

CITY OF NORTON SHORES
WATERMAIN SPECIFICATIONS

Last Rev. June 2018

I. Materials

- A. Watermains - To be ductile iron pipe conforming to ANSI A21.51 (AWWA C151), standard for ductile iron pipe centrifugally cast in metal molds, for water, thickness Class 52 for all pipe with 150 psi rating, or ANSI A21.50 (AWWA C150), standard for ductile iron pipe centrifugally cast in sand-lined molds. Pipe to be cement lined in conformance to ANSI A21-4 (AWWA C104), standard for cement mortar lining for ductile iron pipe and fittings for water. Pipe joints to be push-on conforming to ANSI A21.11 (AWWA C111), standard for rubber gasket joints for ductile iron pipe, with bronze wedges as outlined in section 111.B to provide electrical continuity, strap type, or see section 111.C.

Nitrile or Viton gasket materials shall be used in areas of soil and/or ground water contaminations.

- B. Fittings - Shall conform to ANSI A21.10 (AWWA C110-12), standard for cast iron and ductile iron fittings, with 250 psi working pressure rating, and they shall have mechanical joints conforming to ANSI A21.11 (AWWA C111), standard for rubber gasket joints for cast iron and ductile iron pressure pipe and fittings. Plugs, where shown on the Plans, shall be solid mechanical joint type.
- C. Mechanical Joints - Shall conform to ANSI A21.11 (AWWA C111). The bolts shall be of high strength, low alloy type steel.
- D. Welded Bossed Outlets - For ductile iron water main shall be accepted only for 24" and larger.
- E. Fire Hydrants

1. Fire hydrants shall meet or exceed the requirements of ANSI/AWWA C502. Standard for Dry-Barrel Hydrants, Underwriter Laboratories UL 246, Factory Mutual 1510, and must have a 250 psi working pressure rating tested at 500 psi before leaving the manufacturing facility. They shall have a 5-1/4" valve opening and 6" mechanical joint inlet with two drain holes plugged with no lead brass plugs. Hydrants shall have two 2-1/2" hose connections and one 5" (HiHS50-Hydrant) Harrington Integral Hydrant Storz Connection. Storz fitting shall be installed by the hydrant manufacturer. All 2-1/2" nozzle connections shall have 6 threads per inch (Muskegon Big Six). All nozzles shall be on a removable head with a break flange so that they may be rotated by changing the position of the flange.

2. Brass nozzles must be designed with brass lugs and 0-ring gasket as the means to form a pressure tight compression fit when attached to the hydrant bonnet.
3. Hydrants shall be 5' 6" depth of bury from bottom of inlet pipe to the grade line, unless otherwise specified. Top of hydrants shall be 32 +/- 3 inches above finish earth grade. A 3 foot clear space shall be maintained around the circumference of fire hydrants except as otherwise required or approved by the City.
4. The color of the hydrants shall be yellow. Those portions of the hydrant above ground shall have two coats of yellow enamel.
5. Hydrants must have one traffic breakaway flange below the upper barrel with a galvanized steel breakable stem coupling located near the ground line to minimize barrel and stem damage from traffic impact. The operating stem must be at least 1-1/4" in diameter.
6. Hydrant operating nut must be solid brass and attached to operating stem utilizing a standard Acme thread at 5 t.p.i.. Lubrication of the operating nut must be designed to use food grade grease only. No oil bath operating assembly designs allowed. No "V" threads allowed for operating stem or nut.
7. Fire hydrant bottom brass drip shut off must be attached to the 1-1/4" operating stem by means of a 7/16" diameter stainless steel drive lock pin. Bottom brass drip shut off must be a heavy-duty design to enable removal by means of a stem drive seat removal wrench in the event of an obstruction to the seat.
8. The operating nut shall open left (counter clockwise).
9. The main valve shall be formed of specially molded rubber. The valve assemblies, including seat and guides, shall be lead free brass and must be threaded into a lead free brass liner in the hydrant shoe.
10. Fire hydrant shoes, barrels, and bonnets must be made of ductile iron.
11. All components, iron and bronze, must be cast, manufactured and machined in the USA, and shall have MADE IN USA clearly stated, cast into the exterior of the iron body.

12. All hydrants shall be EJ, Inc. 5BR250 Water Master Product #55965D, or approved equal, and equipped with a 60" tall, 3/8" diameter, plastic coated fiberglass, red & white reflective, heavy duty steel spring hydrant marker capable of being attached to the hydrant with a flange bolt.

