

DEVELOPMENT HANDBOOK

CITY OF NEW BERLIN INFRASTRUCTURE STANDARDS

Adopted by Board of Public Works (BPW) as "Developer's Handbook" August 6, 2001

First Revision Adopted by BPW as "Developer's Handbook" February 13, 2006

Second Revision Adopted by BPW July 18, 2016



Prepared for:

*Mayor David A. Ament,
Board of Public Works
City of New Berlin*

By:

*Gregory W. Kessler, AICP – Director
Department of Community Development
July 18, 2016*



TABLE OF CONTENTS

- 1 PRE-CONSTRUCTION REQUIREMENT**
 - 1.1 CONSTRUCTION PLAN STANDARDS
 - 1.2 DEVELOPMENT AGREEMENT
 - 1.3 FINANCIAL GUARANTIES
 - 1.4 CONSTRUCTION MANAGEMENT DEVELOPER DEPOSIT
 - 1.5 INSPECTION REQUIREMENTS

- 2 WATER SYSTEM**
 - 2.1 SPECIFICATIONS
 - 2.2 ABANDONMENT
 - 2.3 INSPECTION

- 3 SANITARY SYSTEM**
 - 3.1 SPECIFICATIONS
 - 3.2 ABANDONMENT
 - 3.3 INSPECTION

- 4 STORM SYSTEM**
 - 4.1 SPECIFICATIONS
 - 4.2 INSPECTION

- 5 ROAD SYSTEM**
 - 5.1 GEOMETRICS
 - 5.2 SPECIFICATIONS
 - 5.3 INSPECTION

- 6 PROJECT CLOSE-OUT DOCUMENTS**
 - 6.1 CONSTRUCTION INSPECTION BINDER
 - 6.2 LIEN WAIVERS
 - 6.3 ASBUILTS
 - 6.4 EASEMENTS



7 APPENDICES

7.1 DOCUMENT TEMPLATES

- 7.1.1 DEVELOPMENT AGREEMENT
- 7.1.2 STORMWATER MAINTENANCE AGREEMENT
- 7.1.3 PUBLIC UTILITY EASEMENT
- 7.1.4 LETTER OF CREDIT
- 7.1.5 BIDDER'S PRE-QUALIFICATION STATEMENT

7.2 DETAILS

Figure	Detail Description
1	Typical Cross Section for a Residential Street
2	Typical Cross Section for a Commercial/Industrial Street
3	Typical Cul-De-Sac Detail
4	Typical Acceleration/Deceleration Lane
5	Mountable Curb & Gutter
6	Vertical Face Curb & Gutter
7	Road Underdrain Detail
8	Concrete Invert
9	Driveway Approach Urban Section
10	Driveway Approach Rural Section
11	Culvert End Walls
12	Side Path Cross Section Through Driveway
13	Side Path Cross Section
14	Interim Pavement Inlet Design
15	Behind the Curb Collector
16	Sampling Manhole
17	Pond Outlet
18	Alternate Pond Outlet
19	2-Unit Water Service
20	Trench Check Dam



TABLE OF CONTENTS

1	PRE-CONSTRUCTION REQUIREMENTS	2
1.1	CONSTRUCTION PLAN STANDARDS	2
1.1.1	GENERAL	2
1.1.2	SANITARY SYSTEM	4
1.1.3	WATER SYSTEM	5
1.1.4	STORM SYSTEM	6
1.1.5	ROADWAY	6
1.1.6	LOT GRADING	8
1.1.7	GRADING PLANS	10
1.2	DEVELOPMENT AGREEMENT	10
1.3	FINANCIAL GUARANTIES	10
1.4	CONSTRUCTION MANAGEMENT DEVELOPER DEPOSIT	11
1.5	INSPECTION REQUIREMENTS	11
1.5.1	GENERAL CONSTRUCTION MANAGEMENT	11
1.5.2	GENERAL INSPECTION	13
1.5.3	GENERAL UTILITY CONSTRUCTION	15
1.5.4	SANITARY SEWER CONSTRUCTION	16
1.5.5	WATER MAIN CONSTRUCTION	17
1.5.6	STORM SEWER CONSTRUCTION	17
1.5.7	ROADWAY CONSTRUCTION	18



1 PRE-CONSTRUCTION REQUIREMENTS

1.1 CONSTRUCTION PLAN STANDARDS

1.1.1 GENERAL

- 1.1.1.1 Plans shall be prepared on sheets preferably measuring 24" high by 36" wide, but may be as large as 36" high by 40" wide. Sheets shall have margins of ½-inch on all sides except on the left side which shall be 2 inches.
- 1.1.1.2 The title block shall be in the lower right corner of the construction plan sheet and include at a minimum, the following information:
- City of New Berlin
 - Name and Address of Engineering (Design) Firm
 - Date of the Drawing and last Revision
 - Scale
 - Plan Sheet Number (# of #)
 - Name and Location Description of Development
- 1.1.1.3 Plans submitted for final approval shall include the seal and signature of the professional engineer responsible for the preparation of the construction plans which shall be shown immediately adjacent to the title block.
- 1.1.1.4 North shall be to the top or left of the sheet and shall be shown by a 2" long north arrow, clearly, shown without intrusion.
- 1.1.1.5 The scale of the construction plans shall be 1" = 50' or 1" = 40' horizontally (1" = 100' is allowable for 1 acre or larger lots) and 1" = 5' or 1" = 4' vertically. Partial site plans shall have a scale of 1" = 20' or larger. The scale of details shall be such that the detail is clearly shown. The scale shall be shown with a line scale and text.
- 1.1.1.6 Each plan set shall have the "Call Digger's Hotline" note prominently displayed.
- 1.1.1.7 All construction plan sets shall include a cover sheet that shows the locations of the proposed improvements and an index of all plan sheets included in the set. The cover sheet shall also include the following statement: *"All site improvements and construction shown on the plans shall conform to the City of New Berlin Developer's Handbook. Where the plans do not comply, it shall be the sole responsibility and expense of the Developer to make revisions to the plans and/or constructed infrastructure to comply."*



