January 2007

PART 5
STANDARD SPECIFICATIONS
FOR THE CONSTRUCTION OF SEWERS

CITY OF ONALASKA, WISCONSIN

CONTENTS

SECTION 501: SEWERS

501.1 GENERAL

The Contractor is to make the required excavation for building the sewer and appurtenant structures; to do all ditching, diking, pumping, bailing, draining, and laying under drain if required, all sheathing, shoring, bracing, and supporting, all fencing, all rock excavation, lighting, and watching; to make all provisions necessary to maintain and to protect buildings and other structures, fences, water pipe, gas pipe, sewers, culverts, railways, and any other structures; to repair all damage done to such structures at their expense; to provide all bridges, fences or other means of maintaining travel on intercepted streets and roads in which the trenches are excavated; to construct all foundation, all brick, concrete, stone and timber work; to set in place all iron work; to build all roadways, to refill all trenches, to clear away all rubbish and surplus material, and to furnish all materials, all tools, equipment, and labor required to build and put in complete working order the specified section of sewer.

501.2 LOCATION OF UNDERGROUND OBSTRUCTIONS

The location of pipes and other underground objects are approximately correct as shown on the plans, but should they be found to be otherwise, or should the Contractor encounter quicksand, springs, or other difficulties, he shall have no claim on that account, it being understood that the Board or Engineer do not warrant the plot of underground objects to be correct.

501.3 PRIVATE LANDS

The Contractor shall not, unless consent has been given by the proper parties, enter or occupy with men, tools or material any land adjoining the work.

501.4 TEMPORARY BRIDGES & CROSSING

Whenever it is necessary to cross roads or railways, the Contractor shall, at his own expense, provide suitable and safe bridges or other sufficient crossing for the accommodation of travel on the said road, and shall maintain the same in a good and safe condition until the roads can be restored, when he shall remove all bridges and other temporary expedients and restore said roads to a condition suitable for use. The Contractor shall give reasonable notice to the owners of railroads and private ways before interfering with them. He shall provide watchmen, red lights and fences at his own expense, and take such other precautions as may be necessary to protect life and property; and he shall be liable for all damages incurred in any way by his acts of neglect, or that of his agents, employees, or workmen.

501.5 EXCAVATION

Where salvable material such as crushed rock or stone of a depth of 6 inches or more is encountered in excavation of utility installation, such material shall be carefully removed and segregated for future use by the City or as directed on the project by the Engineer. In such cases, the Engineer shall order removal and segregation of materials he considers salvable, where it shall be stored, and whether or not it is to be used by the Contractor in final backfilling operations on the project involved. Contractor shall be compensated for haulage of salvaged material on the same basis as for excess dirt or debris.

The Industrial Commission Code for Safe Trench Excavation shall be adhered to where applicable, subject to such specific additions as are incorporated in the plans and specifications. The excavations must either be sloped or supported as required to comply with OSHA requirements as defined in 29 C.F.R. Sub-part P ï Excavations. Said regulations shall become a part of these specifications by reference.

The Contractor shall not deviate from the type of excavation indicated on the plans without written approval of the Engineer, except in case of driveways and surface obstructions requiring short tunnel sections, which have been indicated on the plans as open trench sections.

The trench in which the sewer and appurtenances are to be constructed shall be excavated in all cases in such manner and to such depths and widths as will give suitable room for the building of the structures they are to contain, and for bracing and supporting, pumping and draining, and for removing from the trench peat, silt or other materials which may not be deemed proper for foundations.

Not more than one City block of trench shall be opened in advance of the completed sewer, except by permission of the Engineer, nor shall the limits of such open trench extend simultaneously across two streets intersecting the street in which the work is being done; nor in the case of a sheathed trench shall the opening in the street extend farther in length than the amount of sheathing physically present on the site.

Open cut trenches shall be sheathed and braced as required by the Industrial Commission Code, by the plans and specifications, and as may be necessary to protect life, property, or the work. When close sheathing is required, it shall be driven so as to prevent adjacent soil from entering the trench either below or through such sheathing.

The Contractor shall furnish, put in place and maintain such sheathing, bracing, etc. as may be necessary to support the sides of the excavation, whether above or below the grade of the sewer, and to prevent any movement which could in any way injure the masonry, diminish the width necessary for proper drainage, or otherwise injure or delay the work; all slides and cave-ins to be at his expense and cost.

If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports at the expense of the Contractor, and the compliance with such orders shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports.

The bottom of the trench, in general, is to be excavated to the exact form and size of the lower portion of the sewer which is to be laid in it. In case of pipe sewers, the bottom of the trench shall be trimmed to the form of the outside of the pipes with additional excavation at the joints, so that the bearing shall be continuous and the pressure shall be equally distributed.

