Seat Valve

.6 Tapping sleeve: stainless steel, or epoxy coated (minimum epoxy coating 150 microns c/w stainless steel bolts).

.1 Acceptable products:

.1 Mueller H-304 (SS)
.2 Rockwell 622
.3 Romac FTS420
.4 Robar 6906
.5 Robar 6606 (SS)
.6 Smith Blair 622
.7 Ford FTSC

.3 Chamber valve: to AWWA C509 up to 300 mm, minimum working pressure rating 1380 kPa, UL and FM approved and as follows:

.1 Body: cast-iron with Class 125 flanged ends to ANSI B16.1.

.2 Mechanism: solid resilient wedge gates, O.S. & Y., rising stem, and handwheel.

.3 Direction to close: clockwise.

.4 Acceptable product:

.1 Clow/Kennedy 8068 Resilient Seat Valve
.2 Mueller R2360-6

.4 Epoxy coat all gate valves with minimum 150 microns coating.

2.8 (i) Butterfly Valves

.1 Buried: to AWWA C504 greater than 300 mm, short body, Class 150B, minimum pressure rating 1035 kPa and as follows:

.1 Body: cast-iron with mechanical joint ends.

.2 Mechanism: cast-iron, cast steel, alloy cast-iron or ductile-iron disc, type 304 s.s. shafts to ASTM A276, rubber seated for positive shut-off at minimum 1 MPa differential pressure, either direction.

.3 Direction to ***close***:
- All serviced areas within the former City of Halifax; counterclockwise.
- All other areas; clockwise.

Note: For further clarification, refer to HRWC Standard Drawing No. 2400.

.4 Operating nut: 50 mm square.

.5 Acceptable products:

.1 Mueller Lineseal III
.2 Clow M&H Style 4500 and 1450

.2 Chamber: to AWWA C504, greater than 300 mm, short body, Class 150B, minimum pressure rating 1035 kPa and as follows:

.1 Body: cast-iron with Class 125 flanged ends to ANSI B16.1.

.2 Mechanism: cast-iron, cast steel, alloy cast-iron or ductile-iron, type 304 s.s. shafts to ASTM A276, rubber seated for positive shut off at minimum 1 MPa differential pressure either direction. Provide hand wheel operator.

.3 Direction to ***close***: clockwise.

.4 Acceptable products:

.1 Mueller Linseal III.
.2 Clow M7H Style 4500 and 1450.

.3 Epoxy coat all butterfly valves with minimum 150 microns coating.

2.8 (ii) Check Valves

.1 Wafer swing check: wafer style, ANSI series 125, minimum working pressure 2 MPa, and as follows:

.1 Body: ductile-iron with s.s. disc.

.2 Spacers: Teflon O-rings.

.3 Seat: Buna N O-ring seal.

.4 Acceptable product:

.1 CheckRite, Model 210.

2.8 (iii) Backflow Prevention Devices

.1 Backflow prevention devices in accordance with CSA-B64.

.2 Style determined by hazard as indicated by HRWC.

.3 Backflow prevention devices on fire protection systems to be UL and FM approved.

2.8 (iv) Pressure Reducing Valves

.1 For use on services, sizes less than 100 mm diameter:

Acceptable Products:

.1 Watts Series No. U5B, No. 25 AUB, No. 223
.2 Ross Model T. Series, Model 82EP

.2 For use on transmission and distribution mains:

(Note: On PRV's 100 mm and larger, the pilot control system shall include a second pilot with a single, manually adjusted set point with isolating ball valves. The backup pilot shall be piped to sense the downstream pressure beyond any flow restrictions that may be part of the control system. This requirement shall apply to both the piston style and diaphragm style valves.)

.1 Piston type valve:

.1 Body: cast iron, globe design with flanged covers from which all inside parts are accessible without its removal from the line.

Flanges shall be in accordance with ANSI B16.1, Class 125.

.2 Seat: single seat design with seat base equal to size of valve. Piston and seat component metal parts to be bronze to ASTM B62. Piston shall be guided and cushioned to ensure positive closure and be furnished with indicator rod as an integral part of the valve to show position of piston.

.3 Packing: leather to ensure tight closure and prevent metal to metal wearing of surfaces of piston.

.4 Pilot valve and component parts: bronze of single seated balance design type, globe body pattern. Hydraulic pilot valves shall be diaphragm operated and spring loaded permitting convenient adjustment over the specified range

.5 Acceptable products:

.1 Ross Model – 40-PR-SL/W
Stainless Steel trim with digital limit switch connected to RTU.

.2 Diaphragm type globe valve:

.1 General: hydraulically operated globe valve with inner valve assembly both top and bottom guided by means of replaceable bearing bushings. Main valve shall be completed with a direct acting, spring loaded, diaphragm actuated pressure reducing pilot valve.

.2 Body: ductile iron to ASTM A536, with heat fused internal and external epoxy coating to NSF 61 or FDA standards and 150 lb. flanges complete with stem position indicator.

.3 Seat: stainless steel stationary seat, with abrasion and erosion resistant mechanically held, polyurethane disc. Valve actuation shall be by a flat diaphragm and shall consist of nylon fabric, bonded with synthetic rubber. Lip seals or packing may not be used to seal actuator.

.4 Pilot valve: easily adjustable and equipped with a stainless steel seat and urethane disc. Pilot circuit shall include a strainer, and three shut-off cocks.

.5 Acceptable products:

.1 Singer 106-PR
.2 Cla-val 90-01

.6 Diaphragm valve to be supplied with digital limited switch connected to the RTU if it is the larger valve in the standard chamber configuration.

.3 The size, configuration, type of pressure reducing valves and additional valve features for a specific application will be determined by HRWC based on functional performance requirements for the location.