- 1.1.1.8 The plan set of drawings shall include a list of:
- A minimum of two (2) current SEWRPC reference benchmarks shall be required for each forty (40) acre or less project. Survey documentation of tie to USGS, MMSD and City of New Berlin datum shall be provided. Project or Plan datum is not acceptable.
 - All permanent benchmarks;
 - All temporary control points which shall be established at least every 1,000 feet;
 - A description of the locations of the benchmarks; and the basis or origin of the vertical control network.
- 1.1.1.9 Existing surface improvements shall be indicated with solid light lines and clearly labeled.
- 1.1.1.10 A profile view shall be located below the plan view on plan - profile sheets and both views shall be aligned by stationing whenever possible. Stationing shall be from left to right.
- 1.1.1.11 Plan and profile sheets shall start and terminate at match lines.
- 1.1.1.12 The plan view shall show the following:
- The assumed bearing base, control monuments and stationing reference line(s).
 - Right-of-way limits and easement limits;
 - Edge of pavement or face and back of curb;
 - Name of each existing and proposed roadway and any intersecting roadways.
 - Lot lines, lot and block numbers and frontages;
 - Proposed utilities and laterals and appurtenances with length, size and material type clearly labeled;
 - Ghosting of existing utilities and service locations either in screened or dashed format. Pipe size of existing utilities shall be labeled;
 - Dimensions showing offset from right-of-way to the utility line and separation distance between other utilities;
 - All laterals shall have the proposed invert elevations at right-of-way lines and lengths clearly shown;
 - An estimate of all material quantities to be used in the construction of the public infrastructure;
 - Material and size of proposed utility and that of the existing utility to be connected to;
 - All obstructions located within the project limits including, but not limited to: trees, signs, utilities, fences, light poles, structures, etc.;



- A note warning that underground utilities must be located by “Diggers Hotline” prior to start of construction; and

1.1.1.13 The profile view shall show the following:

- Stationing;
- Existing and proposed surface profiles over the subject utility;
- Existing and/or proposed utilities;
- Limits of gravel, spoil, and/or slurry backfill; and
- Material and size of any existing utility to be tied into.

1.1.1.14 Erosion control measures shall be clearly shown on the plans.

1.1.1.15 All submittals of revised plans shall include:

- Written correspondence shall accompany each set of plans explaining, in detail, each and every revision that was made to the plans.
- Revision date and description of the revisions on each sheet of plan set.
- Place a cloud symbol around each revision.
- If no revisions are made, indicate such on the respective plan sheets.

1.1.1.16 Upon approval of construction plans, provide a rendition of the project area reduced to fit on an 8 ½” x 11” or 11” x 17” plan sheet.

1.1.1.17 Upon approval of construction plans, provide complete PDF and CAD files on CD/DVD with CAD drawings in an AutoCAD format that is compatible with the version used by the City.

1.1.2 SANITARY SYSTEM

1.1.2.1 Proposed sewer shall be designed and located in accordance with City’s Development Handbook and shall be dimensioned on the plan view.

1.1.2.2 The plan view shall show the following:

- Distance between manholes and between each sewer lateral;
- Manholes shall be numbered with a Design Plan Number;
- Rim and invert elevations at each manhole, based on City of New Berlin datum;
- Lengths, slopes and flow directions of all proposed mains;
- Length of each sanitary sewer lateral and length of any lateral risers;

1.1.2.3 The profile view shall show the following:

- The proposed sanitary sewer and manholes;
- Proposed rim and invert elevations, based on City of New Berlin datum, type of frame to chimney seal and design plan number for each manhole;



- Pipe diameter, length, percent grade to two (2) decimal places, direction of flow, and center to center length of proposed sanitary sewer installed between manholes and laterals shall be shown;

1.1.2.4 A general note on each plan sheet giving the size, class, type, and ASTM designation of every proposed main and lateral shall be shown, with an estimate of material quantities clearly tabulated. General specifications on manhole frames / lids / barrel structure shall be noted. Elevations, based on City of New Berlin datum, shall be referenced to MMSD datum. The MMSD datum shall be shown in parentheses by subtracting the conversion factor of 580.58 from City datum.

1.1.3 WATER SYSTEM

1.1.3.1 Proposed water main shall be designed and located in accordance with City's Development Handbook and shall be dimensioned on the plan view.

1.1.3.2 The plan view shall show the following:

- At least one clearly labeled benchmark or control point;
- Lengths and slopes of water main between fittings and grade breaks;
- Label appurtenances (i.e.: hydrants, valves, bends, etc.);
- Proper position of each hydrant pumper nozzle;
- All areas to be insulated over water main;

1.1.3.3 The profile view shall show the following:

- Labels, elevations (based on City of New Berlin datum), and distances between appurtenances;
- Pipe diameter, percent grade to two (2) decimal places, direction of flow, and center to center length of proposed water main installed between valves, grade breaks and laterals locations;
- Invert elevation at grade breaks;
- Material choices of the new water main;
- Hydrant nozzle and hydrant tee elevations;
- Stationing of any areas to be insulated;

1.1.3.4 Curved lines shall indicate deflected pipe (with proposed curve data provided); lines shall be straight between fittings.

1.1.3.5 A general note on each plan sheet giving the size, class, type, and ASTM designation of every proposed main, service lateral, and hydrant shall be shown, with an estimate of material quantities clearly tabulated. Water services shall include size of service, footage and count. General specifications on valve boxes and manhole frames / lids / barrel structure shall be noted.