All materials shall be so placed as not to endanger the work and so free access may be had at any time to all parts of the trench and all hydrants and gates in the vicinity. They shall be kept neatly piled so as to inconvenience as little as possible the public travel of the adjoining tenants. Reasonable provision shall be made for travel on the streets, roads, railroads and private ways.

If detours are required, the Contractor shall furnish, at his own expense, approved type barricades, properly lighted and protected. Layout of detour must be coordinated with the Board of Public Works, the Police Department, and the State Highway Commission where state or federal highways are involved.

The Contractor is to furnish adequate pumping equipment to maintain essential ground water level for particular construction involved.

Water is not to be allowed to rise on any masonry until the mortar has set, and no stream of water shall be allowed to flow over the masonry until such time as the engineer may direct.

All water pumped or bailed from the sewer trench shall be conveyed to a suitable point of discharge subject to approval of the Engineer.

Care shall be taken not to move, without the consent of the Engineer, any sewers, drains, water or gas pipes, or other structures, and in crossing these, and in running parallel or near them they shall be sustained securely in place until the work is completed. Whenever it is necessary to interfere with said structures, the Contractor shall maintain their respective service, and if necessary for that purpose, shall lay temporary water, gas or other pipes. He shall repair all damage done to any of said structures, and he shall leave them in as good condition as they were previous to the commencement of the work. If so directed by the Engineer, permanent changes of location not indicated on the plans nor in specifications shall be made by the Contractor to meet the requirements of the sewer and appurtenances, and new work shall be added, when necessary, to leave all in good working order. The cost of such permanent changes not indicated on the plans nor in the specifications is to be paid for as extra work, on the valuation of the Board of Public Works, and depending on the decision of the Engineer as to whether the work done is or is not included in the work required by the Contractor under his Contract. Any damage done or caused to said pipes or other existing structures by act or neglect on the part of the Contractor is to be paid by him.

The Contractor shall be responsible for disposing of all excess dirt and debris resulting from construction. The City will not furnish a disposal site unless otherwise stated on the plans or in the special specifications. Cost shall be included in bid price for pipe laid unless a bid item is included in the Bid Proposal.

No stone monuments, bench marks, etc. of any description locate in line of the work, shall be removed or taken up unless it be in the presence of the Engineer or his assistants.

END OF SECTION

SECTION 502: TRENCHES

502.1 TRENCHES – OPEN CUT & SHEATHED

The width of the trench shall be sufficient to allow the pipe to be laid and jointed properly and to allow the backfill to be placed and compacted as needed. The trench sides shall be sloped from the top of pipe as required or braced as required by OSHA regulations. Ledge rock, boulders, and large stones shall be removed to provide a minimum clearance of 4 inches below and on each side of the pipe.

Maximum trench width for 36 inches or larger pipe shall be 3 feet greater than the outside diameter of the pipe. Maximum trench width for pipe smaller than 36 inches shall be 5 feet. These maximum widths shall apply except where specially specified on the plans or in the specifications. Trenches shall be kept free from water until the material in the joints has sufficiently hardened.

Where sheathing is specified on the plans, no excavation of more than 6 feet in depth shall be permitted before sheathing is installed, unless field conditions require sheathing at a shallower depth to protect pavement, curb and gutter or other structures, as determined by the Engineer.

All applicable safety standards set by the US Department of Labor, Occupational Safety and Health Administration (OSHA) shall be strictly adhered to; noting specifically Title 29, Chapter XVII, Part 1926, Safety and Health Regulations for Construction. In addition the following Order 6.06 from the Industrial Commission Code shall be strictly adhered to:

502.1.1 – TIMBERING REQUIREMENTS AND PROCEDURES FOR TRENCHES AND OTHER EXCAVATIONS

(1) Brace or Slope. All areas in trenches in which men are permitted to work shall be adequately and securely timbered or sloped as follows:

(a) Depth. Exception. Trenches cut in hard solid soil need not be braced or sloped if less than 4 ½ feet in depth. Trenches cut in loose or sandy soil need not be braced or sloped if less than 3 feet in depth.

(b) Rock. Exception. Trenches need not be timbered if excavated in solid rock and if there have been no previous known excavations within the minimum lateral distance of the depth of the trench being excavated. The total depth of the trench must be in rock or any over burden must be sloped or braced.

(c) Sloping. Exception. Trenches need not be timbered if the sides are cut down to the angle of repose. The angle of repose shall not be considered greater than one to one-half (measuring 1 foot of rise to each ½ foot horizontal) for dry or moist soils and not more than one to one for wet or heavy soils.

(2) Partial Slope with Benches. When the sloping of trenches to the angle of repose does not extend to the bottom of the trench, level benches 2 feet wide shall be provided adjacent to and between the top edges of the vertical walls and the toes of the slopes. The spoil bank adjacent to a slide sloped trench shall be kept at least 2 feet from the top of the slope.