F. Gate Valves

1. Valves shall be manufactured and tested to meet the requirements of ANSI/AWWA C515. Valves shall be listed by Underwriters Laboratories and shall meet the requirements of Standard UL262 & FM1 130.
2. The rated working pressure of the valve shall be 250 psi.
3. The body, bonnet, wedge and seal plate shall be made of domestically poured ductile iron, and in accordance with ASTM A536. The wedge shall be totally encapsulated in rubber with polymer ear caps. This rubber coating shall be permanently bonded to the ductile iron wedge casting and shall meet ASTM D429 tests for rubber to metal bonding. No paint shall be allowed in the wedge and the wedge must not be hollow. Containment of the stem nut must only be on two sides, to facilitate easy removal.
4. The stem and stem nut shall be made of high strength manganese bronze manufactured and machined domestically in the USA. The stem must have an integral thrust collar. Stainless steel stems are not acceptable. Polymer thrust washers shall be located above and below the integral collar of the stem. Stainless steel thrust washers are not acceptable. There shall be two O-ring seals in the seal plate which shall be replaceable, if required, with the valve in the full open position at rated working pressure and one below the integral collar. All gaskets shall be O-ring seals. O-rings set in a cartridge shall not be allowed. O-ring seal between upper bonnet and lower body must be set in a "U" type channel. A grit seal must be present above seal plate to prevent dirt intrusion. All fasteners to be 304 or 316 Stainless Steel, Zinc plated as a "lubricator" to prevent galling. Socket head bolts shall not be allowed. All valves shall open LEFT (counter clockwise).
5. The stem seal plate shall be removable to allow stem to be replaced without separating the bonnet from lower body in the event of having to replace the stem. No exposed bolt/nut slots used to fasten seal plate to upper body shall be allowed.

6. The body, bonnet and seal plate shall be epoxy coated in accordance with ANSI/AWWA C550 certified to NSF61. This coating shall be on the interior and the exterior valve. The manufacturers' name, valve size, year of manufacture, pressure rating ("250W"), C515, "DP", UL, FM, and MADE IN USA shall be cast on the valve. No separate tags/plates attached to the valve body stating this shall be allowed.
 7. Each valve shall be tested in accordance with ANSI/AWWA C515, UL262 and FM1 130. This shall include hydrostatic pressure testing at 500 psi before leaving manufacturing facility.
 8. A certification of manufacture and testing shall be provided at the purchaser's request.
 9. All Resilient Wedge (RW) Valves shall be EJ, Inc. C515 Flow Master or approved equal.
 10. All valves must have a continuity strap from gland to gland installed and be able to pass Section III (Electrical Conductivity) on water main and appurtenances.
- G. Valve Boxes - Shall be screw type, cast iron three sectional adjustable with round bases with an overall length sufficient to permit the top to be set flush with the established pavement or ground surface. The boxes shall be provided with cast iron lids or covers and marked with the word "water". The valve boxes shall be designed to withstand heavy traffic. Valve box shall be EJ 8560 Series Screw Type 4-piece w/ #4 Bases or approved equal.
- H. Butterfly Valves - Shall have cast iron body, neck and top piece with a minimum non-shock W.O.G. working pressure of 150 psi. Seats shall be Hycarbuna "N" providing leak-proof shut-off with the disc and acting as a body liner to prevent corrosion. Disc shall be ni-resist cast iron with a 304 stainless steel shaft rotation in permanently lubricated bearings. Stem seal shall be Hycarbuna "N". Joints shall be flanged. Flanged to mechanical joint adapters shall be provided for each valve. Butterfly valves shall be manufactured by Henry Pratt Company or approved equal.
- I. Air Release Valves - When specified, air release valves shall be designed to operate under a maximum operating pressure of 300 psi and capable of venting 200 cubic feet of free air per second. Valves shall be cast iron with bronze internal parts and Type 304 stainless steel float.
- J. Corporation Stops - Shall be an AY McDonald 74701 (Flared) or approved equal. The size of the corporation stop shall be per plans. All stops shall have bronze cast bodies, keys, stem washers and nuts. Inlet thread shall conform to the latest revision AWWA C800. The outlet connection shall be able to receive the flared end of the copper service pipe.