1.1.4 STORM SYSTEM

- 1.1.4.1 Proposed storm sewer shall be designed and located in accordance with City's Development Handbook and shall be dimensioned on the plan view.
- 1.1.4.2 The plan view shall show the following:
- Proposed storm sewer, catch basins and junction boxes;
 - Length and size of storm sewer between catch basins and junction boxes;
 - Details of outfall or ditch inlet protection requirements such as rip-rap, end sections or headwalls as needed;
 - Details of detention facilities outfall and overflow structures as needed;
- 1.1.4.3 The profile view shall show the following:
- The proposed storm sewer, catch basins and junction boxes;
 - Distance, length, slope to two (2) decimal places, and size of storm sewer between catch basins and junction boxes;
 - Rim and invert elevations, based on City of New Berlin datum, at each manhole, catch basin and junction box;
 - Lateral locations;
 - Material and size of proposed storm sewer and that of the existing storm sewer to be connected to; and
 - Cross-section of detention facilities, including outfall and overflow structures.
- 1.1.4.4 A general note on each plan sheet giving the size, class, type, and ASTM designation of every proposed manhole, inlet or outlet section shall be shown, with an estimate of material quantities clearly tabulated. General specifications on storm sewer pipe, catch basins and manhole frames / lids / barrel structure shall be noted.

1.1.5 ROADWAY

- 1.1.5.1 Elevations shall be based on City of New Berlin datum.
- 1.1.5.2 The plan set of drawings shall include:
- Plan and profile views; and
 - Cross-sections at 50-ft intervals.
- 1.1.5.3 Each roadway plan sheet shall show the following:
- The assumed bearing base, control monuments and stationing reference line along the centerline of the roadway, including cul-de-sacs;
 - At least one clearly labeled bench mark or control point;
 - Width of pavement and median;
 - Final grade elevations at 50' intervals for pavement centerline and edge of pavement for all streets and roadways, and at 50' intervals for top of curb for urban sections;



- Final grade elevations for cul-de-sacs at 50' intervals, including high points, edge of pavement and top of curb for urban sections;
- Final grade elevations for all PVC's, PVT's and PVI's, and PC's, PT's, PI's for vertical and horizontal curves at intersections;
- Radii of all intersections (edge of pavement or back of curb, with note indicating which is referenced);
- All driveways within 100' of the proposed intersection;
- All roadside ditch locations, flowline elevations (based on City of New Berlin datum) at 100' intervals of the ditches;
- Slope intercepts;
- Invert profile for 200' downstream for any existing ditches receiving flow from a proposed road or street;
- All culverts and endwalls, with length, size and material type clearly labeled;
- The limits of any areas which need special stabilization techniques;
- Specific details of all existing connected roadways. Pavement, shoulders, ditches, curb alignment, and grades shall be shown as needed to adequately make the transition;

1.1.5.4 The profile view shall show the following:

- Stationing and final centerline grades at all 50' and 100' stations and at grade breaks;
- Existing and proposed roadway profiles along centerline of roadway and cul-de-sacs;
- Stationing and final centerline grades at all PC's, PT's, PVI's, and POC's at PVI's for horizontal and vertical curves;
- Slope of the roadway between each grade break;
- Sizes and inverts for all existing and/or proposed utilities and all culverts;
- Limits of any areas that need special stabilization techniques.

1.1.5.5 All existing lot, property, and public utility easement lines in the area in which the road or street is to be located shall be shown. The address, lot and block numbers, and subdivision or development name shall be indicated. Addresses shall be labeled with italics. Unplatted lands and the address of any home on such lands shall be so indicated. All street names shall be clearly shown.

1.1.5.6 Road cross sections shall show the following:

- Slope intercepts shall be clearly labeled by station, elevation to the nearest 0.1', and offset distance (left or right) from the reference line.
- Invert elevation of ditches (for rural roadway) and flowline elevation of the gutter (for urban street).
- Final pavement elevation at the centerline of the street or roadway.



- 1.1.5.7 A separate detail sheet shall be required for the roadway plans. This detail sheet shall show typical cross-sections for a roadway and cul-de-sac if applicable.
- 1.1.5.8 Specific cross-section(s) and details along with specifications must be shown if not supplied elsewhere in the plan set.
- 1.1.6 LOT GRADING**
- 1.1.6.1 The plan shall show existing tree lines and any obstructions (fences, structures, power poles, etc.) within the project limits.
- 1.1.6.2 Lots with proposed private owner waste treatment systems (POWTS) shall have the POWTS area designated as a “No-Touch” zone with respect to grading or other ground disturbance activities during overall project site or lot grading and construction activities, except for the actual POWTS installation commensurate with the home construction.
- 1.1.6.3 The plan shall show:
- all proposed lot lines and lot numbers;
 - lot line dimensions;
 - outline of buildable areas for each lot;
 - all existing and proposed roads with names;
 - all existing buildings, structures and foundations;
 - all existing drainage channels and watercourses;
 - the 100-year flood plain limit;
 - wetlands; and
 - all existing and proposed easements.
- 1.1.6.4 Wetland limits shall be labeled with bearings and distances and be tied down to lot lines for easy location by individual lot owners. Bearings and distances may be tabulated.
- 1.1.6.5 Existing topography of the site and all areas within 100 feet of the site shall be shown at a one foot contour interval using City of New Berlin datum (USGS). Two foot contour intervals may be used on lots over 1 acre in size. Existing contours shall be shown as thin, dashed lines with a readily discernable heavier line used for the 5-foot contour intervals.
- 1.1.6.6 The yard grade of any existing buildings located within 150 feet of the subdivision boundary shall be shown.



