



## **5.0 WATERMAIN CONSTRUCTION**

### **5.1. Work Included**

Provide all labour, products and equipment required for the work, including but not limited to:

- 1) bedding under and over pipe
- 2) watermains and appurtenances
- 3) testing watermains
- 4) flushing and disinfecting watermains
- 5) connection to existing systems
- 6) thrust blocks

### **5.2. Quality Standards and Assurances**

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship may be subject to inspection by the County.

Perform all tests required by the specification and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the County in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County, at no additional cost to Owner.



**5.2.1. Products**

**5.2.2. Polyvinyl Chloride (PVC) Water Pipe**

Polyvinyl chloride water pipe shall be equivalent to cast iron pipe outside diameter meeting CAN3-B.137.3 M86 (AWWA C900).

Pipe shall be Class 150 (dimension ratio 18) and pipe must be blue in colour.

Pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections.

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

**5.2.3. Pipe Fitting**

Cast iron or ductile iron fittings shall meet the requirements of AWWA Specification C110-77. Pressure rating shall be 1.1 MPa ( 60 psi).

Joints on fittings shall be the same as specified for pipe.

Fittings shall be externally and internally coated with bituminous material approved for waterworks service.

PVC fittings shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.

PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the County. Gaskets to conform to AWWA C111.

Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts and bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the County.



#### ***5.2.4. Gate Valves (NRS)***

Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron resilient seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:

- 1) Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph value of 9.0.
- 2) Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.
- 3) Valves to be supplied with either bronze or type 304 stainless steel stems.
- 4) Working pressure 1,035 kPa ( 150 psi).
- 5) Valve interior to be epoxy coated for corrosion protection.
- 6) Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50 mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.
- 7) Exterior to be factory coated.
- 8) All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.
- 9) Main Valve Casing Detail is located in Section 18 Standard Drawings 4.2.

#### ***5.2.5. Valve Boxes***

Valve boxes shall be Norwood Foundry Type A, or equal. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid.

Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300 mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.



Valve Box Construction Detail is located in Section 18 Standard Drawings 4.3.

### ***5.2.6. Hydrants***

Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:

1. Working pressure of 1,035 kPa.
2. Two hose connections at 180 Deg., 63 mm ID with threads to Alberta Mutual Standard.
3. One pumper connection, 100 mm OD, outlet nozzles to be fastened by a thread connection.
4. 150 mm riser barrel, 125 mm bottom valve.
5. Minimum distance from flange to bonnet will be 600 mm.
6. Main connection to be 150 mm ductile iron size rubber gasketed bell end joint.
7. Self Draining hydrants (or as determined by site condition)
8. Number 6 operating nut with five sides.
9. Hydrant to open counter clockwise.
10. All hydrants will be painted Fire Engine Red.
11. Ground line breakaway system: 2.75 m from invert to flange, including a 450 mm top extension spool section with hydrant rod coupled at extension.
12. Minimum 710 mm from top of operating nut to bottom of base flange.
13. All exposed nuts and bolts to be T304 or type 3145.5 stainless steel.
14. Interface between removable parts of main valve and hydrant body shall be bronze to bronze.
15. Hydrants shall be of the same type and make as presently used in the County (Canada Valve, McAvity, A.V.K.).

Typical Hydrant and Valve Detail is located in Section 18 Standard Drawings.



### ***5.2.7. Watermain Plugs***

Watermain plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

### ***5.2.8. Air Relief Valve & Flushing Chamber***

Air Relief Valve and Flushing Chamber located in Section 18 Standard Drawings 5.1.

### ***5.2.9. Bedding Pipes***

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus 600 mm, plus allowance for timbering, if required. Refer to Standard Drawing 5.2 and 5.3.

Excavate below bottom of trench at joints as required to provide working space. Body of pipe to rest on minimum 100 mm firmly compacted sand bedding throughout its length.

Place sand bedding for PVC pipe as per trench bedding and installation and backfill with Class B granular surround as detailed in the Standard Detail Drawing 5.2. If site material meets bedding sand specification requirements, it may be used to replace the top 300 mm of bedding sand.

For trench in rock, bed pipe on minimum of 150 mm of compacted sand.

### ***5.2.10. Laying and Jointing Pipe***

Carefully lower pipe and specials into trench using proper appliances. While suspended, inspect for defects. Remove foreign materials from inside of pipe. Unless otherwise directed, lay pipe from lower end of line upward.

Lay pipe true to line and establish grade using laser level or measurement rod and sight rails.

Cut pipe accurately to bring valves, fittings and hydrants to correct position.



At all hydrants, plugs, tees, crosses, bends of 22° or more and all other points of concentrated thrust, provide reaction blocking as detailed in the Standard Drawings to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7,323 kg/m<sup>2</sup>, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

Install turned wood or plastic plugs, properly sized, in pipe and fittings to prevent ingress of water, mud, dirt and debris at all times. Do not use rags, clothing or other means.

Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.

Ensure that valve box can be adjusted up or down at least 300 mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

#### ***5.2.11. Setting and Jointing Valves***

Check and ensure stuffing glands on valves are properly packed before installation.

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50 mm from elevations provided by the County.

Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer.

Check operation of valves in presence of the County before and after testing.

#### ***5.2.12. Setting and Jointing Hydrants***

Set hydrants and hydrant valves on pressure treated timber blocking as per details.



Ensure hydrant stock and valve box are truly vertical.

Locate hydrants and valves as per drawings within the following tolerances: 50 mm horizontal, 15 mm vertical.

Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150 mm of the sidewalk.

Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.

Ensure that regular maintenance of hydrants is carried out for the duration of the maintenance period. Pay all costs for maintenance such as repainting, draining prior to freeze-up, etc.

#### ***5.2.13. Thrust Blocks***

Do concrete work in accordance with Section 9.0 – Curb, Gutter and Sidewalks.

Cement to be sulfate resistant Portland cement.

Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

Thrust Block Details are located in the Standard Drawings.

#### ***5.2.14. Testing Watermains***

Watermain testing may be carried out when all the following conditions have been met:

- 1) a section of watermain not exceeding 365 meters in length has been completed.
- 2) the section has been carefully filled with water and allowed to sit for at least 24 hours.



- 3) reaction or thrust blocking within the section has reached 15.0 MPa of compressive strength.

If all the conditions have been met, apply a constant pressure of 1,035 KPa ( 150 psi) for a minimum of two hours to mains, hydrants, valves and services. Make good all defects at no additional cost to Owner. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1,035 KPa (150 psi) in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

- 1) Allowable leakage =  $N \times D \times P \times 0.5 \div 128320 = \text{Litres per hour}$
- 2) Where N = Number of joints; D = nominal diameter of pipes (mm); and P = average test pressure (kPa).

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding 365 m in length.

Provide all equipment, labour and material for tests.

#### ***5.2.15. Flushing and Disinfecting Watermains***

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at minimum velocity of 0.8 m/sec as required by AWWA C651-99 procedures (250 mm line requires 2 - 50 mm openings to provide the required flushing velocity).

After flushing, disinfect mains by pumping chlorine solution into mains through a special main cock at beginning of line near source of water. Do not use hydrants at point of application for disinfectant.



Introduce disinfectant according to AWWA C651-99 and to approval of the County and Provincial Ministry of Health.

Conform to AWWA C651-99 for quantity of disinfectant, method of distribution throughout system and final flushing.

After final flushing and before placing watermain in service, the County will collect samples in sterile bottles from an approved sampling point. The sampling is to be witnessed by local authorities as necessary. Samples will be submitted to Provincial Ministry of Health for testing and test results forwarded to Local Authorities. Heterotrophic plate counts will be provided.

If initial disinfection fails to produce satisfactory results, repeat disinfection until satisfactory samples are obtained.

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment in order to meet the regulatory requirements of the Lamont County or Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

#### ***5.2.16. Markers***

A 50 mm by 100 mm stake, from 1000 mm below ground to 600 mm above ground level shall be placed at each water valve, the top 600 mm to be painted blue.

### **5.3. Trenching and Backfilling for Utilities**

#### ***5.3.1. General***

Trenching and backfilling to be carried out in accordance with Alberta Occupational Health and Safety Regulations, Part 10. Standards for pipe bedding and typical trench details are located in Section 18, Drawings 5.2 and 5.3.



### ***5.3.2. Work Included***

Provide all labour, products and equipment for trenching and backfilling for utilities, including but not limited to:

- 1) watermains
- 2) sanitary sewers
- 3) storm sewers
- 4) manholes, valve boxes
- 5) lot service connections
- 6) shoring, sheet piling
- 7) dewatering

### ***5.3.3. Excavation***

Excavate to lines and to design depth shown or as required by the County to provide satisfactory bearing. Excavate unsuitable soil from trench bottoms as required by the County. Backfill with screened rock material specified to the required level and compact to provide uniform bearing.

No additional compensation will be paid for any changes due to deterioration of excavations caused by activities or neglect of the contractor.

Level and clean excavation bottoms free from loose material and debris.

Where excavation is made below depth shown through error, fill to required depth with 20 MPa compressive strength concrete or screened rock at no additional cost to Owner.

Provide firm undisturbed earth or rock bearings for granular bedding below pipelines and structures.



Excavate for structures to widths sufficient for formwork construction. Place no concrete or masonry until the County has inspected excavation.

Where concrete is to be placed, thaw excavation bottom if frozen, and protect from further freezing.

Maximum lengths for open trenches are 30 m ahead of pipe laying crew and 200 m behind, unless otherwise permitted by the County.

Where pipelines are constructed through fills and embankments, surface elevations will generally at least be 250 mm above top of pipeline prior to excavation.

Where trenches are excavated in existing pavements, saw cut the pavement to neat lines.