(3) Partial Slope and Braces. Uprights in all partially sloped excavations shall extend not less than 2 feet above the vertical portion. The vertical part of the trench shall be timbered in accordance with the trench bracing requirements. Toeboards with a total of 12 inches in height shall be placed behind all uprights to prevent material from falling into the vertical portion of the trench.

(4) Undercutting. All trenches shall be cut with vertical walls unless side sloped to required minimums. Undercutting or trenches sloped to less than required minimums shall not be permitted.

(5) Timbering Tables. Timbers shall be installed according to tables of trench timbering requirements contained in this code.

(6) Good Installation. In using Tables 1, 2, 3, and 4, maximum distance from the top of the trench to the top cross brace and from bottom of the trench to the bottom cross brace shall be 2 feet. All sheathing shall extend from the ground surface to at least within 6 inches of the bottom of the trench. If any cross braces are removed to install pipe or other conduits, men shall not be allowed to return to work in these unprotected areas except to replace the cross braces.

(7) Good Timber. All timbers used for supporting sides of trenches shall be of good quality, reasonably straight grained and free from weakening knots and other defects.

(8) Driving Sheathing. When sheathing is driven by power equipment, drivers especially designed for the purpose shall be used.

(9) Plans for Approval. For trenches and other excavations exceeding 40 feet in depth or 12 feet in width, plans for timbering shall be submitted to the Industrial Commission for approval.

(10) Equivalency Approval. Other methods of supporting the walls of an excavation may be approved if designed and constructed to afford equivalent protection.

(11) Barricade. A temporary guard railing or other effective guard or barricade shall be provided at or near the sides of excavation, and shall be kept in place at all times, except at such times when safeguards will interfere with excavation or other work, or in places not frequented by the public.

(12) Night Lights. All trenches exposed at night shall have lighted red lanterns, torches, or flashers placed along the exposed side or sides.

(13) Ladders. A substantial ladder shall be provided for access to al trenches greater than 8 feet in depth.

(14) Brace Removal. While removing trench bracing, workers shall be required to work only in the portion of the trench where bracing is still in place.

The top of any sheathing shall not be driven below the existing ground or street elevation.

502.2 PIPE BEDDING

The foundations in the trench shall be formed to prevent any subsequent settlement, which might result in excessive pressure and consequent rupture of the pipes. If the foundation is rock and equalizing bed of concrete or sand well compacted shall be placed upon the rock. The thickness of these beds shall be not less than 4 inches.

If the foundation is good firm earth, the earth shall be pared or molded to give a full support to the lower third of each pipe, and if necessary, to secure a proper bearing for the pipe, a layer of concrete, fine gravel, or other suitable material shall be placed. The same means of securing a firm foundation shall be adopted in case the excavation has been made deeper than necessary.

Bedding Class B described in ASTM C12 (1981) shall be used for all pipe unless otherwise specified by the Engineer.

END OF SECTION

SECTION 503: PIPE & STRUCTURE PLACEMENT

503.1 PIPE LAYING

503.1.1 METHODS

The Contractor is responsible for maintaining line and grade for all pipe laid. A laser shall be used for this purpose. The method used shall provide accurate line and grade for the existing construction conditions. The Contractor will be required to re-lay any pipe not installed on proper line or grade.

503.1.1.1 LASER

Lasers specifically designed for providing line and grade for pipe laying may be used. The laser shall be capable of maintaining line and grade within 0.1% (0.02 foot allowable error per 100 feet). The laser shall be securely mounted in the pipe or manhole as per the manufacturer's recommendations and shall be checked periodically to insure accurate alignment is maintained. The Contractor shall provide a method of checking laser alignment after 25 feet of pipe have been laid, and at 100 foot intervals thereafter. The check may be made by using a batter board, a transit mounted over the laser, or other method approved by the engineer that checks both line and grade, and is independent of the laser beam.

The laying of pipes in finished trenches shall be commenced at the lowest point, so that the spigot ends point in the direction of flow. All pipes shall be laid with ends abutting and true to line and grade. They shall be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert.

Lifting holes shall be plugged with tapered cast concrete plugs mortared in place, or other plugs approved by the engineer.

Each pipe shall be carefully inspected, and those not meeting the specifications shall be rejected. No pipe shall be laid except in the presence of the engineer or his authorized inspector, and the engineer may order the removal and relaying of any pipe improperly installed.

503.2 BACKFILLING TRENCHES

All trenches and excavations should be backfilled as ordered by the Engineer or his representative, unless other protection of the pipe line is directed. The backfill should be solidly tamped about the pipes up to a level at least 1 foot above the top. This material should be deposited in uniform layers of 6 inches or less. Unless otherwise permitted, each layer should be solidly tamped or rammed with proper tools so as not to disturb the pipeline. Backfill materials shall be clean and approved by the Engineer, free from rocks or broken concrete exceeding 2 inches in size.