- 1.1.6.7 Proposed grading by a developer shall be shown at a contour interval of 1 foot using City of New Berlin datum (USGS). Two foot contour intervals may be used on lots over 1 acre in size. Proposed contour lines shall be shown as solid medium lines, with a discernible heavier line use for the 5-foot contour intervals.
- 1.1.6.8 The grading plan shall show proposed road(s), curb and gutter, all storm sewer grates and storm sewer manholes (or cross-culverts for open ditches). Show any off road storm inlets and discharge locations with surface entry elevations.
- 1.1.6.9 At front setback line show a typical 66' x 54' house shell on each lot and the proposed yard grade to the nearest tenth of a foot (assumed to be 0.7' below the top of block) for each building. Show proposed finished elevations to the nearest tenth of a foot at all lot corners and along side lot lines adjacent to the front and back corners of the typical house. Show proposed finished elevations to the nearest tenth of a foot at high and low points along any side or back lot lines, and at high and low points if roads to demonstrate proposed drainage.
- 1.1.6.10 The grading plan for any house that will probably require special design due to topography, shall clearly show separate grades for the garage and yard grade if extra steps are needed. Separate spot finish elevations shall be shown for rear or side exposure or walkout.
- 1.1.6.11 The plan shall indicate if cuts and fills will be balanced on site.
- 1.1.6.12 Proposed storm inlets shall be shown on each grading plan. Each plan shall also include specific details on all applicable retention/detention basins, ponds, overflows, etc. Separate sheets or notes may be required.
- 1.1.6.13 The plan shall include all notes required to properly sequence the construction activities (i.e.: erosion and grading plans must be done ahead of other operations on site to manage storm water runoff).
- 1.1.6.14 On a separate plan sheet show erosion and sediment control measures and details including:
- Locations and dimensions of all proposed land disturbing activities, including finished topography;
 - Proposed limits of disturbance including proposed tree cutting areas;
 - Location and dimensions of all temporary topsoil and dirt stockpiles;
 - Location and dimension of all construction site control measures necessary to meet the requirements of the City of New Berlin Erosion Control Ordinance;
 - Location of all channels, pipes, basins or other conveyances proposed to carry runoff to the nearest adequate outlet, including applicable design assumptions and computations;



- Areas to be sodded or seeded and mulched or otherwise stabilized with vegetation, describing the type of final vegetative cover; and
- Schedule of anticipated starting and completion date of each land disturbing and land developing activity, including the installation of the construction site control measures that are needed.

1.1.7 GRADING PLANS

1.1.7.1.1 A detailed grading plan is necessary for all new subdivisions, land divisions, and construction of any new industrial, commercial, or multi-family building. The final grading plan and other associated utility plans are to be approved by the Engineering Services Division prior to signing the Development Agreement. The grading plan that is required is the “DEVELOPER’S CONSTRUCTION GRADING PLAN”. It shows all the grading that the developer proposes to do. It differs from the “MASTER GRADING PLAN”, which shows the typical ultimate lot grading after each individual homeowner has constructed his house and done his finish landscaping. For a commercial or industrial site that the developer is building himself, the Developer’s Construction Grading Plan and the Master Grading Plan are one and the same.

1.1.7.1.2 A Developer’s Construction Grading Plan and a Master Grading Plan are required for any new subdivision.

1.2 DEVELOPMENT AGREEMENT

Projects that include public infrastructure shall be required to enter into a Development Agreement. Regulations regarding development agreements are set forth in Municipal Code Chapter 235, Subdivision of Land, § 235-15J.

235-15J(3)(a) “Development agreements are intended to provide the City with the public infrastructure and amenities necessary to serve the proposed land use (development) and that they will be provided for according to an agreed-upon schedule and at a level of quality consistent with current City standards adopted by the Board of Public Works. Public benefits arising from a development agreement may include, but are not limited to, provision of public facilities such as streets, sewerage, parks/open space, transportation, schools, drainage, stormwater facilities, and utility facilities.”

1.3 FINANCIAL GUARANTIES

Projects that include public infrastructure shall be required to guarantee the construction of the improvements through financial securities. Regulations regarding improvement guaranties are set forth in Municipal Code Chapter 235, Improvement guaranties, §235-16.



1.4 CONSTRUCTION MANAGEMENT DEVELOPER DEPOSIT

Projects that include public infrastructure shall be required to provide a Construction Management Developer Deposit to cover any of the following applicable public infrastructure inspection costs: as-built and easement preparation and inspection services for roadway, water system, sanitary system, storm system and all associated apparatus. Regulations regarding the construction management developer deposit are set forth in Municipal Code Chapter 275, Developer Deposit Fees, §275-20.C(2).

1.5 INSPECTION REQUIREMENTS

Development Projects that include public infrastructure shall be subject to City Inspection. Regulations regarding inspections are set forth in Municipal Code Chapter 235, Inspections, §235-17. City Inspection of public infrastructure shall be performed by the City or by an Inspection Consultant approved by the City, at the sole cost of the Developer. The City inspection is required to observe that the public infrastructure is in accordance with City standards. The City inspection is not responsible for supervision or directing of the work. The City inspection is in addition to and not replacement of construction oversight by the developer and their contractors and at no time replaces the developer's or the contractor's responsibilities of construction management and oversight or their work.

The following requirements apply to City projects where the City is hiring a consultant to provide full construction management.

1.5.1 GENERAL CONSTRUCTION MANAGEMENT

1.5.1.1 The Inspection Consultant shall be responsible for managing, coordinating and inspecting all construction work performed on-site relative to completing the project for intended use and purpose.

1.5.1.1.1 Provide full-time on-site construction observation services for the installation of all project elements, as appropriate for the nature and type of project element being constructed. Intermittent site observation is generally suitable for work performed that can be fully accessed and assessed as to material and workmanship quality after installation.