2.8 (v) Combination Air Relief and Vacuum Valves .1 75 mm diameter and larger:

.1 Heavy duty type of cast-iron body with bronze trim and combination of small orifice and large orifice units. Small orifice size shall be 3.2 mm. Valves shall be suitable for operation at 1 MPa working pressure and have flanged ends to ANSI B16.1.

.2 Operation shall be through independent floating stainless steel buoyballs located in both orifices.

.3 Orifices shall be capable of expelling air at a high rate during filling and at a low rate during operation

and will admit air while draining the pipeline. Seats shall be replaceable.

.4 Valves shall have no moving parts except for stainless steel balls which shall remain in the throat area discharging air without blowing shut or collapsing the balls.

.5 Valves shall not leak in the closed position when pipeline is filled.

.1 Acceptable products:

.1 G.A. Industries Ltd., Fig 960-C
.2 APCO, Model 147C
.3 Crispin, Model AL30

.6 Corporation stop: Brass c/w IPS inside and outside thread, size as indicated

.1 Acceptable products:

.1 Mueller A-218

.7 Service saddle: bronze, double stainless steel strap type.

.1 Acceptable manufactures:

.1 Rockwell
.2 Mueller
.3 Ford
.4 Robar

.8 Stainless steel nipples and ball valve are to be provided between saddle and air relief valve.

.9 Stainless steel gooseneck pipe arrangement to be provided at the threaded outlet for discharge protection.

.2 50 mm diameter:

.1 Heavy duty type body consisting of metal and nylon reinforced glass fibre high impact plastic, with a combination small and large orifice. Small orifice shall be stainless steel with a minimum opening of 1.00 mm, valve shall be suitable for working at 1.5 MPa working pressure. Size as indicated.

.2 Operation shall be independent floats located in both orifices.

.3 Orifices shall be capable of expelling air at a high rate during filling and at a low rate during operation and will admit air while draining the pipeline. Seats shall be replaceable.

.4 Valves shall have no moving parts except for the floats which shall remain in the throat area discharging air without blowing shut.

.5 Valves shall not leak in the closed position when pipeline is filled.

.1 Acceptable products:

.1 Bermad, Model No. 4415
.2 Valve-Matic, Model 202C
.3 APCO, Model 145C
.4 Crispin, Model AL20

.6 Corporation stop: Brass c/w IPS inside and outside thread, size as indicated.

.1 Acceptable product:

.1 Mueller A-218

.7 Service saddle: bronze, double stainless steel strap type.

.1 Acceptable product:

.1 Mueller
.2 Rockwell

.3 Ford
.4 Robar

.8 Stainless steel nipples and ball valve are to be provided between corporation stop and air relief valve.

.9 Stainless steel gooseneck pipe arrangement to be provided at the threaded outlet for discharge protection.

2.9 Valve Boxes .1 Valve Boxes: to AWWA C500 and as follows:

.1 Cast iron, slide type, adjustable for depth of pipe below finished grade or; composite valve box with one piece ABS lower and ductile iron upper (min. length 686mm). Maintain minimum of 125mm between the top of the lower and flange of the upper.

.2 Covers marked “Water”, “Sprinkler”, “Service” or “Hydrant”, as applicable.

.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

.4 Have clear opening of 135 mm.

.5 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.

.6 Acceptable products:

.1 IMP Model V.1
.2 Mueller MVB 070C-27 Composite Valve Box

2.9 (i) Bolts for Buried Service .1 T-head bolts and nuts:

.1 Low alloy Corten steel

2.10 Service Pipe and Fittings .1 Service connections 100 mm and larger refer to pipe specifications section 2.2 and 2.3.

.2 Domestic services 50 mm and smaller:

.1 Copper tubing: to ASTM B88, type K annealed, minimum pressure rating 1035 kPa.

.2 Joints: compression type, minimum pressure rating 1035 kPa.

.3 Corporation stop: brass to ASTM B62, compression type, inlet threads to AWWA C800, minimum pressure rating of 1035 kPa.

.1 Acceptable products:

.1 19-50mm Mueller B25008 (Ball Valve)
.2 19-50mm Cambridge Brass 301-A3H3 to 301-7H7 (Ball Valve)

.4 Curb stop and drain: brass to ASTM B62, compression type joints. Minimum pressure rating of 1035 kPa.

.1 Acceptable products:

.1 19-50mm Mueller H15219 (Oriseal)
.2 19-50mm Cambridge Brass 203-H3H3 to 203-H7H7 (Ball Valve)

.5 Insulated couplings for use with PVC watermains.

.1 Acceptable products:

.1 19-50mm Mueller
.2 19-50mm Cambridge Brass

.6 Service saddle: bronze body, confined O-ring seal cemented in place, double stainless steel strap type and straps suitable for connecting to a main. Outlet tapped and threaded to AWWA C800.

.1 Acceptable products:

.1 Rockwell

.2 Mueller
.3 Ford
.4 Robar

.7 Service Box: adjustable type, cast iron bottom section, stainless steel operating rod and cotter pin, cast iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service boxes are to be magnetized to facilitate future locates. Service box to have appropriate foot piece. 38 mm and 50 mm curb stops to be fitted with full size valve boxes.

.1 Acceptable products:

.1 Mueller
.2 Clow

2.11 Gaskets and Bolts for Flanges

.1 Flanged: Unless otherwise specified, full face one piece gaskets to be supplied for all flange joints. Gaskets to be red virgin rubber material of 3 mm thickness. Unless otherwise specified, all nuts and bolts to be American Standard threads of the coarse thread series, conforming to ANSI B18.2.1. For sizes 30 mm diameter and below, threads to be conventional type and material conforming to ASTM A-307 (Grade B). Material for bolts and studs 36 mm diameter and above to conform to ASTM A193 (Grade B-7) or to ASTM A325 (S.A.E. Grade 5). Nuts for all sizes to conform to ASTM A-194 (Grade 2H). Bolt to be hexagonal semi-finished nuts. Length of any bolt to be such that it will not project beyond nut more than 10 mm or less than 5 mm and no bolt shall be less than diameter of the hole in which it fits by more than 3 mm. Bolts to be utilized for all flanged joints unless otherwise indicated. Studs or “stud bolts” may be used for certain special connections only when approved by the HRWC. Unless otherwise specified, bolts and nuts for flanged connections to be steel as specified above.