The remainder of the trench shall be backfilled by mechanical compaction methods. Backfill shall be placed in layers not generally exceeding 12 inches in depth, and each layer thoroughly compacted before the following layer is placed. Organic material, large stones, debris or frozen lumps of earth, will not be allowed in the backfill. The mechanical compaction equipment shall be capable of compacting the backfill to the specified density. If not otherwise specified, the required density shall be 95% of maximum (Proctor) density. The type of mechanical compaction equipment and the compaction method shall be approved by the Engineer prior to

backfilling. If the Contractor wants to use compaction equipment or methods which the Engineer feels may not provide adequate compaction, the Contractor shall pay for not less than three soil compaction tests by an independent testing lab taken at locations specified by the Engineer.

Where solid compaction tests are called for in the special specifications, they shall be conducted by a qualified independent testing lab at the Contractor's expense unless otherwise stated. The tests shall be taken at locations specified by the Engineer.

The Engineer reserves the right to reject any compaction method that may damage the sewer pipe or other utilities or structures. This does not relieve the Contractor of any liability for such damage.

The trench may be settled by jetting with water after granular backfill is placed, or by other methods approved by the Engineer. Any alternate method of compaction shall be approved by the Engineer prior to placement of backfill.

For water flooding, puddling, or jetting for consolidating granular backfill, the Contractor shall provide at the Contractor's expense an approved setup that shall prevent backflow or back-siphonage into the water supply. Said setup shall conform to State and Local plumbing codes and Chapter 145 of the Wisconsin Statutes and be approved by the Engineer. The Contractor shall obtain a wrench, valve, and meter for a temporary water supply from a hydrant or approved source, from the Water Utility. The Contractor will be billed for water according to the standard price schedule of the Water Utility. The Contractor shall be responsible for any damage to or loss of Water Utility equipment. Final payment to the Contractor will be withheld until these costs are paid in full.

The Contractor shall have sufficient hose on hand to accomplish the required watering of the ditch and shall exercise caution in the operation of the City hydrants.

The hose used for jetting shall be equipped with a control valve so the hydrant valve can be kept fully open during use. The hose shall have a minimum diameter of 1 ½ inches and shall be equipped with a pipe nozzle not less than four (4) feet long or less than 1 ½ inches in diameter. A longer nozzle shall be used if deemed necessary by the Engineer. During the jetting operation, the nozzle shall be inserted as deeply into the backfill as possible without damaging the sewer structure or other utilities. The nozzle should not be inserted to within 2 feet of the sewer pipe. The insertions should be made at intervals of 5 feet or less and maintained until the backfill is saturated. Depressions caused by flooding shall be backfilled until no further settlement occurs.

As the work progresses, all rubbish or refuse and all unused materials and tools shall be removed at once from the ground. Whenever this clearing of rubbish from the streets, or the repairing of the street surfaces, fences or other damage is neglected, notice may be given to that effect to the Contractor, and if said rubbish be not removed or said repairing be not done within two days thereafter, or if the Contractor does not at once take the necessary precautions to insure safety of public travel, the Board may employ other parties to do such work and the expense thus incurred will be deducted from any moneys due or that may become due the Contractor.

When, for any reason, the work is left unfinished, all trenches and excavations shall be filled if so required and the roadways and sidewalks be left unobstructed, and with the surfaces in a safe and satisfactory condition.

No excavated material, except the road surfacing and a limited amount of sand and gravel to be used for masonry, shall be left on the streets; but such materials shall be backfilled into the trench or carted away.

503.3 MATERIALS & WORKMANSHIP

The sewer is to be kept entirely free from rubbish of every kind as its construction progresses. All refuse and surplus matter must be scraped off and entirely removed before it has time to harden, being left, upon completion, entirely clean. The same provisions are to be complied with in regard to catch basins and manholes.

No masonry is to be laid in water, and water shall not be allowed to flow against or over masonry or concrete until it has had time to thoroughly set. Any defects in the work discovered at any time shall be immediately corrected, even if it is necessary to take down and rebuild portions of it.

No masonry, mortar or other cement work shall be done during freezing weather unless the Contractor shall provide the necessary means for, and shall heat the bricks, gravel, sand and water, and shall comply with all requirements to thoroughly protect the masonry from frost during and after laying; all at the cost and expense of the Contractor and with the approval of the Engineer.

503.4 LEAKAGE & INFILTRATION

All sanitary sewers shall be nearly watertight and free from leakage as the materials used will permit. The rate of infiltration of water into the sewer project, including appurtenances, shall not be in excess of 200 gallons per day, per inch diameter, per mile of sewer, for any section of the system. The Contractor is required, however, to repair all visible leaks even if the infiltration requirements are met.