1.5.1.1.1.1 *Inspection Consultant shall provide a list of inspectors to the City Engineer for approval prior to the start of construction. Inspectors that will be on site shall be pre-approved by the City Engineer prior to performing site inspections.*

1.5.1.1.2 Be responsible for coordination of the contracts, as necessary and appropriate per the Contract Documents and monitoring the schedule of individual phases of the project elements to ensure a timely completion. Verify that all necessary Permits are obtained by the Contractor(s).



- 1.5.1.1.3 Make recommendations for adjusting the work to accommodate changing and unforeseen conditions, as applicable and appropriate. Delay Reports when required, reflecting the effect on each Contractor or Subcontractor and the overall project schedule.
- 1.5.1.1.4 Prepare daily progress reports describing work completed, trades involved, and any issues that occurred at the site.
- 1.5.1.1.5 Maintain an ongoing and current record of changes to the Plans or Specifications that occur on the project. The Marked up plan-set shall be submitted to the City Engineer prior to final payment to the Contractor.
- 1.5.1.1.6 Receive and forward required Shop Drawings to the Designer for review. The Designer shall be responsible to distribute the reviewed Shop Drawings to the appropriate parties. Document correspondence via Memorandum.
- 1.5.1.1.7 Assist the City in selecting and obtaining material and laboratory testing services required by the project.
- 1.5.1.1.8 Inspect all materials delivered to the site to ensure that they meet required standards.
- 1.5.1.1.9 Maintain daily logs and records, submitting an original copy to the City at no less often than weekly during the project construction period.
- 1.5.1.1.10 Assist the City with such other services as may be required in execution of the Contract Documents to complete the project.
- 1.5.1.1.11 Assist City in implementing the project completion consistent with the project schedule and the Contract Documents.
- 1.5.1.1.12 Prepare contract closeout and acceptance documents, including oversight of all Start-up operations of equipment in accordance with the Contract Documents.
- 1.5.1.1.13 At the close of the project, the inspection consultant shall provide the City with a Construction Inspection Binder including the following documents.
 - 1.5.1.1.13.1 *Material Submittals*
 - 1.5.1.1.13.2 *Inspection Reports*
 - 1.5.1.1.13.3 *Test Results/Reports*
 - 1.5.1.1.13.4 *Change Orders / Substitutions*
 - 1.5.1.1.13.5 *Pay Applications*
 - 1.5.1.1.13.6 *Final Record Set of Construction Plans*



1.5.2 GENERAL INSPECTION

- 1.5.2.1 Inspector shall have a thorough understanding of construction dealing with construction of sanitary systems, water systems, storm systems, roadway systems, and all associated construction requirements.
- 1.5.2.2 Review project plans, specifications and special provisions. At all times have a set of Approved Construction Documents and a copy of the City of New Berlin Development Handbook available for use at the Project Site.
- 1.5.2.3 Hold a briefing for any new Inspectors prior to their performing inspection services at a Project.
- 1.5.2.4 Pre-notify the City Engineer of any meetings that are scheduled.
- 1.5.2.5 Attend the pre-construction meeting.
- 1.5.2.6 Provide daily notification to the City Engineer of any Inspectors scheduled to be working. This notification may occur during the previous days work or before 8:00 a.m. each day.
- 1.5.2.7 At the request of the City Engineer, prior to the start of construction, take photos or videotapes of pre-construction conditions of adjacent or intersecting pavement conditions on material or hauling routes. Make note of any special drainage features to be restored after construction.
- 1.5.2.8 Before work starts, confirm that the Contractor has the necessary barricades and warning devices in conformance with applicable standards.
- 1.5.2.9 Monitor the installation and condition of erosion control devices prior to allowing any land disturbing activities to proceed in accordance with the Contract Documents and any Agency permits issued.
- 1.5.2.10 Complete a Daily Projects Events Report that includes monitoring erosion control devices to ensure that they are functioning at the beginning and end of the workday. Note the status of erosion control. Turn in the report to the City Engineer during the next day or mail it to the Engineering Department if leaving the Project Site.
- 1.5.2.11 Review all construction materials delivered to the project. Mark all defective material and have the Contractor remove it from the site in a prompt manner. Record manufacturer, class and type of material being used on both the Daily Project Events Report and in the Inspector's set of field plans. Equipment shall be verified through review of the approved Shop Drawings.
- 1.5.2.12 Review the project location and become familiar with marked underground utility locations. Be alert for underground utilities when the Contractor is excavating.



- 1.5.2.13 Watch for damage to private and City property and report any damages to the City Engineer. Include photographs and document any damage in the Daily Project Events Report. Notify the Contractor, in writing, of any damages so that he/she will be aware of the responsibilities for repairing the damage.
- 1.5.2.14 Take a reasonable and representative number of construction photos during the progress of the Project to record routine and special construction.
- 1.5.2.15 If a laser is being used to install pipe, check the laser for accuracy at least twice daily. Determine that the correct grade percentage is dialed in on the laser. Checks should be done more frequently in cold weather.
- 1.5.2.16 After the project is substantially completed, prepare a Punch List of corrective work and provide copies to the Contractor, City and project inspection file. Perform follow-up to assure completion of the Punch List work items, as directed by the City.
- 1.5.2.17 During final inspection, determine that all areas disturbed by the Contractor have been cleaned up, graded and properly restored.
- 1.5.2.18 When corrective work has been completed, coordinate the completion of Record Drawings, compilation of all test and inspection forms and reports and submit to the City Engineer.
- 1.5.2.19 Maintain one (1) record set of “as-built” drawings at the Project Site, marked up to show all field changes, locations of buried utilities around and contiguous to the building(s), and other significant items. This information shall be turned over to the City Engineer at the conclusion of the Project. Preparation of the Utility line as-builts shall be the responsibility of the Inspection Consultant, consistent with City Standards.
- 1.5.2.20 Review, modify or approve all progress and final payment requests by the Contractor(s), verifying work completed, reasonableness of request, and recommend to City Engineer the amount to be paid with each request using specified forms.
- 1.5.2.21 Identify any liquidated damages that may become due, basis for the charges against the Contractor(s) and document in writing to the City Engineer. Track any possible causes that justify the granting of a time extension to the Contract. Review and recommend any requests by the Contractor for changes in compensation differing from the amount(s) bid. Document these issues on the Daily Project Events Report form.