- K. Copper Tubing - Shall be in accordance with ASTM B-88, Type "K" annealed, seamless copper, federal specification WW-T-799 with flared type fittings.
- L. River Crossing Pipe and Fittings – Shall be ductile iron with a boltless flexible joint of the ball and socket type. Maximum working water pressure shall be 350 psi. Pipe shall be Clow F-141 Boltless River Crossing Pipe, U.S. Pipe USIFLEX or equal.
1. The river crossing joint shall be a push-on type ball and socket joint utilizing a first grade synthetic rubber gasket. The joint shall be capable of up to 15-degree full turning deflection without separations, leakage or restriction of the pipe waterway. Joint restraint shall be provided by a boltless means, which is locked against accidental disengagement of the restraining component. All structural joint components (bell, ball and retainer) shall be ductile iron meeting the physical requirements of ANSI Specification A21.10 (AWWA C-110). Pipe shall be furnished with the necessary gaskets, lubricant and retainer locking accessories. End connections shall be as specified under, Pipe and Fittings.
 2. Pipe shall have a centrifugally cast ductile iron barrel made in accordance with ANSI Specifications A21.51 (AWWA C-151), Class 55. Pipe shall be standard cement lined and seal coated with an approved bituminous seal coat in accordance with ANSI Specification A21.4 (AWWA C-104).
- M. Restraint System - Shall be EBBA Iron Works ductile iron retainer gland (Mega-Lug) or approved equal. Restraint by rodding must be approved by the Water & Sewer Superintendent prior to use. All parts shall be Corten steel. All rods shall be 3/4" in diameter, minimum. The Contractor shall be responsible for the adequacy of the system installed.
- N. Gatewells – Brick for grade adjustment of gatewells shall meet the requirements for "medium brick" of the Standard Specifications for Clay Sewer Brick, ASTM Serial Designation C32, or the latest revision thereof. Mortar for masonry or plastering outside of gatewells shall be made of one part of portland cement to two parts of sand. Mortar materials and mixing shall correspond, in general, to those for concrete.

Reinforced concrete gatewells shall conform to the latest revision of ASTM Specifications for Precast Reinforced Concrete Manhole Sections, Serial Designation C478, with rubber gasket joints.

Steps shall be plastic coated steel. They shall be EJ 8512 or equal.

Standard frames and covers shall be cast gray iron conforming to the Standard Specifications Castings, Serial Designation A48, or the latest revision thereof, EJ 8020 or approved equal. They shall have machined bearing surfaces and suitable notches for convenient removal of the cover. Covers shall be EJ product number NPR11-2516 or approved equal. All frames and covers shall be coated at the point of manufacture with coal tar pitch varnish or other approved asphaltum coating.

- O. Tapping Sleeves – Tapping sleeves, when specified, shall be full length of heavy-duty stainless steel construction designed for use with the type of pipe to be tapped. Tapping sleeve body shall be 18-8 type 304 stainless steel. Flange shall be CF8 cast stainless steel. Bolts shall be 304 stainless steel. Gasket shall be full circumferential SBR compounded for water service. Tapping sleeve shall contain a test plug to assure seal prior to tapping. Tapping sleeve shall be JCM Industries, type 432; Romac Industries type SST; or approved equal.
- P. Concrete Curb Box Receptacle - Concrete curb box receptacle shall be used whenever the proposed or existing curb box shall be placed in concrete sidewalk, curbing, roadway or driveway. The receptacle shall be AY McDonald #5639 or approved equal.
- Q. Miscellaneous Parts - Where called for on the plans, the following tapping sleeve & curb stop materials shall be used:
1. Tapping Sleeves Romac SST Main OD" x Tap Size" DI Flange Tapping Sleeve
 2. Corporation Stops, Curb Stops and Curb Stop Boxes
 - a. 3/4" & 1" Corporation Stops AY McDonald 74701 Flared
 - b. 3/4" & 1" Curb Stops AY McDonald 76104 Minneapolis Thread Flared
 - c. 3/4" & 1" Curb Stop Box AY McDonald 5612 4' Box Minneapolis Thread w/5660 - 3/8" Rod
 3. Large Curb Stops 1-1/2" & 2"
 - a. Service Clamp Romac SS1 Main OD x 12" Long w/2" NPT Thread
 - b. 2" Curb Stop AY McDonald 76109 2" MIP x FIP Minneapolis Thread 1/2" x 1-1/2"
 - c. 2" AY McDonald 74753 M.I.P. threaded into AY 76109
 - d. For 1-1/2" services use lead free brass bushing 2" M.I.P. x 1-1/2" F.I.P. with a AY McDonald 74753 1-1/2" M.I.P. x 1-1/2" flare
 - e. 2" Box AY McDonald 5613 4' Box Minneapolis Thread w/5660 - 3/8" Rod and a EJ 8550 top and cover
- R. All material which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 61.
- S. All plastic materials which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 61 and be certified to meet ANSI/NSF Standard 14.
- T. All chemicals which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 60.
- U. All manhole covers shall be cleaned from any residual asphalt left over from paving. The cost of cleaning shall be incidental to the cost of the project.