2.12 Couplings

.1 Mechanical joint sleeve type: to AWWA C110; use on new ductile iron pipe. Provide spacer ring between pipe ends. Where gap between pipe ends is less than 10 mm, spacer not required.

.2 Grooved and shoulder type: to AWWA C606 with malleable iron housing, halogenated butyl gasket and heat treated, plated carbon steel bolts and nuts to ASTM A183. This type of coupling is not to be used in new ductile iron pipe buried installations.

.1 Acceptable products:

.1 Victaulic

.3 Collar type: steel with minimum pressure rating of 1035 kPa, appropriate to the type and size of pipe being joined, epoxy coated with type 316 stainless steel bolts and nuts. This type of coupling is not to be used in new ductile iron pipe installations.

.1 Acceptable products:

.1 Robar
.2 Dresser
.3 Romac
.4 Viking Johnson
.5 Baker

2.13 Thrust Restraint

.1 Thrust blocks and anchors: Use 25 MPa concrete and 15 M, Grade 400 reinforcing steel where indicated.

.2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111 and C153 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 KPa and minimum safety factor of 2:1. No special tools shall be required for installation.

.1 Acceptable products:

.1 Ebba Iron Megalug
.2 Ford
.3 Star
.4 Mueller Aquagrip
.5 Field Lok Gasket
.6 MJ Field Lok
.7 Tufgrip
.8 McWanes Sure Stop 350 (100mm - 300mm)

.3 Mechanical joint restraint devices are generally to be used in combination with concrete thrust blocks. Mechanical joint restraint devices alone are permitted on 11¼, 22½ and 45 Deg. horizontal bends for sizes up to 300 mm diameter. No pipe joints are permitted within the "minimum pipe length" as denoted in Standard Drawing No. 3272. All restrained joints / pipe shall be identified in the field prior to backfilling by wrapping the pipe with a red colored adhesive tape. The joint / pipe shall be wrapped with two bands of adhesive tape.

.4 Thrust block design requirements are outlined in HRWC Standard Drawing No. 2383.

2.14 Disinfectant

.1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.

.2 Liquid chlorine: to AWWA B301.

2.15 Reducing Agent

.1 Hydrogen peroxide, 35% by mass commercial grade.

2.16 Insulation

.1 Where insulation is indicated on the drawings it shall be to CAN/ULC S701-05, type 4, for expanded polystyrene.

.1 Acceptable products:

.1 Styrofoam H140
.2 Formular 400

2.17 Marker Stake

.1 Timber marker stake – 40 mm x 90 mm painted blue. Must be installed as location marker for end of service at property line.

2.18 Geosynthetic

.1 Synthetic fibre, rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Non-woven construction, with minimum thickness of 2 mm and minimum density of 200 g/m^2.

2.19 Anode Packs

.1 Zinc anodes (ZN24-48), complete with clamps, as directed.

2.20 Polyethylene Encasement

.1 Encasement to be 200 micron polyethylene tube or sheet conforming to AWWA C105.

2.21 Meter and Air Release Valve Chambers

.1 Sump pump – Heavy duty, submersible type with auto start and shut-off non-clog impeller, stainless steel shaft, water-lubed bronze bushing, strainer, weights and 31 mm heavy duty vertical check valve.

.2 Frame and Cover – Frame and cover with HRWC marked in center of cover.

.1 Acceptable products:

.1 IMP. No. R-90.

.3 Air release/Air vacuum valve chamber. Minimum size 1200 mm. Precast concrete sections with "O" ring gasket. Cast in place concrete floor or bottom section with precast floor. As per HRWC Standard Drawing No. 2398 A & B.

.4 Meter chamber for 38 mm and 50 mm diameter services as per HRWC Standard Drawing No. 2397.

.5 Typical meter chamber for meters larger than 50 mm as per HRWC Standard Drawing No.'s 2395 and 2396.

.6 Meter chamber for PVC watermain leak detection and system monitoring. Refer to HRWC Standard Drawing No. 5553.

.7 Air vent and drain as per HRWC Standard Drawing No. 2398 A & B.

2.22 Pressure Gauges

.1 Pressure gauges shall have increments of no more than 14 kPa (2 psi); a minimum of 100 mm faced diameter, liquid filled, graduated in p.s.i. and kPa and have an accuracy of 3% at maximum reading. Stainless steel nipple and ball valve to be provided between water main and pressure gauge.

.1 Acceptable products:

.1 Ametek P545
.2 Ashcroft Duralife 35-1009AWL-2L
.3 Marsh P0154P
.4 Winters Part No. P606

2.23 Heated Outdoor Enclosures

.1 Pre-manufactured outdoor enclosure for backflow pevention device to ASSE 1060.

.1 Acceptable products:

.1 Hot Box
.2 Hydrocowl

2.24 Protective Coating

.1 Anti-corrosion petrolatum paste, tape and mastic.

.1 Acceptable products:

.1 Winn & Coates (Denso) Ltd.
.2 Trenton
.3 Petro
.4 Tapecoat
.5 STAC

2.25 Trace Wire

.1 Trace wire shall be RWU90, number ten gauge (AWG), single strand, insulated copper wire with 60 mil of black, cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial applications or approved equivalent.