#### ***5.3.4. Rocks and Boulders***

Remove boulders to provide 150 mm minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than 0.4 m<sup>3</sup>.

Boulders larger than 0.4 m<sup>3</sup> and material which cannot be removed with pick and bar will be classified as rock by the County. Notify the County when rock is encountered for classification and measurement.

Excavate rock to provide 150 mm minimum clearance on each side and under pipes. Backfill with granular and compact at required level to provide suitable bearing.

Prior to commencing blasting operations, obtain written approval from authorities having jurisdiction and from the County. Employ qualified and licensed workers only.

#### ***5.3.5. Shoring, Bracing and Sheet Piling***

Provide all shoring, bracing and sheet piling required for support and protection of earth banks at excavations.



Erect all shoring, bracing and sheet piling independent of utilities and structures.

Shore and brace sides of trenches and excavations in accordance with Workers' Compensation Board Regulations.

Maintain during backfilling and remove in stages as backfilling progresses or as approved by the County.

Remove all shoring, bracing and sheet piling unless otherwise permitted by the County. If shoring is allowed to remain, cut off to a level at least 600 mm below finish grade.

Pre-fabricated cages or shields may be used, at the discretion of the County, to supplement or replace conventional shoring provided they conform to all applicable safety regulations, and permit the proper placing and tamping of bedding material under and around utility pipes.

#### ***5.3.6. Backfilling - General Requirements***

Bedding of pipes and utilities and backfill to 300 mm above top of pipes and utilities is included in other sections.

Backfill trenches and excavations with excavated earth material. Remove all rocks larger than 200 mm in diameter from earth backfill.

Place and compact all backfill in maximum 300 mm deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from 300 mm above top of pipe to 300 mm below bottom of granular base for roads to a density not less than 98% of Standard Proctor Density, as defined herein, and carried out at moisture content within 3% of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the contractor will make every reasonable attempt to dry the material by whatever means available (i.e. discing, spreading, etc.) should the County deem the



material to be "unworkable" the use of imported granular backfill may be required. Compact the final 450 mm below road or lane granular base to not less than 100% of Standard Proctor Density.

Compaction results will be based on a minimum of one density test per 150 lineal m of trench for each 1.5 m of depth. If a density test indicates insufficient compaction at any depth, then two more densities, which are proportionally representative of trench length will be taken at that depth. Then, if the average of the three tests is below the required density, the contractor will re-excavate and re-compact to meet the specified density.

Place and compact evenly around structures to prevent damage or displacement. Grade surface to direct water away.

Stockpile, spread or remove excess excavated earth material where directed by the County.

Remove and dispose of boulders off site at no additional cost.

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of 98% of Standard Proctor Density from the lower pipeline up to the invert elevation of the higher pipeline.

Where imported material is called for by written direction of the County, place the specified depth of granular material to the elevations provided and compact to specified Standard Proctor Densities.

Where filter fabric is called for by written direction of the County, place fabric to the overall dimensions specified.

### ***5.3.7. Settlement***

The contractor shall be responsible for all settlement of backfill that may take place during a period of two (2) years after date of completion certificate.



When notified of any such settlement, promptly repair same, or make arrangement for others to do so at the contractor's expense. Failure to do so will result in the Owner making appropriate arrangements at the Contractor's expense and at no cost to the Owner.

Pay the cost of all damages that may be caused by such settlements, including but not limited to repair and/or replacement of concrete sidewalks, curb and gutter and asphaltic concrete pavement.

#### **5.4. Adjustment of Appurtenances**

##### ***5.4.1. Work Included***

The work described in this section pertains to the adjustments of all appurtenances.

##### ***5.4.2. Execution***

##### ***5.4.3. Valve and Curb Boxes Adjustments***

Valve box tops and curb box tops shall be adjusted so that the top of the box is set exactly to the required elevation. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the boxes are plumb and the valves operate effectively. The rock guard and operating nut are to be located no closer than 300mm below the proposed finished grade.

##### ***5.4.4. Manhole and Catch Basin Adjustments***

Manhole and catch basin frames shall be adjusted so that the top of the cover is set exactly to the required elevation. Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks meeting the requirements of the current issue of ASTM C478. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved



sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800 mm.

#### ***5.4.5. Damaged Appurtenances***

The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor as approved by the County at an agreed lump sum price.

#### ***5.4.6. Final Adjustment Elevations***

The tops of valve boxes, manholes, and catch basins shall be set to the design elevations, or as approved by the County. Generally, the following shall apply for setting the final elevations of the tops of the appurtenances.

- 1) In asphaltic pavement, 5 mm below the finished surface elevation for manhole frames.
- 2) In concrete curb gutter, 10 mm below gutter elevation for catch basin frames.
- 3) In gravel roadways/lanes, 50 mm below the surface.
- 4) In landscape areas, 50 mm above the final surface, providing a smooth transition to match the surrounding areas.

**END OF SECTION**