- V. All iron (cast or ductile) watermain, watermain valves, curb stop boxes, fire hydrants , water service material or any other watermain/water service apparatus (including copper piping) removed by the contractor during construction shall continue to be the property of the City of Norton Shores Water and Sewer Division unless otherwise released in writing by the City. The Contractor shall deliver such materials to a designated area as determined by the Water and Sewer Supervisor at the Public Works Facility located at 1174 E Mount Garfield during normal business hours.

II. Installation of Watermain

- A. Depth of Pipe - The top of the pipe shall be placed 5'-6" below the finish surface of the ground, or 5'-6" below the lowest grade at gutter line of streets, or approved in writing or specified on the plans by the Water and Sewer Superintendent in unusual circumstances. The Contractor shall not be entitled to any additional compensation because depth is more than specified at certain locations or due to clearances at manholes, or due to unforeseen obstacles, or occasioned in order to avoid undue changes in grade.
- B. Pipe Bedding and Backfill - All pipe shall be completely encircled with 6" of compacted MDOT Granular Material-Class III. Backfill above watermain and within the 1 on 1 influence of the road shall be MDOT Granular Material Class II or III (Class III allows stones to be 5" + but less than 6"). Any backfill material outside of the road's influence shall be suitable material excavated from the trench, except unstable clay. Shape ditch bottom so that the entire length of pipe barrel is evenly supported. A section not exceeding 12" in length may be disturbed in order to remove slings used in handling pipe or for making up pipe joints. Wood block or earth mounds shall not be used under the pipe line for any purpose.
- C. Dewatering - The trench shall be completely dewatered before any pipe is laid and shall be kept dry until the joint has been made and the backfill carried to the top of the pipe. Joint areas may be left open for inspection during pressure and leakage tests.
- D. Inspection and Cleaning Before Installation - All pipe and fittings shall be carefully examined for defects and shall be cleaned of blisters, excess coating from the bell and spigot ends, and shall be free of oil, grease and debris before the pipe is laid.
- E. Laying of Pipe - Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations no debris, tools, etc. shall be placed in the pipe. When pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug. This shall apply during break periods as well as at the end of the construction day.
- F. Cutting of Pipe - The cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe or cement lining. Flame cutting of any pipe by means of an oxyacetylene torch will not be allowed.

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- G. Bell Ends to Face Direction of Laying - Pipe shall be laid with bell ends facing in the direction of laying, unless directed by the Water and Sewer Superintendent.
 - H. Assembly of Push-On-Joints - The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe. The spigot end of the pipe shall be entered into the socket with care used to keep the joint from contacting the ground. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field-cut pipe shall be filed or ground to resemble the spigot end of such pipe as manufactured. Deflection of push-on joint pipe shall not exceed the maximum limits shown of Table 2, AWWA Specifications C-600.
 - I. Pipe Restraint System - All pipe restraint shall be a retainer System, EBBA Iron Works "Mega Lug" or approved equal. No thrust blocks will be accepted. All hydrant assemblies shall be completely restrained using the retainer system (EBBA Iron Works "Mega Lug"). For push joint pipe, restraint gaskets may be used in accordance to the pipe restraint schedule; however, all fittings will require retainer glands. All pipe sections after fittings can use restraint gaskets for length. **See attached Pipe Restraint Schedule.**
 - J. Backfill - Backfill shall be compacted to 95% of maximum unit weight and incidental to the watermain item. MDOT Granular Material Class III shall be placed 4" below & 12" above the proposed pipe. Pipe within the 1 on 1 influence of the road shall be MDOT Granular Material Class II or III. All other backfill material shall be suitable material excavated from the trench (other than wet unsuitable clay). It shall be free of cinders, ashes, refuse, sod, organic materials, and boulders, rocks, or pavement in size greater than 6" in any one dimension.

III. Electrical Thawing Devices and Conductivity

- A. General - A device to provide electrical conductivity from one pipe length to another shall be furnished on all new watermain and also on all cut-ins to existing watermain. Thawing devices shall be capable of carrying a minimum of 150 amperes of current through the pipe joint without damage to the gasket in the joint.
- B. Serrated Silicon Bronze Wedges - Serrated wedges can be used with push-on joint in accordance with the manufacturer's recommendation. Each wedge shall be driven into the opening between the plain end and the bell until snug. When four or more wedges are used, they shall be inserted side-by-side in pairs.
- C. Conductive Push-On Gaskets - Gaskets having metal contact strips which are molded or inserted into the gasket may be used in lieu of wedges in push-on joints. The gasket seating surface should be thoroughly cleaned prior to assembly.

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- D. Cable or Strip Conductor - May be used for all types of joints. Conductor shall be sufficiently flexible to withstand minor ground and pipe movement. When it is necessary to bond conductor strips to cut lengths of pipe in the field, the strips shall be welded to the pipe by exothermic welding.
 - E. Payment - Furnishing and placing electrical thawing devices will not be paid for separately but shall be considered incidental to furnishing and laying the pipe.
 - F. Testing - After installation of the mains, backfilling and the hydrostatic pressure tests are completed, the system (pipe line and hydrants) shall be tested for electrical continuity and current capacity.