.2 All spliced or repaired wire connections in the tracer wire system shall be made using a Model Number 454, Catalogue Number 30-454, Wing Nut Wire Connector (for two or four number ten wires), or approved equivalent, and made waterproof using an approved buried service wire closure. The buried service wire closure shall be either a Klik-It II Number C8816 Buried Service Wire Closure or a Raychem GHFC-2-90 H-Frame Gel Closure or approved equivalent.

PART 3 – EXECUTION

3.1 Preparation

.1 Carefully inspect products for defects and remove defective products from site.

.2 Ensure that pipe, fittings, valves and hydrants are clean before installation.

3.2 Trenching, Bedding and Backfilling

.1 Do trenching, bedding and backfilling to Section 31 20 00 except as specified differently in this document or HRWC standard drawings.

.1 Common Selected Backfill as defined in Section 31 20 00 as follows:

Common: excavated soil which is not rock, unsuitable, or topsoil.

Selected Backfill: common which is free from stumps, trees, roots, sods, organics, rocks, boulders, and masonry larger than 200mm in any dimension; and other deleterious materials.

.2 Use Type 1 gravel for pipe bedding and protection unless otherwise specified.

.3 Clear stone may be used in wet or freezing conditions only where specified or with the prior approval of the engineer.

.4 Blasting for rock removal shall not be permitted within 10 m of an existing water main.

.5 Break rock 3m beyond end of watermain and lateral(s) for full trench width.

3.3 (i) Buried Pipe Installation

.1 Lay and join pipe, fittings, and valves, as specified herein and according to manufacturer's published instructions.

.2 Do not lay pipe and fittings when trench bottom is frozen, under water or when trench conditions or weather are unsuitable.

.3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within the following tolerances:

Horizontal Alignment: 150 mm
Vertical Alignment: 75 mm

.4 Face bell ends in direction of laying. On grades of 5% or greater, lay pipe up grade. For grades exceeding 16%, install appropriately designed gradient thrust restraint.

.5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.

.6 Do not use excessive force to join pipe sections.

.7 Install gaskets in accordance with manufacturer's published instructions. Use only lubricant approved for potable water. During cold weather, store gaskets in heated area to assure that gaskets remain flexible.

.8 Align pipes carefully before joining.

.9 Support pipes as required to assure concentricity until joint is properly completed.

.10 Keep pipe joints free from mud, silt, gravel or other foreign materials.

.11 Avoid displacing gasket or contaminating with dirt, or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed. **Do not** reuse a gasket that has been contaminated with petroleum products.

.12 Complete each joint before laying next length of pipe.

.13 Where deflection at joints is permitted by the Engineer, deflect only after spigot is fully inserted in bell. Do not exceed joint deflection recommended by manufacturer.

.14 At structures, provide flexible joint not more than 300 mm from outside face of structure. Support pipe between structure wall and first joint with 20 MPa concrete

.15 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating. Leave smooth beveled edge.

.16 For corrosion protection, install polyethylene on ductile-iron pipe and fittings, as detailed on HRWC Standard Drawing No. 2380. Install zinc anodes on all valves, hydrant bases, and copper service connections, as detailed on HRWC Standard Drawing No. 2390. Care must be taken when handling poly wrapped pipe. Any damage to the polyethylene must be repaired to the Engineer's satisfaction.

.17 Give sufficient notice so that appropriate inspection and approval of pipe installation can be undertaken by the HRWC, if so desired.

3.3 (ii) Standard Chamber Pipe Installation

.1 Flanges joints:

.1 Clean all flanges with a wire brush worked parallel to servations prior to assembling joints.

.2 Use gasket lubricant to ease gasket installation.

.3 During assembly, tighten diametrically opposing pairs of bolts simultaneously.

.2 Victaulic joints:

.1 Inspect joint, pipe or nipple end to ensure material is free of chuck marks, mill scores, dents or burns prior to assembling joint.

.2 Apply a silicone graphite paste lubricant on pipe or nipple ends and on lips and back of gasket prior to assembly.

.3 Stainless steel pipe:

.1 Clean stainless steel pipe and fittings of burns, dents and other imperfections prior to welding.

.2 Use only certified welders experienced in welding stainless steel pipe.

.3 Ensure welds are free from interior projections. Ground smooth exterior welds.

.4 Use only stainless steel chisels, hammers, brushes and the like to assemble stainless steel pipe.

.5 Cut stainless steel pipe by sawing. Burning is not permitted.

3.5 Hydrant Installation

.1 Install hydrants at locations indicated or where directed.

.2 Install 150 mm gate valve and cast-iron valve box on hydrant anchor tee, as indicated.

.3 Set hydrant plumb, with hose outlets parallel to roadway, pumper connection facing roadway and breakaway flange, as indicated on HRWC Standard Drawing No.'s 2384 and 2385.

.4 Provide mechanical joint restraint on all joints from the hydrant tee to the hydrant. In addition to joint restraint, provide concrete thrust blocks on all hydrants. Do not obstruct drain holes.

.5 Provide drainage not less than 0.5 m^3 in volume and backfill with clear stone to a level 150 mm above top of hydrant lead from hydrant to main.

.6 Place geosynthetic over clear stone from hydrant to main.

.7 Where water table is above drain holes, notify HRWC. Where hydrant cannot be appropriately relocated, plug drain holes and advise HRWC.

.8 Hydrants that come off a service connection on private property are considered 'private' unless approved by the HRWC. Paint private hydrants "safety yellow".

.9 Set back hydrants a minimum of 700 mm from face of curb to center of hydrant on local streets, 850 mm on all other urban streets, and behind the ditch for rural roads as per HRWC Standard Drawing No.'s 2384 and 2385.

.10 Immediately upon installation of hydrants, place a 300 mm x 300 mm blue "hydrant out of service" marker on each hydrant pumper nozzle. Maintain markers on hydrants and remove when system is taken over by HRWC.

.11 Where the installation of bollards is directed by HRWC, or requested by the developer, they shall be installed in accordance with Standard Drawing No. 4148.