The infiltration allowances for manholes shall be computed using the total number of vertical feet of manhole subject to infiltration expressed as the equivalent diameter sewer.

The maximum allowable infiltration, expressed in gallons per hour, is shown in Table 1 for various pipe and manhole sizes.

New sanitary sewer installed shall be tested for infiltration by the Contractor in the presence of the Engineer. An exfiltration or infiltration test shall be performed with a minimum positive head of 2 feet. An air test, if used, shall at a minimum, conform to the test procedure described in ASTM C828 (1980), entitled "Tentative Recommended Practice for Low-Pressure Air Test of Vitrified Clay Pipe Lines". The testing method used shall be approved by the Engineer and should take into consideration the range in groundwater elevation.

TABLE 1

ALLOWABLE LIMITS OF INFILTRATION
(Based on 200 gal. / in. dia. / mile)

Diameter of Sewer Inches	Infiltration Per Ft. Per Hr. Gallons	Diameter of Sewer Inches	Infiltration Per Ft. Per Hr. Gallons
4"	0.0063	21"	0.0332
6"	0.0095	24"	0.0378
8"	0.0126	27"	0.0426
10"	0.0158	30"	0.0474
12"	0.0190	36"	0.0568
15"	0.0237	42"	0.0663
18"	0.0284	48"	0.0758

42" Dia. Manhole 0.0663 Gal. Per Vertical Ft. Per Hr.
48" Dia. Manhole 0.0758 Gal. Per Vertical Ft. Per Hr.

In flood prone areas, new and replacement sanitary sewer systems shall be designed and installed to minimize or eliminate any infiltration of flood waters into the sewer system or exfiltration from the sewer system into the floodwaters. Any on-site waste disposal systems shall be designed, located and constructed to avoid impairment to the system or contamination from the system during flooding.

503.5 MANHOLES & CATCH BASINS

Manholes and catch basins must be built of such dimensions as are shown on the plans, unless otherwise directed by the Engineer as work progresses.

Manholes and catch basins shall be of precast concrete only. Construction with 6 inch solid concrete block shall only be allowed when pre-approved by the Engineer.

All manhole and catch basin joints, except the upper most joint between the frame and top precast ring, shall be free of concrete mortar. Concrete mortar shall be allowed at this joint up to a thickness of ¾ inch to achieve final plan grade of the casting. All other joints shall be sealed with flexible butyl rubber gaskets or rope. Catch basins joint between concrete and frame shall be sealed with Butyl-Lok rubber gasket material or approved equal.

Precast manhole or catch basin sections shall be mortared to the base if no concrete invert is to be poured.

All pipes entering a manhole or catch basin shall be cut to the proper length as described below. The pipe shall be cut by sawing or other method approved by the engineer. Breaking the pipe to length with a hammer will not be allowed. The pipe shall be cut so the point in the pipe which extends least into the manhole or catch basin is flush with the inside wall of the manhole or catch basin, plus or minus 1 inch. Openings around the pipe shall be sealed with a concrete collar poured both inside and outside the structure to provide a watertight seal. Bricks and mortar shall not be allowed for joint sealing.

Manholes designated as Class "W"; and all sanitary sewer manholes, inlet and outlet pipes shall be joined to the manhole with a gasketed flexible watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall. Class "W" manholes shall be waterproofed on the exterior with a coating of coal tar epoxy or other approved bituminous waterproof coating.

Manhole inverts shall be poured with 3500 PSI concrete (minimum 28 day strength) with ¾ inch maximum aggregate size. Inverts shall be filleted to provide a smooth flow line through the manhole, with the radius of the "trough" formed matching that of the pipe. The fillets shall extend half way up the pipe on each side of each pipe and slope upward to the sides of the manhole. The invert shall be poured directly on the concrete base of the manhole. Where the invert elevation is below the ground water table, the minimum thickness of the invert shall not be less than 4 inches.

503.5.1 CLASS “W” – MANHOLE SEALING

The joints between the manhole casting and cone selection or flattop shall be sealed with an internal or external flexible rubber seal. An external flexible rubber seal shall be utilized on all newly constructed manholes. Internal flexible rubber seals shall only be used on sewer renovation projects with pre-approval by the Engineering Department. A bead of butyl rubber caulk shall be applied to the lower sealing surface of the rubber sleeve to fill minor irregularities.

All manhole joints, except the upper most joint between the casting and top precast ring, shall be free of concrete mortar. Concrete mortar shall be installed at this joint up to a thickness of ¾ inch to achieve final plan grade of the casting. All other joints shall be sealed with flexible butyl rubber gaskets or rope.