It is imperative that all lines and appurtenances be filled with water prior to conductivity testing. The line will be tested in sections between hydrants. The hydrants and hydrant valves will be opened to bleed off any air in the lead. The hydrant will be closed and the hydrant valve left open. Adjacent hydrants will serve as test section termini.

The Contractor will provide electric current of 150 amperes for the tests. Direct current of 150 amperes shall be passed through the pipeline for a period of five minutes. Current flow through the pipe shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the five-minute test. Insufficient current or intermittent current or arcing indicated by large fluctuations of the ammeter needle shall be evidence of defective electrical contact in the pipeline. The cause shall be isolated and corrected. Thereafter, the section in which the defective test occurred shall be re-tested as a unit and shall meet the test requirements to the satisfaction of the Water and Sewer Superintendent.

The Contractor shall supply the labor and equipment to perform the test to the satisfaction of the Water and Sewer Superintendent, the cost of which shall be considered incidental to the unit price bid per lineal foot for watermain.

IV. Hydrostatic and Leakage Tests

- A. Pressure Test - After the pipe has been laid and partially backfilled; all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of not less than 150 psi for at least two hours. Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected in a manner satisfactory to the City. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Contractor. All air shall be expelled from the pipe before applying the test pressure. No pipe installation will be accepted if the leakage is greater than that determined by the formula.

The table of allowances governing leakage tests is based upon the following formula taken from AWWA Standard for Installation of Ductile Iron Watermain and Appurtenances (ANSI/AWWA C600-05):

$$L = (SD) \times \sqrt{P/148,000}$$

in which L is the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in PSI gauge (typical P=150psi).

It is recommended that water be allowed to stand in the pipe for 12 to 24 hours prior to beginning the leakage test. The Water and Sewer Superintendent shall be furnished with a written report of the results of the leakage and pressure test that identified the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. If any test of pipe laid discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints.

The pipe may be subject to hydrostatic pressure and inspected and tested for leakage after the trench has been partially backfilled. Contractor shall schedule with Water and Sewer Supervisor at least 48 hours prior to running any tests. All tests are to be witnessed by a representative of the Water and Sewer Division.

Hydrostatic will not be allowed to include more than 2,000 feet of pipe at any time unless approved by the City's Water and Sewer Superintendent in writing prior to the start of construction. Therefore, testing will be divided as agreed upon by both the Contractor and the City. All hydrostatic testing shall be completed during normal business hours unless the contractor agrees to cover all associated overtime and equipment costs prior to the said testing.

V. Cleaning and Disinfecting

- A. Flushing Watermain – The watermain shall be flushed in such a manner to provide a minimum velocity of 3 feet per second in the line being flushed. The line shall be flushed prior to chlorination of the watermains. Use of blow off fire hydrants or other means as shown on the plans or approved by the City to flush water mains may be used. Provide hoses and other equipment and arrange a means of disposing of the water without damaging the work or adjacent property.

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B. Chlorination - All newly laid line shall be chlorinated and disinfected per AWWA Standard C651. The contractor shall furnish all necessary equipment and materials and shall furnish all necessary assistance for effective disinfection of the mains. Chlorination shall be accomplished by using the following general procedures

1. After the watermain has been pressure tested and flushed, the Contractor shall pump a chlorine solution into the watermain in such a manner and at such strength that the residual free chlorine shall be 50 to 100 parts per million (ppm).
 - a. If high test calcium hypochlorite is used, prepare a 50 (fifty) parts per million solution in water and pump at a constant rate into the watermain while bleeding off the water at the extreme end. The rate of application will need to be adjusted for the degree of concentration, normally, 65 percent available chlorine. If liquid chlorine is used, apply to main as above. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine, normally, 15 percent available chlorine.
 - b. If liquid chlorine is used, apply to main as above. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine.
 - c. If chlorine gas is used, it shall not be injected directly into the mains but shall be applied through an appropriate chlorinating device to place the chlorine into a water solution prior to injecting it into the main. Leaking of chlorine gas must be prevented! If chlorine gas is used, the procedure and equipment must be checked and approved in writing by the Water and Sewer Superintendent.
2. The chlorinating agent shall be applied at the supply end of the line through a corporation cock. Extreme care shall be exercised to prevent any of the strong chlorine solution from entering the existing water main. If the strong chlorine solution does enter any existing main, Water and Sewer personnel shall correct the situation at the Contractor's expense at the direction of the Water and Sewer Superintendent.