3.6 Valve Chambers

.1 Construct valve chambers where and as indicated in accordance with applicable sections. Do not allow valve chamber to rest upon pipe.

3.7 (i) Valves and Valve Boxes

.1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.

.2 On direct buried valves, install valve boxes plumb and centered over operating nut, and true to line and grade.

.3 Install zinc anodes on all valves as detailed on HRWC Standard Drawing No. 2390.

.4 Place select backfill material, maximum size 50 mm around valve box to subgrade.

.5 When valves are installed with cover in excess of 2.0 m, provide a valve stem extension in accordance with HRWC standards.

.6 Where details of road or easement construction do not dictate asphalt paving at valves an asphalt pad may be required around the valve box as indicated on Standard Drawing No. 3635.

.7 Valves installed on PVC mains shall have a 450 mm x 450 mm pre-cast concrete block placed underneath for support. Refer to PVC handbook installation guide.

3.7 (ii) Thrust Restraint

.1 Where concrete thrust blocks are required provide formed thrust blocks to undisturbed ground on all tees, bends, plugs and caps. Keep joints and couplings free of concrete and construct, so as to avoid conflict with manholes in dual pipe trenches.

.2 Backfill over thrust blocks when concrete has sufficient strength and can withstand earth pressure.

.3 Provide mechanical joint restraint devices where specified.

.4 Mechanical joint restraint alone is permitted on 11¼, 22½ and 45 Deg. horizontal bends of 300 mm diameter or smaller.

.5 Where mechanical joint restraint is used alone, provide a single length of pipe within the "minimum pipe length" denoted in Standard Drawing No. 3272.

.6 Reaction backing for plugs and caps shall be of timber blocking (hardwood sized to withstand thrust restraint against undisturbed earth or against a concrete thrust block). Install blocking to allow future removal without disturbing pipe, cap or bedding.

.7 Place polyethylene on bend before pouring concrete thrust block.

3.8 Service Laterals

.1 General

.1 Service size and configuration to be as approved by the HRWC dependent on required flow, internal plumbing arrangements and peak domestic demand. Install service lateral in accordance with HRWC Standard Drawings.

.2 Minimum domestic water lateral sizing to be as follows:

20mm (for single residential domestic services)

25 mm (for single residential domestic services) where:

- pressure less than 345 kPa (50 psi) or
- set back greater than 30 m (100')

25 mm minimum (for domestic commercial uses)

.3 Each lot and / or building shall have a separate water service from the building to the water main unless otherwise approved by the HRWC.

.4 The HRWC does not warrant or guarantee the condition of existing water mains at the proposed location of any service connection.

.5 Existing services that are to be left dormant due to the demolition of structures may be disconnected and abandoned at the curb stop, provided they meet current HRWC Specifications and with the approval of the Engineer. The disconnection must be inspected by the HRWC's representative. All other services shall be excavated and disconnected at the water main at the expense of the developer /contractor. A meter will not be installed until disconnection of the existing service is complete.

.6 Services are not to be installed under floor slabs or garages.

.7 Whenever possible, services shall not be installed in private driveway or parking areas.

.8 In areas where on-site sewage disposal is proposed, the water service lateral must not pass under the proposed sewage disposal field area. There is to be a minimum of 6 m of undisturbed soil between the water service lateral and the disposal field or septic tank.

.9 Water services to maintain 1.5 m horizontal separation from electrical conduit, communications, steam or hot water piping, transformer pads, utility poles, gas lines, or other utilities.

.10 Compression couplings shall not be used with 1.5 metres of the foundation of any serviced building.

.11 Water Laterals to maintain 3.0 m separation from outdoor fuel storage tanks.

.12 Laterals from the curb stop to inside the premise shall be installed as a single piece of pipe with no couplings

unless the length is greater than 20 m, in which case one compression fitting is permitted per 20 m or part thereof.

.13 Maintain minimum of 1.6 metre ground cover on service connections. Maximum depth of bury shall not exceed 2m.

.14 Install water service 300 mm horizontally and vertically (above) from gravity sewer service in common trench.

.15 Install water service in a separate trench with 3 m horizontal separation from pressure sewer service.

.16 Lay service pipe in a smooth trench bottom with Type 1 gravel bedding 250 mm below the pipe and a minimum 300 mm over the pipe.

.17 Backfill with well graded Selected Backfill.

.18 HRWC reserves the right to limit the number and location of bends on services.

.19 Install new zinc anode on service in accordance with HRWC Standard Drawing No. 2390.

.20 Locate curb stops as indicated on Drawing 2387. Locate curb stops 300 mm from the street line unless there is a sidewalk over the lateral. Where sidewalks are intended to cross over the lateral locate the curb stop 1 m beyond the sidewalk, and provide an easement for a minimum of 1 m in all directions around the curb stop.

.21 Do not install curb stop within 1.5 metres of a building.

.22 Install service box over curb stop, set plumb with the top of service box flush with finished grade. Where grade has not been finalized or established, leave the top of service box 150 mm above top of curb or edge of asphalt. Place select backfill material, maximum size 50 mm, around the service box to subgrade.

.23 Leave corporation stop fully open. Operate curb stop to ensure flow, then close curb stop and leave closed.

.24 Place temporary marked stake at end of each service lateral, extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake blue.

.25 Pressure test and chlorinate all service laterals 100 mm and larger.

.26 If a HRWC representative is required outside regular working hours during the installation of service connections, pay incurred costs of salaries and expenses for overtime hours required.

.27 HRWC may require plan and profile record drawings for service laterals of 50 mm diameter or greater, or where the length of the service is longer than typical.

.28 Do not backfill services until advised by HRWC.

.2 Direct Tapping

.1 All tapping of HRWC owned mains and existing service laterals upstream of the meter are to be performed by the HRWC at the contractor's expense.