503.5.2 CLASS “W” – MANHOLE SEALING MATERIALS

The flexible sleeve portion of the internal/external manufactured frame/rings seal shall be made of a rubber type product. The seal shall have a minimum thickness of 3/16 inch, have a minimum unstretched width of 9 inches and be extruded or molded from a high-grade rubber compound conforming to ASTM C-923. The sleeve shall be capable of a vertical expansion of not less than 2 inches (see attached detail sheet).

The bands used for compressing the sleeve against the manhole shall be fabricated from minimum 16 gauge, if channel sheet, or 5/16 inch diameter, if round, stainless steel conforming to ASTM A240, Type 304, for sheet and ASTM A479, Type 304, for rods. Any screws, bolts or nuts used on these bands shall be stainless steel conforming to ASTM F593 and F594, Type 304.

The internal seal and its appurtenances shall not extend excessively into the manhole opening restricting entry or exit from the manhole.

If the seal is constructed of another flexible material, it shall have both tensile and tear strength equal to or greater than that of the rubber when tested in accordance with the applicable ASTM procedures.

The flexible butyl rubber gaskets or rope shall comply with the physical requirements for Type "B" gaskets in AASHTO Designation M-198 or Federal Specification SS-S-210A, sealing compound, preformed plastic for expansion joints and pipe joint.

REQUIRED GASKET SIZE

M.H. Diameter	Size
48"	1"
60"	1.5"
Ó72"	2"

The butyl rubber caulk shall conform to AASHTO Designation M-198, Type "B".

503.5.3 CLASS "W" – MANHOLE FRAME/RING SEAL PERFORMANCE

Manhole frame/ring seals shall be designed to prevent the leakage of water into the manhole at the area of the joint between the manhole frame and rings continuously throughout a 20-year design life. The seal shall remain flexible, allowing repeated vertical movements of the frame due to thermal movement of the pavement or other causes of up to ½ inch, both rates of movement occurring at rates not less than 0.10 inch per minute.

The seal shall be made of only materials that have been successfully used in sanitary sewer construction for at least 10 years and have proven to be resistant to sanitary sewerage; corrosion or rotting under wet or dry conditions; the gaseous environment in sanitary sewer and at road surfaces including common levels of ozone, carbon monoxide and other trace gases at the sites of installations; the biological environment in soils, and sanitary sewers; chemical attacks by road salts; road oil and common street spillages or solvents used in street construction or maintenance; the temperature ranges, variations in moisture conditions and humidity; fatigue failure caused by a minimum of 30 freeze-thaw cycles per year; or vibrations due to traffic loading; fatigue failure due to repeated elongation and compression; and any combination of the forgoing. The materials used shall be compatible with each other and the manhole materials and be capable of providing a service life of at least 20 years.

The seal shall be designed to continuously, throughout a 20 year design life, prevent the leakage of water from outside the manhole into the manhole at the joint where the manhole frame meets the rings, cone or flattop. At the same time the seal shall remain flexible allowing repeated vertical movements of the frame, due to frost heave of the pavement of the frame or due to other causes, from 0 to 2 inches above the top of the rings, cone or flattop and repeated horizontal movements of the framer with respect to the top of the rings, cone or flattop, due to pavement movements or other causes, of 0 to ½ inch, or both simultaneously, with both types of movement occurring at rates not greater than 1/10 inch per minute. If the seal is an internal seal, it and its appurtenances shall not restrict entry or exit from the manhole. Design shall be as approved by the Engineer.

503.6 CATCH BASIN CONNECTIONS AND GRATES

All existing catch basin connections that are replaced shall be plugged at both ends with at least 6 inches of concrete. In all cases where the existing catch basin connections intersect a new manhole, they shall be connected to the storm sewer system at no extra cost to the City. All other connections shall be left except for those shown to be replaced on the plans.

Catch basin laterals shall be laid at a slope not less than ¼ inch per foot (2%) where practical. Where this slope cannot be maintained, the lateral shall be laid as directed by the engineer.

Materials and methods used for laying catch basin laterals shall conform to requirements for storm sewer mains.

503.7 CONSTRUCTION SCHEDULE – MAINS & CATCH BASIN LEADS

In order to maintain functional purpose of catch basins, in place at the time a storm sewer project is begun, as well as to avoid unnecessary expenditures on the part of the City in the closing, repair or resurfacing of an intersection, it is mandatory that the Contractor proceed as follows in the scheduling of his work:

(1) Catch basin leads to the new sewer must be completed at each intersection during initial closing of such intersection and before a new intersection is closed for construction.

(2) Where catch basin leads are damaged that subsequently are to be "dead", the new leads essential are to be installed as soon as sufficient new main is available for such installation.

(3) Where catch basins leads and basin structures are planned, but do not exist when construction is started, scheduling of such installation shall depend upon the decision of the City with respect to necessity of opening the intersection and to avoid unnecessary expense in repair or replacing the surfacing of the street.