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3. The chlorinated water shall be retained in the new watermain for a period not to exceed 24 hours nor less than 16 hours in the event 50 parts per million is used, or not to exceed 12 hours nor less than 8 hours if a 100 parts per million is used. In cases where a shorter retention period is necessary, a stronger solution may be used and the retention period reduced accordingly. Disposal of the chlorinated water shall be the responsibility of the Contractor. All valves controlling water used from the distribution system shall remain under the control of the Water and Sewer Division personnel.

For solutions stronger than 100 parts per million, the approval of the Water and Sewer Superintendent must be secured in writing as to the length of retention time in relationship to chlorine strength.

While the chlorine solution is in the line, the Contractor shall operate the valves in the chlorinated section to ensure the complete disinfection thereof.

4. The chlorinated water shall be flushed from the main at the end of the retention time so that the entire line is clear of any residual chlorine. Dispose of chlorinated water in accordance with applicable state and federal requirements. If necessary, apply a reducing agent to the water to neutralize the chlorine and create a chlorine residual of no greater than 1 ppm. A sample shall be taken by the City of Norton Shores after the line is flushed for bacteriological analysis. In the event that the water does not pass this bacteriological test, the test procedure outlined above shall be repeated until the test reports show the quality of water is substantially the same as that being delivered from the existing distribution system. Quantity and location of samples taken shall be determined by the City of Norton Shores' Water and Sewer Division. All costs incurred incidental to failed bacteriological testing shall be the responsibility of the contractor.
5. Total coliform monitoring following the disinfection of the main shall be a minimum of two (2) sets of non-detected samples collected 24 hours apart to one of the following options:
 - a. After final flushing, collect the first sample, wait at least 16 hours, and then collect the second sample.
 - b. After final flush, wait at least 16 hours before collecting the first sample, then wait at least 15 minutes before collecting the second sample.
6. All flushing and testing shall be completed during normal business hours unless the contractor agrees to cover all associated overtime and equipment costs prior to said flushing or testing.

VI. Connection of New Water Mains or Services

- A. Connecting Water Mains - The contractor shall schedule water main tie-ins with the Water and Sewer Division with a minimum advance notice of 5 days (3 days for customer notification and 2 days for preparation and delivery of the notification). The tie-ins will be completed during normal business hours unless it is determined by the Water and Sewer Superintendent that a tie-in must be done after business hours because of system needs or critical customer needs, the Contractor will provide such service at his own expense. [The Water and Sewer Division shall assume all expense incurred internally with all non-business hour tie-ins.]
- B. Connecting Water Services - The Contractor shall schedule all water service tie-ins with the Water and Sewer Division with at least a 24 hr notice. All water service tie-ins shall be scheduled during normal business hours. If the Contractor wishes to have any inspections or testing completed after normal business hours he may request those inspections and will be responsible for any incurred overtime labor or equipment charges by the City. If directed to complete such inspections or testing after hours by the Water and Sewer Division it shall be considered to be incidental to the project and all overtime charges incurred by the City shall be at City's expense.

VII. Restoration Specifications

***Unless otherwise directly specified or called on plans, restoration specifications shall be as follows:**

- A. Gravel Surface Restoration - Graveled roads, road crossings, shoulders, driveways, and parking areas will be restored with 6- inches of MDOT 23A Aggregate Surface Course per MDOT Standard Specification Section 306, unless otherwise specified by the City.
- B. Local Road Crossings and Paved Driveways - Shall be saw cut beyond the limits of construction as directed by the City. Replacement of local roads shall consist of 6 or 8-inches (matching existing aggregate base thickness) of MDOT 21AA or 22A Aggregate Base material (CIP) per MDOT Standard Specification Section 302, MDOT HMA 13A levelling course @ 165#/syd and MDOT HMA 5E1 or 13A top course @ 165#/syd placed per MDOT Standard Specifications Section 501. Replacement of paved asphalt driveways shall consist of 6-inches of 21AA or 22A Aggregate Base material (CIP) with MDOT HMA 13A levelling course @ 165#/syd and MDOT HMA 36A top course @ 165#/syd. Pay limits are determined based on 1-on-1 slopes from the top of pipe plus one foot.