.2 Do not tap closer than 1.0 m to adjacent service or pipe joint. Tap water main and install corporation stops at a position between 75° and 90° from vertical (as detailed on HRWC Standard Drawing No. 2387) using type of connection and tapping method appropriate for type, size and pressure of water main. Tape a 150 mm wide continuous band around polyethylene encasement when used, centered on the area to be tapped.

.3 Provide a minimum of 1.0 m working space along the main and 150 mm clear space around the main for tapping.

.4 Appointments for tapping **must** be made with HRWC a minimum of 24 hours in advance.

.3 Tapping Sleeves

.1 All services 100 mm and larger must be done using a Tapping Sleeve and Tapping Valve.

.2 All tapping is to be performed by the HRWC at the contractor's expense.

.3 Edge of tapping sleeve must be a minimum of 1.0 m from flange, fitting or bell of pipe to be tapped.

.4 If two tapping sleeves are installed together, a minimum of 1.0 m separation is required.

.5 Test tapping valves and sleeves before tapping of main. Test tapping valves from both directions. HRWC staff shall witness all tests prior to tap.

.6 Do not use a tapping sleeve of the same nominal size as the existing water main. The tapping sleeve must be at least one size smaller than the diameter of the existing water main.

.4 Sprinkler Service

.1 Install sprinkler service connections in accordance with HRWC Standard Drawings. Bring sprinkler main above floor slab within 2.0m of exterior wall.

.2 Service connections off a sprinkler line larger in size than that which require a 50 mm meter based on domestic design demand or the use of a solenoid valve must be individually approved by HRWC. Application must be supported by hydraulic calculations for fire and domestic flow, sealed by a Professional Engineer. A valve is required between the service connection off the sprinkler line and the building.

.3 HRWC reserves the right to limit the number and location of bends on services.

.4 Pressure test and chlorinate all sprinkler lines from the water main in the street to the backflow prevention device location at the proposed building.

Testing shall be carried out in accordance with Section 31 11 00 Subsection 3.11 and 3.12 of this Specification.

.5 Record drawings are to be provided for all sprinkler lines and are to be in accordance with the HRWC Design and Construction Standards, Subsection 7.3 Record Drawings.

.6 Construction inspection and preparation of Record Drawings for all sprinkler services shall be carried out by the Developer's Professional Engineer or his representative in accordance with the HRWC Design and Construction Standards, Subsection 8.3.2 Quality Control Standards.

.7 The owner is responsible for ensuring that the sprinkler line and related materials are designed and constructed in accordance with other applicable code requirements. In addition, the owner is responsible for carrying out any other testing requirements necessary to demonstrate that the sprinkler lines meet applicable code requirements.

.5 Meters

.1 Meter size to be as approved by HRWC dependent on required flow, internal plumbing arranged and peak domestic demand.

.2 Each service shall have a separate meter.

.3 Provide shut-off valves on both sides of the meter. Place meter at not more than 750 mm and not less than 300 mm in height and a maximum of 1.2 m from the wall where the service enters the building. Meter must remain accessible at all times and must be located where it can be easily repaired and exchanged.

.4 Provide a 12 mm conduit through the face of the exterior wall minimum of 100 mm below top of concrete wall nearest the meter for the purpose of installing an outside water meter register.

.5 A by-pass line is required around meters 50 mm and larger as per HRWC Standard Drawing No. 2395. Submit layout of meter and by-pass for the HRWC's approval.

.6 Meters will not be installed until all required backflow prevention devices and pressure reducing valves are installed. All installations must be inspected and approved by a HRWC representative. Meters will not be installed where an alternate water supply remains physically connected to the plumbing system.

.7 Where a service is off a sprinkler line, the meter will not be installed until all required backflow prevention devices and pressure reducing valves, on the service and sprinkler service, are installed by the owner and inspected and approved by a HRWC representative.

.8 Meters will not be installed within a garage.

.9 Install meters in a heated space where they will be not exposed to freezing temperatures.

.10 If polyethylene pipe is used downstream of the meter/BFP, one standard length of copper pipe (8 to 10 feet) must be properly installed and secured downstream of the meter/shut off valve to prevent vibrations loosening the connections.

.11 Piping material up to and including the meter and backflow prevention device shall be consistent with the incoming service pipe material (refer to Section 33 11 00, 2.10).

.12 Valve prior to meter can be compression and/or one lead free soldered joint.

.13 Where a pressure reducing valve is required it shall be installed on the upstream (public) side of the meter.

.14 Record drawings, when required, are to be provided prior to meter installation.

.6 Trenchless Installation

.1 Installation of services by trenchless methods may be approved by the Engineer upon review of a written installation procedure which addresses boring method, bore size, carrier piping (if any), bore end conditions, the subsoil environment and other factors as may be deemed relevant.

.2 Couplings are not permitted on the bored section of services.

3.9 Hydrostatic Testing

.1 The Contractor shall provide a written plan outlining the measures that will be taken for the hydrostatic testing, chlorination and disinfection of the water system extension. This plan is to indicate the areas to be tested, the sequence of testing and the sample locations for bacteriological tests. This plan shall follow all requirements set forth in sections 3.11 and 3.12 of this specification and be provided to and approved by the Commission's representative prior to any testing taking place. Unless approved by the Commission's Representative the maximum length of watermain that can be tested shall be limited to 450m.

.2 Provide labour, equipment and materials required to perform hydrostatic test.

.3 The operation of any existing valve not part of the new construction, shall be by HRWC staff. 24 hours notice is required by the HRWC for all filling, flushing or chlorination operations for new construction

.4 All services, hydrants, mains and other appurtenances shall be included in the system test.

.5 Testing shall not be carried out until the street base course (first lift of gravel) has been placed and compacted. Pipework located outside of the street right of way (R.O.W.) (ie easements) shall be at finished grade prior to testing.