(4) Where closing of intersections is unimportant, such as in new sub-divisions systems, scheduling shall be relatively unrestricted, but the Contractor shall comply with orders where public safety or convenience requires such issuance by the City.

503.8 SIDE JUNCTIONS & HOUSE CONNECTIONS

Fittings for building sanitary sewer connections shall be wyes, unless otherwise specified. These fittings shall be placed at an angle of forty-five degrees with the horizontal, unless otherwise specified. On sewers 12 inches or larger in diameter, tees may be used in place of wyes. Tees or wyes shall be 4 inches in diameter, unless otherwise specified.

House connections shall not be less than 8 feet below the curb grade except in cases where the water line of the sewer is less than 8.8 feet below the curb grade. In all such cases, the water line of the house connections shall not be more than ¼ inch per foot grade above the centerline of the sewer. Where sewers are of a greater depth that 12 feet below the curb grade, the elbows used for house connections may be brought to a point 10 feet below the curb grade, by means of 4 inch vertical stacks unless otherwise specified, and the house connections then run from the elbows. When a vertical stack is used, it shall be plumb and all joints unbroken.

All wyes, tees, and laterals not connected immediately shall be sealed off at their ends with a watertight stopper that can be easily removed for later connections.

Laterals shall be PVC pipe or extra heavy cast iron pipe as designated on the plans for in the bid proposal. PVC pipe and fittings for laterals shall conform to requirements for Type 1, Grade 1, as set forth in ASTM Designation D-3034 and all subsequent revisions thereof. Cast iron pipe and fittings for laterals shall be of the commercial grade known as "Extra Heavy" and shall meet the requirements set forth in the ASTM Specification A-74 and all subsequent revisions thereof. Cast iron pipe and fittings shall be evenly coated with coal tar pitch or similar suitable material.

503.9 PIPE MATERIALS

Pipe used shall be of the size, material, and class specified on the plans or in the special specifications. Each length of pipe and fitting used in a sanitary sewer shall be stamped or indelibly marked with the manufacturers name or mark. All material used shall be free from defects. The Engineer may reject any pipe he feels defective. The pipe used shall conform to the current specification (latest issue) listed below:

Concrete Pipe (reinforced)	ASTM C-76
Concrete Pipe (non-reinforced)	ASTM C-14
Clay Pipe	ASTM C-700
Ductile Iron	AWWA C-100
Cast Iron	AWWA C-100
ABS & PVC Composite	ASTM D-2680

Sanitary sewer pipe joints shall be water tight and shall conform to the current appropriate specification listed below:

Concrete ï rubber gasket conforming to ASTM C-443

Clay ï resilient joint conforming to ASTM C-425

Cast or Ductile Iron ï rubber gasket or mechanical joint conforming to AWWA C-100

ASB & PVC Composite ï Solvent weld or mechanical seal meeting ASTM D-2680.

Rubber gaskets shall be stored in a cool, clean place, as shaded as possible. The gasket shall be applied to the pipe, and the joint made according to the manufacturer's recommendations. The gasket and pipe shall be lubricated to insure proper seating. The joint shall be kept free of any dirt or debris that could affect seating or sealing.

Mortar joints, or any joint approved for sanitary sewer used, shall be used for storm sewers in dry (above groundwater) locations. Mortar to be one part cement to two parts sand by volume. Joints shall be neatly finished with the inside of the pipe free of mortar. Goutweld or gunite joints are acceptable. Joints for storm sewer in wet locations shall conform to requirements for sanitary sewer joints.

503.10 SEWER & WATER LATERALS

The items of sewer and water replacement shall apply only to those laterals where a change in grade is necessary and not to those that the Contractor destroys through operations.

Water Services that are changed shall be cut off a minimum of 2 feet from the outside of the sewer to provide enough room for easy bends in the gooseneck. Forty five degree bends shall be used in lowering sewer laterals.

Laterals shall be replaced with the same type of pipe as was removed, unless otherwise directed by the Engineer.

503.11 HYDRANTS & VALVES

Access to all hydrants and valves must be proved at all times because of emergency requirements of Water and Fire Departments.

503.12 COORDINATION WITH UTILITIES

The Contractor shall notify all utilities, both public and private, including gas, electric, telephone, telegraph, sewer and water, of his schedule of operations. The notice shall be given at least 48 hours prior to actual date of the commencing of construction. The Contractor shall also check as to any utility facilities which may be encountered during construction and take due notice of same.

The same notice and determination of facilities which may be encountered as well as to proposed blocking of streets or alleys shall be given to the Fire and Police Departments so as to enable them to maintain and plan their operations.