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- C. Major Road Crossing - Shall be saw cut beyond the limits of construction as directed by the City. Replacement of major street shall match existing with a minimum consisting of 8 inches MDOT 21AA or 22A Aggregate Base material (CIP per MDOT Standard Specification Section 302, MDOT 3C levelling course @ 220#/syd (2") and MDOT HMA 5E3 or 4C top course @ 220#/syd (2"). Pay limits as described above.
 - D. Disturbed Areas - Traveled roadways used for storage of excavated materials shall be cleared, cleaned and/or bladed as directed by the Engineer to present a finished look to the project. Existing topsoil will be salvaged and replaced. All disturbed areas outside the roadway shall be top soiled to 4 inches in depth, seeded and mulched or sodded according to the plans. The cost of salvaging and replacement of existing topsoil and final cleanup shall be included in the item for Restoration. Surplus excavated material not needed for embankment shall be disposed of by the Contractor. Headwalls, culverts, drains, sewers, and appurtenances filled or damaged by the Contractor during the course of the operations shall be cleaned, repaired, or replaced at the Contractors expense.
 - E. Clearing - Shall be in accordance with MDOT specifications.
 - F. Concrete Driveways - Shall be saw cut and removed as needed and shall be replaced with 6-inch concrete, MDOT Division 6, Grade Pl.
 - G. Protection of Trees - All trees which are to be preserved and which, in the opinion of Engineer, might be subject to damage by the Contractor's operations, shall be adequately protected against damage to the bark by 2-inch thick vertical planking securely wired or tied completely around the tree trunk. Such protection shall not be removed until authorized by the City. Trees which interfere with the work, and the removal of which is permitted, shall be removed by the Contractor in a safe manner. No trees are to be removed without the expressed approval of the governmental body that has jurisdiction thereof, and the Engineer.

VIII. Measurement and Payment

- A. Watermains - Shall be measured in place and paid for using the unit price bid and shall include all work and materials necessary to excavate, install, backfill, test and dispose of excess material according to these specifications. No deduction in length will be made for valves and fittings.
- B. Fittings and Hydrants - Shall be paid using the unit price for fittings in place and shall include joint restraint systems when called for on the plans. Standard fire hydrant assembly shall be paid as a unit in place and include the hydrant, restraints, valve and box, and 6" ductile iron hydrant lead.

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- C. Gate Valves and Boxes - Shall be paid using the unit price bid for each valve in place.
 - D. Road Crossings, Paved Driveways and Gravel Driveways - Shall be paid by the square yard for bituminous pavement as called for in the plans and specifications. Aggregate base will also be paid for by the square yard for material compacted in place. Payment for these items shall include all work and material necessary to complete road crossings and driveways using the unit prices bid.
 - E. Butterfly Valves and Boxes - Shall be paid using the unit price bid for each valve in place.
 - F. Butterfly Valves and Well - Shall be paid using the unit price bid for each valve, well, and cover in place.
 - G. Salvage Fittings - Shall be paid using the unit price bid for salvaging, cleaning, reusing and/or delivering to Norton Shores Department of Public Works facility at 1174 E. Mt. Garfield Road as shown on the plans or directed by the Water and Sewer Superintendent.
 - H. Concrete Driveways - Shall be paid by the square yard for 6-inch concrete using the unit price bid.
 - I. Blow Offs - Shall be measured and paid using the unit price bid for blow offs, completed and in place according to plan details. Price shall include all work and materials necessary to construct according to details. The plugs will be paid as separate items.
 - J. Class A Sod - Shall be paid per square yard as per MDOT specifications.
 - K. Restoration - Shall be paid as a lump sum; for Class A or Roadside seeding at a rate of not less than 100 pounds per acre, fertilizer at a rate of not less than 240 pounds per acre, and mulching with straw, hay, or other approved material at a rate not less than 1.5 tons per acre. Hydro mulch is approved. If called for on the plans, Class A or Roadside seed may be measured and paid for by the pound and unit price per pound shall include all work to also fertilize and mulch the areas needed.
 - L. Water Services - When called for in the plans or specifications shall be measured and paid for using the lump sum price bid for long or short services. Work shall include, but not be limited to, tapping the watermain; placing copper tubing; setting curb stops as directed by the Water and Sewer Superintendent in the field; supplying the Water and Sewer Superintendent with measurement ties to both the curb stop and the corporation stop. Ties are to be to houses or other permanent structures. Services crossing paved streets shall be blown under or moled under the street in a safe manner as to protect all other utilities. Services shall have a minimum of 5 feet cover and all backfill is to be compacted to 95% of maximum density.

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- M. Traffic Control - Maintaining traffic shall be the responsibility of the Contractor and shall be paid as a lump sum unless otherwise called out in the bid documents. Signs and barricades will be furnished and operated by the Contractor. All signs, lights, and barricades connected with the project shall be maintained by the Contractor from the time they are placed until otherwise notified by the Project Engineer. All lights and flares must be lighted from one hour before sunset until one hour after sunrise. The Contractor may be required to furnish flagmen with necessary equipment such as flags, signs, safety vests, etc. as determined by the City. The City shall be furnished the name and address of an employee within a ten mile radius who can be called in case of an emergency. All barricades and signs shall conform to the current Michigan Manual of Uniform Traffic Control Devices.
- N. All Materials - will be supplied by Contractor, shall meet Norton Shores specifications, be made in the USA, and after installation shall include a one-year warranty.