1.5.2.22 Review, document and recommend payment or disapproval of all Contractor proposals and requests for Change Order using appropriate forms. Document any verbal requests for Change Order work on the Daily Project Events Report form. Compile all Change Order request documentation and submit to the City Engineer with recommendation.

1.5.2.23 The Project Designer shall be responsible for resolving any conflict between the Plans, the Specifications and the site conditions that are encountered in the Construction Phase with due notice to the City Engineer. The Designer shall be responsible for review and approval of all Shop Drawings for the Project.

1.5.3 GENERAL UTILITY CONSTRUCTION

1.5.3.1 As grade staking is completed for various sections of the project, verify stakes for offsets and note all locations for structures, hydrants, valves and fittings. Confirm that the line and grade of the grade stakes corresponds with the approved construction plans and survey cut sheets.

1.5.3.2 Verify that the surface upon which the pipe is to be laid is true to grade, firm and thoroughly compacted. Never allow pipe to be laid upon a trench bottom which is soft, yielding, mucky or under water. Any undercutting not provided for in the contract should be cleared with the City Engineer. Measure all undercutting to depth, width and location to provide proper documentation and payment.

1.5.3.3 Confirm that the pipe is properly bedded the entire length.

1.5.3.4 Verify that the proper trench width is maintained, but not exceeded, from the trench floor to a point 12" above the top of pipe.

1.5.3.5 Check the line and grade of the pipe as it is being set by the Contractor.

1.5.3.6 Verify that the pipe is clean, joint components and contact surfaces are free of defects. Make sure that the pipe is driven "home" to the full depth of the socket according to manufacturer's requirements and instructions.

1.5.3.7 Obtain an accurate measurement of all piping installed and record the measurements on the Daily Inspection Report and Inspector's field plans.

1.5.3.8 Confirm that the Contractor is using a pipe plug or "cookie" in the last installed pipe prior to excavation of the next length of pipe to prevent debris from entering the pipe. Also insist that the Contractor installs the pipe plug in the last pipe installed each day to prevent dirt, water or animals from entering the pipe.

- Observe removal of the pipe plug or "cookie".



- 1.5.3.9 Observe the backfilling work to assure that only proper material is placed into the trench (no clay lumps, broken concrete, frozen chunks, etc.).
- 1.5.3.10 Verify that the pipe is properly protected against subsequent damage during backfilling operations.
- 1.5.3.11 Observe that backfilling around the pipe is done by hand methods to one foot above the top of pipe. Observe that subsequent backfill is completed in uniform lifts and compacted per the specifications.
- 1.5.3.12 Observe staking and Record ties and invert and top of pipe elevations for all main line stubs which are installed for future connections.
- 1.5.3.13 Observe that all services, including those to vacant properties and buildings, have been properly staked by the survey crew. Verify the staked service locations and elevations against the approved construction plans.
- Record the actual location of services on the Inspector's field plans.
 - Confirm that all services are marked by a wooden marker as specified.
 - Accurately record the location, size, depth (or invert elevation) and length of all sanitary services on the Inspector's field plans.

1.5.4 SANITARY SEWER CONSTRUCTION

- 1.5.4.1 All precast and cast-in-place manhole components should be checked for configuration, dimensions, thickness, damage, and defects as they are delivered or constructed.
- 1.5.4.2 When the manhole base is installed, confirm the base is level and at proper grade.
- 1.5.4.3 Prior to backfilling, verify that the manholes are completely finished. Check for plumbness, dimensions, proper inverts, proper patching and leakage. All manholes must be free of dirt and debris.
- 1.5.4.4 Prior to completion, confirm that all manhole inverts have been finished off, in accordance with the plans and specifications. Check the floor and flow line, castings and steps for compliance with Contract Documents. Verify that the casting and adjusting rings are mortared in place.
- 1.5.4.5 Schedule and observe low pressure air tests and mandrel tests. Coordinate the scheduling with the Utility Department. Confirm that the Contractor removed all plugs in existing lines.
- 1.5.4.6 Verify that the Contractor cleaned and televised the sewer.



1.5.5 WATER MAIN CONSTRUCTION

- 1.5.5.1 Verify that the hydrants are installed in accordance with the plans and specifications.
- 1.5.5.2 Verify that trace wire is installed in accordance with City requirements.
- 1.5.5.3 Determine if insulation is required above the water main at crossings of ditches and culverts.
- 1.5.5.4 Visually inspect to make sure that all water service corps are in the open position and not leaking before backfilling.
- 1.5.5.5 Verify that all sections of the water main have had chlorine tablets properly added for purpose of disinfection. After the specified disinfection period, confirm that the Contractor flushes the system. Observe the performance of the pressure test, main flushing, and safe water sampling (safe water sampling shall be conducted by the Utility Department). Coordinate these tasks with the Utility Department.
- 1.5.5.6 During final inspection, lamp all valve boxes to visually inspect that they are free of dirt and debris, and installed plumb. Confirm that the valve key fits on all valve operating nuts.
- 1.5.5.7 Check all hydrants for flags and ensure that the pumper nozzle on each hydrant is facing the proper direction.
- 1.5.5.8 Verify the finished grade around all hydrants and hydrant valve boxes to ensure that the valve box is exposed and that the break-off flange is above finished grade.