.6 Perform tests in presence of a Professional Engineer or his representative and a representative of the HRWC. Provide HRWC representative with at least 24 hours notice prior to

conducting any tests. Provide a ¼ inch NPT connection at an appropriate location for the HRWC's pressure gauge.

.7 All valves must be pressure tested, including hydrant valves.

.8 Where hydrant extensions are required, install extensions prior to testing.

.9 Open all valves in test section.

.10 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air-vacuum release valves are installed.

.11 The test shall be conducted at a minimum pressure of the greater of 1035 kPa or one and one-half (1.5) times the operating pressure at the lowest point of elevation of the system being tested. In any case, the test pressure shall not exceed 1205 kPa. Pressure testing shall be done in sections where necessary to meet testing requirements. Testing shall be in accordance to AWWA C600.

.12 The test shall be conducted over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted during the test period.

.13 Locate and repair defects if test fails. Retest until results show remedial measures have been successful.

.14 All water used for pipe testing including pressure testing, chlorination, flushing and dechlorination shall be the responsibility of the contractor, and shall be chlorinated potable water.

.15 Following acceptance of field tests, the HRWC may order a second test. Cost of retesting will be paid by the HRWC providing the test is satisfactory.

3.10 Flushing and Disinfection

.1 Chlorination of any water system can proceed only after system has been successfully pressure tested. The chlorination test is to be witnessed by the HRWC.

.2 Flush and disinfect water mains to AWWA C651 and as herein specified. Notify the HRWC 24 hours in advance of flushing and disinfection.

.3 Flush water mains with potable water through available outlets until foreign materials have been removed and water is clear. The size and number of taps should conform to Table 3 of AWWA C651.

Pipe Diameter		Flow Required to Produce 2.5 ft/s (approx.) Velocity in Main		Size of Tap, In. (mm)			Number of 2 ½" (64 mm) Hydrant Outlets
				1 (25)	1½ (38)	2 (51 mm)	
In.	(mm)	Gpm	(L/s)	Number of Taps on Pipe			
4	(100)	100	(6.3)	1	-	-	1
6	(150)	200	(12.6)	-	1	-	1
8	(200)	400	(25.2)	-	2	1	1
10	(250)	600	(37.9)	-	3	2	1
12	(300)	900	(56.8)	-	-	2	2
16	(400)	1600	(100.9)	-	-	4	2

.4 Slowly open and close valves and hydrants to ensure thorough flushing.

.5 If satisfactory results cannot be achieved by flushing, swab pipe by approved methods and re-flush.

.6 Disinfect water main upon completion of flushing using chlorine solution distributed throughout entire system.

.7 Inject 1% chlorine solution through a corporation stop in the top of newly laid pipe, at point close to where main is being filled and at rate proportioned to filling rate. Prepare stock chlorine with concentration of 1% free chlorine by volume as follows:

Product	Amount Of Compound	Quantity of Water (litre)
high test calcium hypochlorite (67-70%C1)	1.0 kg	60 litres
liquid laundry bleach (5.25% CI)	1.0 litre	3.5 litres
(10.5% C1)	1.0 litre	7.0 litres

.8 Calcium hypochlorite is not to be used when water temperature is less than 5 ° C.

.9 The following table indicates the quantity of 1% chlorine stock solution required per 100 metre length of pipe.

1% Stock Chlorine

Pipe Diameter (mm)	Solution (litres)
100	4.9
150	10.9
200	19.4
250	30.4
300	42.9
350	58.4
400	76.3
450	96.6
500	119.2
600	171.7
750	268.3

.10 Operate valves, hydrants, and appurtenances while main contains chlorine solution.

.11 Take water samples at all hydrants and termination points, in suitable sequence, to test chlorine residual. When tests indicate minimum chlorine residual of 50 mg/L, leave system charged with disinfectant solution for 24 hours. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 25 mg/L. If the residual has fallen below 25 mg/L the system shall be rechlorinated.

.12 Flush disinfectant solution from line after 24 hours. Under no circumstances shall disinfectant solution remain in the line longer than 48 hours. Add 1.0% hydrogen peroxide reducing agent to the disinfectant solution at point of discharge or within a retention facility such that the solution is disposed to the environment with a total chlorine residual no greater than 0.0 mg/L in accordance with the requirements of the Nova Scotia Department of the Environment. Check chlorine residuals before disposal and at regular intervals during disposal to ensure compliance. This de-chlorination requirement can only be

excluded with the written consent of the Nova Scotia Department of the Environment.

.13 Dispose of de-chlorinated disinfectant solution. Where disposing to the environment, disposal of the de-chlorinated solution must be at least 100 meters from the nearest watercourse.

.14 Where disinfectant solution is de-chlorinated at point of discharge, inject stock reducing agent at a rate proportioned to discharge rate. Injection and discharge rates must be monitored continuously to ensure proper proportioning.

.15 Prepare stock reducing agent with concentration of 1% Hydrogen Peroxide (H_2O_2) by volume, as follows:

Liquid Reducing Agent	Amount of Agent (litres)	Quantity of Water (litres)
Hydrogen Peroxide (35% H_2O_2 by mass)	1.0	34.0

.16 The following table indicates quantity of 1% Hydrogen Peroxide required to reduce total chlorine residual of disinfectant solution contained per 100 metre length of pipe, from 50 mg/L to 0.0 mg/L.

1% Hydrogen Peroxide

Pipe Diameter (mm)	Stock Solution (litres)
100	4.5
150	10.2
200	18.1
250	28.2
300	40.6
350	55.3
400	72.3
450	91.4
500	112.9
600	162.6
750	254.0

.17 Where total chlorine residual of disinfectant solution exceeds 50 mg/L, quantity of stock reducing agent for de-

chlorination can be increased in direct proportion to the quantity indicated in the above table.