IX. Digital Record Plan Submission Requirements

A. Electronic Drawing Files

1. The City shall be furnished with digital data in AutoCAD, compatible with the current City of Norton Shores AutoCAD program (.dwg) or ESRI (shapfile or geodatabase) format. Standard transfer media will be accepted. This media includes CD, DVD, email, ftp or portable storage device.
2. Drawing files of the completed record plans at a minimum must contain all new and altered infrastructure including but not limited to mains, cleanouts, manholes, hydrants, water services (including corporation stops and curb stops) and valves as well as pertinent location information such as back of curb, sidewalks, nearby structures and existing utilities. It is not necessary to include background information such as logos or title blocks in the drawings.
3. Drawing files shall be submitted in the following projection and datum when available:
 - NAD 1983 State Plane Michigan South FIPS 2113 Intl Feet
 - Projection: Lambert Conformal Conic
 - False Easting: 13123359.58005249
 - False Northing: 0.00000000
 - Central Meridian: -84.36666667
 - Standard Parallel _1: 42.10000000
 - Standard Parallel _2: 43.66666667
 - Latitude of Origin: 41.50000000
 - Linear Unit: Foot (0.304800)

Geographic Coordinate System:
GCS North American 1983
Datum: D North American 1983
Prime Meridian: 0

Vertical datum shall be in:
NGVD 1988 also expressed in international feet

If for any reason, a drawing is not in NAD 1983 Michigan State Plan South projection, the drawing must include reference and coordinates to the 2 nearest Public Land Survey System (PLSS) section corners. Documentation should be provided as to the drawing's projection and any scale factors used in the drawing.

B. Electronic Plot Files

1. The Engineer shall deliver one scanned or exported set of approved record plans in Adobe PDF format. The record plan sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the drawings shall be included in the electronic submittal as a separate PDF document. The plan sheets shall be scanned or exported at a minimum of 300 dpi resolution to maintain legibility of each drawing with a 24" x 36" page size. These drawings will assist in the process of performing quality control and quality assurance. The drawings will be reviewed for format and completeness.
2. A full set of record drawings shall be delivered at the project's completion shall be included. For example, do not include "Bid Set" drawings in a record plan submittal. Also, do not include documents that would not normally be included in the set of imaged drawings.
3. Include a label on the media or digital file indicating project name and number, consultant name, project manager and telephone number, type of submittal, subdivision name, date of submittal, and file format.

PIPE RESTRAINT SCHEDULE

LENGTH OF RESTRAINT REQUIRED *(FEET)								DESIGN STRENGTH OF RESTRAINT REQUIRED (KIPS) **	
DEFLECTION ANGLE PIPE SIZE	22-112°	33-3/4°	45°	56-114°	67-1/2°	78-3/4°	90° OR TEE	45°	90°, DEAD END or TEE
6"	4'	8'	14'	20'	30'	37'	47'	3.0	6.0
8"	5'	10'	19'	28'	40'	52'	64'	4.0	12.0
10"	6'	14'	23'	36'	49'	63'	78'	5.0	18.0
12"	8'	17'	28'	42'	58'	75'	93'	8.0	26.0
14"	9'	18'	32'	47'	66'	87'	107'	10.0	36.0
16"	10'	20'	34'	51'	72'	94'	116'	14.0	46.0
18"	10'	22'	38'	58'	81'	105'	131'	18.0	59.0
20"	10'	22'	39'	59'	81'	106'	131'	22.0	73.0
24"	12'	26'	44'	68'	95'	123'	153'	31.0	103.0
30"	14'	31'	53'	79'	111'	143'	180'	47.0	162.0
36"	16'	36'	62'	93'	130'	169'	210'	69.0	234.0
42"	17'	39'	67'	101'	141'	184'	228'	93.0	319.0
48"	19'	43'	75'	113'	157'	206'	255'	123.0	417.0

• In each direction from point of deflection except for tee, at which only the branch where flow changes direction.

•• If tie rods are used, add 1/8" to bar diameter as corrosion allowance.

Basis of Design for Above Table:

1. Cover over pipe = 5.0 foot minimum
2. Earth friction coefficient - $\frac{0.4}{1.5 \text{ safety factor}} = 0.26$

NOTE: The above length of restraint required is the minimum. For less cover or poor soil conditions, the restraint length shall increase as shown on the drawings or as directed by the Engineer