The Contractor shall give special attention to safeguarding and protecting all utilities, public and private, and he shall be held liable for ay damage thereto encountered during construction of the entire project. Relaying or relocation of gas mains to expedite construction of the sewer will be permitted providing it is done at no additional cost to the City following approval of such change by the Excel Energy power company and their Agreement with the Contractor as to payment of cost incurred and specifications for the work.

A notarized copy of such Agreement, signed by the Contractor and Excel Energy, shall be filed with the Board of Public Works before work is started.

503.13 SPECIAL EXCAVATION & CLEANUP

Excavation of street surfacing and street base materials for an entire block, exclusive of one intersection, is permitted with such materials segregated as per Section 5 of these sewer specifications, exempted only by the Engineer.

Pipe laying must be completed with backfilling and cleanup operations completed or being continued without interruption as a positive requirement before permission is granted to continue excavating and pipe laying in the next block. Cleanup shall include removal of all excess materials, pipe and equipment from the entire street right of way, including boulevard and sidewalk. Backfilling must be completed as specified to allow the Street Department to repair the street as soon as possible after pipe laying is complete.

All surplus material excavated shall be the property of the City and shall be hauled and deposited as directed by the Engineer. The Contractor shall not dispose of, give away, sell, or allow to be hauled away, any of said surplus material, without permission of the Board.

503.14 JOB OFFICE

Potable job offices shall be furnished by the Contractor during cold weather operations when requested by the Engineer. Suitable desk and bulletin board shall be provided as well as adequate heating and lighting facilities. The office shall be available to City Inspectors and other personnel designated at all times and shall be placed conveniently to the location of the work.

503.15 APPROVAL TO COMMENCE WORK

The following requirements must be fulfilled before grades are set and approval is given to commence work:

(a) Contract forms to be completely executed.
(b) Notice to utilities given ï see ñUtilities ï Section 19ò
(c) Clearance from Engineer regarding disposal of surplus material, detouring of traffic, closing of streets and alleys, City facilities and services, shall be obtained by the Contractor.
(d) Assignment of Inspector.
(e) Setting of line and grade.

503.16 TREES DAMAGED BY CONTRACTOR

The Contractor will be held responsible for any and all trees damaged during the course of construction. Inspection of the work in progress will be made periodically by the Park Department for the Board of Public Works to insure proper protection to trees and full compliance with ordinances affecting them.

The Contractor shall minimize tree damage by exercising due caution in the operation of any equipment used for installation of the sewer, backfilling operation or cleanup of the areas. Work may be suspended if gross negligence or carelessness in operation is noted.
When damage to trees requires trimming or other corrective measures, a written notice shall be given to the Contractor by the Board of Public Works specifying the work to be done and allowing at least two weeks for the same to be arranged by the Contractor. Corrective measures shall meet the approval requirements of the Board of Public Works. The Contractor may request an extension of time to dot he corrective work required when conditions justify such request ï such extension of time not to exceed an additional two weeks under any circumstances, and shall be considered for approval only if it is submitted in writing.

If specified damage is not taken care of within the time limit set forth in the written order, or as extended, the City may do the work, billing the Contractor for any and all expenses incurred. The board of Public Works shall receive a copy of such billing and payment receipt before allowing final estimate for the project involved.

503.17 ROCK EXCAVATION

Refer to Section 201.2.8.

503.18 MISCELLANEOUS

Contractor shall safeguard engineering stakes; and resetting made necessary through carelessness of workmen, shall be done by City at Contractor's expense

Contractor shall provide assistance to Inspector of Engineering Department on request for necessary measurements during construction. Final measurements shall be made by Engineering Department with assistance of the inspector. Contractor's representative shall be present, if possible, during period of such measurements. In order to be considered claims relative to disputed quantities must be filed by the Contractor within one week from date of final inspection.

Where clearing or leveling of trees, brush, rubble or other obstructions is necessary to permit the Engineer to place line and grade stakes, the Contractor shall do such clearing and/or

leveling not less than two working days before the Contractor plans to begin laying pipe in this area.

All payment, on unit cost basis, shall be made as per final measured units and contract unit bid price unless exceptions are formally approved and evidenced by written order. Verbal orders or changes will not be recognized.

The footage to be paid shall not include construction into or through catch basins, manholes, and inlets. Measurements, in this case, shall be from centerline to centerline of structures named with deduction of structures' inside dimensions.

Any casting or other salvageable materials that are removed shall remain the property of the City.

A bill of materials for force main listed on the plans must be verified by the Contractor for accuracy. Any fitting listed on the bill of material not used on the project shall become the property of the City of Onalaska and shall be delivered to a City storage area as directed by the Engineer.

Any fitting not listed on the force main bill of materials and required for the project shall be furnished and installed by the Contractor and paid for in conformance with Section 9, of the General Conditions.

These Standard Specification, together with the Plans, General and Special Specification, are acknowledged to be a part of the Contract.

END OF SECTION