.18 After disinfectant solution is flushed from water main, assist HRWC representative in obtaining two water samples on each of two consecutive days (at least 24 hours apart) for bacteriological tests. Hydrants shall not be used as sampling points. Repeat disinfection procedure if bacteriological tests fail.

.19 Bacteriological samples are to be obtained from a test sampling tap or a copper service lateral if available. Sampling shall take place from every 366m (1200 ft) of new water main, plus one set from the end of the line and from every branch (See AWWA C651-99, Section 5.1). If service laterals are not available, a hydrant lead may be tapped to provide the required sampling location.

.20 Samples shall be collected in accordance with Appendix A of the NSEL "Guidelines for Monitoring Public Drinking Water Supplies (Guidelines). Analysis shall be done by an independent lab in accordance with Section 410 of the Guidelines.

.21 Should any of the test results be positive, repeat disinfection, flushing, sampling and analysis.

.22 After testing and submission of the written results for the passing of the bacteriological tests, remove corporation stops and install plugs. Check visually for leakage after plugs are installed with water main under normal operating pressure.

3.11 Connections to Existing Main

.1 Connect new mains to existing mains as indicated.

.2 Do not make a connection to an existing main within 1.0 m of a fitting, pipe joint or another service.

.3 The HRWC **does not** guarantee leak tight operation of existing valves.

.4 No work will be performed on existing main until all items required to complete the connection are on site and the outside diameter and type of pipe have been confirmed.

.5 The HRWC will operate valves in the exiting system.

.6 When a connection is made to an exiting main (ie. inserting a new tee) an inspection of the joints for leakage must be made by the HRWC, while the main is under operating pressure, **prior** to backfilling.

3.12 Protective Coating

.1 Apply unless otherwise directed by the Engineer where alternative corrosion protection measures (polywrap, epoxy coating, cathodic protection) are not employed.

.2 Utilize primer, mastic and tape in accordance with manufacturer's instructions.

3.13 Backflow Prevention Devices

.1 Backflow prevention devices are required on services if there is a risk of contamination of the potable water supply. Premises which require backflow prevention devices include, but are not limited to, the following:

.1 Industrial, commercial and institutional buildings.

.2 Apartment buildings greater than four units.

.3 Sprinkler service lines.

.2 Backflow prevention device to be as approved by HRWC depending on flow demand and degree of hazard classification. Install backflow prevention device after approval has been obtained from the HRWC representative and in accordance with HRWC Standard Drawing No.'s 2387A, B & C, 2395, 2396, 4459 & 4460.

.3 A hydraulic analysis by a professional engineer is required for every system where a backflow prevention device is installed, unless otherwise approved by the HRWC.

.4 On domestic services, install backflow prevention device immediately downstream of the water meter. A water distribution connection is not permitted between the water meter and backflow prevention device.

.5 Where a meter by-pass is required, install two backflow prevention devices parallel downstream of the meter and bypass as per HRWC Standard Drawing No. 2395 & 4460.

.6 For fire protection systems, all piping, fittings, valves and test ports must be National Sanitation Foundation (NSF61) approved for contact with potable water (ductile iron, epoxy coated steel, stainless steel, plastic, copper or brass) up to and including the backflow prevention device.

.7 Where a pump is installed on a fire protection system, the backflow prevention device should be installed downstream of the pump. To obtain approval where the backflow prevention device is upstream of the fire pump, a hydraulic analysis must be submitted over the seal of a Professional Engineer. Reduced Pressure Principle (RP) backflow prevention devices are not allowed upstream of the fire pumps under any circumstances.

.8 Maintain minimum clearances around the backflow prevention device; 300 mm below the device; 300 mm from any wall and 600 mm in front of device (the side from which testing and maintenance will be performed). Maximum distance of 1500 mm between backflow prevention device and finished floor elevation.

.9 Install Reduced Pressure Principle (RP) backflow prevention device in upright horizontal orientation with valves in upright position. Double Check Valve Assemblies (DCVA) can be in a horizontal (valves in upright position) or vertical orientation.

.10 Piping material up to and including the backflow prevention device shall be consistent with the incoming service pipe material (refer to Section 33 11 00, 2.10).

.11 All backflow prevention devices must be tested at the time of installation and on an annual basis thereafter, by a certified tester approved by the HRWC.

.12 Requirements for retrofitting of existing systems are the same as new construction, however, due to variable and unique conditions that may be encountered, variances from the policy on location and/or installation of backflow prevention devices will be considered. Submit the request for a variance in writing to the HRWC.

3.14 Trace Wire

.1 Trace wire shall be installed on all non-ductile iron watermains, hydrant laterals, and water services except where such water service pipe is of copper material. The wire shall be installed in such a manner as to be able to properly trace all watermains, hydrant laterals, and water services without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire.

.2 At the point of connection between the cast or ductile iron watermains, with any non iron watermain, the tracer wire shall be connected to the first valve box, or as directed by HRWC.

.3 Tracer wire shall be laid flat and securely affixed to the pipe at three (3) metre intervals. The wire shall be protected from damage during the excavation of the works. No breaks or cuts in the tracer wire or tracer wire insulation shall be permitted. At water service saddles, the tracer wire shall not be allowed to be placed between the saddle and the watermain.

.4 Except for approved spliced in connections, tracer wire shall be continuous and without splices from valve box to valve box, valve box to fire hydrant, or fire hydrant to fire hydrant.

.5 The tracer wire system shall be tested for functionality by HRWC staff only after the contractor has confirmed and demonstrated that the entire tracer wire system is installed and is functioning properly as per Section .1 herein.

.6 If deficiencies are found in the tracer wire system when tested by HRWC staff, then the contractor shall be charged the full cost incurred by the Commission for all subsequent visits to confirm functionality and acceptability of the tracer sire system.