1.5.6 STORM SEWER CONSTRUCTION

- 1.5.6.1 Verify that catch basins are set to match the proposed curb and gutter for both line and grade.
- 1.5.6.2 When the Contractor is installing storm sewer directly below curb and gutter, check the elevation difference between the top of storm sewer and the bottom of the curb and gutter.
- 1.5.6.3 If a storm sewer line is laid close to a watermain, determine the separation distance between the storm sewer and watermain, and consult with City Engineer about the need for insulation.
- 1.5.6.4 During final inspection, determine that all manholes, inlets and catch basins are completely finished. Verify that the floor and flow line are in compliance with the Contract Documents and that the casting and adjusting rings are mortared in place.



1.5.6.5 Verify that the Contractor cleaned the storm sewer.

1.5.7 ROADWAY CONSTRUCTION

- 1.5.7.1 Before the start of construction, develop an understanding of the grading requirements.
- 1.5.7.2 Observe the grading for curb (including sidepath, if applicable) to verify that the Contractor is not undercutting the grades. If undercutting occurs, require the Contractor to bring the subgrade up with suitable granular material, at the Contractor's expense. Verify that the granular material meets the compaction requirements in the Contract Documents.
- 1.5.7.3 Determine that the pavement and the curb areas of the roadway are properly proof rolled, then monitor the repair of any substandard areas.
- 1.5.7.4 Use forms and/or string lines to check line and grade of curb and gutter (including sidepath, if applicable). The forms or string lines should be checked at every grade stake with a carpenter's level. Visually check the string line or form line to assure uniform grade.
- 1.5.7.5 Verify which technique will be employed by the Contractor to construct curbs (forms or curb machine). If forms are used, they should be clean, sprayed with form oil, and well braced.
- 1.5.7.6 Check curb immediately after the curb machine starts, for conformance to standard details. Continue to check for proper alignment, grade and pitch while the machine is in operation.
- 1.5.7.7 Ensure that the water lateral, sanitary lateral and all valve boxes are "branded" onto the curb face at the time of placement to accurately reflect respective aspects and locations.
- 1.5.7.8 Ensure that the curb is backfilled prior to when paving operations begins.
- 1.5.7.9 Before bituminous paving begins, verify that the job mix formula has been received and approved. As paving is conducted, sample and test in accordance with the testing program for the project.
- 1.5.7.10 Check temperatures of the bituminous mixtures from the truck box and the paver hopper.
- 1.5.7.11 Observe the pavement mixture as it is dumped from the truck to the paver. No lumps, clumps or non-coated aggregates are allowed.



- 1.5.7.12 Determine that all joints and areas around castings or obstacles are properly raked to ensure a uniform pavement after compaction.
- 1.5.7.13 Check for uniform shaping of the boulevards and backslopes. If grading beyond the plan limits is required, through no fault of the Contractor, measure and record the additional grading in the Daily Project Events Report and Item Record Accounts.
- 1.5.7.14 Walk the project to ensure that all structures are clean, plumb and functional.



TABLE OF CONTENTS

2	WATER SYSTEM	2
2.1	SPECIFICATIONS	2
2.1.1	WATER MAIN PIPE	2
2.1.2	WATER SERVICES	3
2.1.3	TRENCH CHECK DAM	6
2.1.4	VALVES	7
2.1.5	VALVES BOXES	8
2.1.6	VALVE VAULTS	9
2.1.7	HYDRANTS	10
2.1.8	FITTINGS	12
2.1.9	WATER METERING REQUIREMENTS	13
2.1.10	POLYETHYLENE WRAP	13
2.1.11	TRACER WIRE	14
2.1.12	TAPPING	15
2.1.13	BEDDING/COVER/BACKFILL	17
2.1.14	CAPS & PLUGS	17
2.1.15	CASING/CARRIER PIPE	18
2.1.16	INSULATION	18
2.2	ABANDONMENT	19
2.2.1	General	19
2.2.2	Water Services	19
2.3	INSPECTION	20
2.3.1	SUBMITTALS AND SAMPLES	20
2.3.2	DISINFECTING	21
2.3.3	ACCEPTANCE TESTING	21



2 WATER SYSTEM

All labor and material shall be governed by requirements of the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS), Public Service Commission (PSC) Rules and Wisconsin Department of Natural Resources (WDNR) Regulations, unless otherwise specified in these Specifications, whichever is more restrictive.

2.1 SPECIFICATIONS

2.1.1 WATER MAIN PIPE

2.1.1.1 MATERIALS

All pipe used for water main shall comply with SWS and the following:

6"	Ductile iron – Hydrant leads only
8"	PVC or ductile iron
12"	PVC or ductile iron
16"	PVC or Ductile iron
20"	Ductile iron
Sizing of private mains requires approval by the City Engineer.	

2.1.1.1.1 All Ductile Iron pipe shall be pressure Class 350 or greater unless otherwise noted on the plans approved by the City Engineer. Each Ductile Iron pipe shall be manufactured in the USA, subject to a hydrostatic pressure test of at least 500 psi at point of manufacture. All pipe shall be furnished with Push-On type joints such as "Tyton" or "Fastite" complete with all necessary accessories. Acceptable Manufacturers of Ductile Iron pipe include the following:

- *American Cast Iron Pipe Co.*
- *Clow Water Systems, Co.*
- *U. S. Pipe & Foundry Co.*
- *Pre-approved equal.*

2.1.1.1.2 PVC or PVCO water main for sizes 4" through 16" diameter, excepting service laterals, shall conform to the OD of Ductile Iron pipe and be AWWA C-900 or AWWA C-909, Class 150 or 200, DR-18 or -14. All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints. Acceptable Manufacturers of PVC/PVCO Water pipe include the following:

- *J. M. Eagle*
- *National Pipe*
- *Diamond Plastics*



- *Northern Pipe Company*
- *Pre-approved equal.*

2.1.1.1.3 Fire and Combination Fire/Water service lines from the connection at the main to the backflow prevention device connection, shall be:

- *Ductile Iron conforming to Section 2.1.1.1., or*
- *PVC/PVCO for sizes 3" through 12" diameters only, conforming to the OD of Ductile Iron pipe, AWWA C-900 or AWWA C-909, Class 200, DR-14*
- *All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints.*

2.1.1.2 DESIGN STANDARDS

2.1.1.2.1 Main sizes (Minimum).

- *Residential: 8" minimum*
- *Multifamily and commercial : 12" subject to City Engineer approval.*
- *Industrial: 12" subject to City Engineer approval.*

2.1.1.2.2 Watermain Location

- *In streets & easements: 10 feet from sanitary sewer; north and east.*

2.1.1.2.3 Watermain Bury Depth/Pipe Design Cover

- *Turf - 6 feet (Ultimate grade);*
- *Paved Areas - 7 feet minimum*
- *Special situations (i.e.: ditches, etc.)- 5 feet minimum cover with insulation.*
- ***Under 4 feet of cover water main must be offset to achieve 6 foot cover.***

2.1.1.2.4 Tracer wire installation is required on all water mains, branches, and services.

2.1.2 WATER SERVICES

2.1.2.1 MATERIALS

2.1.2.1.1 Sizes thru 2" diameter shall be of one manufacturer only, as follows:

2.1.2.1.1.1 *Service Lines*

- *Type K copper tubing or HDPE*
- *250 psi pressure rated, SDR-09,*
- *copper tube size, ASTM D-2737, NSF 14, AWWA C-901*
- *with tracer wire*
- *There shall be no joints between the corporation valve and curb stop and no joint between the curb stop and meter horn valve.*
- *Laying length of HDPE lines shall afford enough slack to allow for thermal contraction of the plastic and in such manner as to avoid placing it under any undue tension.*



2.1.2.1.1.2 Fittings

- *Terminal couplings on HDPE services shall be made with a pressure tight joint with a Buna-N beveled gasket, and stainless steel insert sleeve equal to Ford 50-series, and compression fitting which includes a grooved clamp equal to:*
 - *Ford C84-xx, C14-xx, C04-xx, or*
 - *Mueller 110 or*
 - *pre-approved equal.*

2.1.2.1.1.3 Valves

- *Corporation (Ball) Valves: Mueller B-25000; Ford FB1000; A.Y. McDonald 74701BQ.*
- *Curb (Ball) Valves: Mueller B-25154; Ford B44-M; A.Y. McDonald 76104BQ.*
- *Curb Boxes: (Minn. Pattern) Mueller H-10300 and H-10302; Ford E.M. 2-65-56/57 and 2-70-56/57; A.Y. McDonald 5614/15.*

2.1.2.1.2 Sizes 3" diameter and larger shall be as follows for Service Lines, Valves, and Fittings:

- *Connection to Main: Anchoring tee with service line valve anchored to the main branch tee or tapping sleeve and reducing fitting, when appropriate.*
- *Lines: Per "Water Main – Materials" section.*
- *(Curb) Valves: Per "Valves – Materials" section.*
- *Valve Boxes: Per "Valve Boxes – Materials" section.*
- *Fittings: Per "Fittings – Materials" section.*

2.1.2.1.3 Extension rods are required for curb stop boxes deeper than 12feet.

2.1.2.1.4 All stop boxes and service valves shall be exposed, plumb, clean, and operable, when initially installed during new construction, as well as during rehabilitation or repaving projects.

2.1.2.2 DESIGN STANDARDS

2.1.2.2.1 Location, as you face the property, shall be to the left of the sanitary sewer lateral. Each habitable building shall have its own unshared service connection to the main.

2.1.2.2.2 On new construction, curb stop shall not be located within 5 feet of the driveway.

2.1.2.2.3 Water services shall have a trench check dam installed on the property side of the curb stop. See Specification 2.1.3 and Detail Figure 20.



2.1.2.2.4 Pipe design cover:

- *Turf (Ultimate grade) - 6 feet minimum*
- *Paved areas - 7 feet minimum*
- *Special Situation (i.e.: ditches, etc.) - 5 feet minimum cover with insulation*
- ***Under 4 feet of cover water main must be offset to achieve 6 foot cover.***

2.1.2.2.5 Following sizes are minimums, larger sizes may be required based upon fixture units and point of service pressure:

Type	Distance (building to main)	No. of Units	Size
Single Family	<55'		1 ¼" ID
	>55'		1 ½" ID
Two Family	<55'		1 ½" ID
	>55'		2" ID
Multi-Family		≤4	2" ID
		≤8	4" ID
		≤12	4" ID
		≤24	6" ID
		≤48	8" ID
Commercial			2" ID
Industrial			2" ID

2.1.2.2.6 Laterals 2" diameter and smaller may be installed in common trench with the sanitary sewer; Place the shut off at the (future) ROW or easement line.

2.1.2.2.7 Laterals greater than 2" diameter shall be installed a minimum of 8.0 feet away from sanitary or storm laterals; place the shut off at the water main connection tee.

2.1.2.2.8 Generally, copper service lines shall be installed in accordance with SWS Chapters 5.1.0, 5.2.0 and 5.5.0, and File Nos. 50 & 51, and the following requirements.

- *Copper service pipe 1¼" diameter and smaller shall be installed with NO coupling or joint from the corporation stop to the curb stop valves, and the run from the curb stop valve to the meter horn.*
- *Copper service pipe 1½" and 2" diameter shall be installed with NO coupling or joint from the corporation stop to the curb stop valve, and the run from the curb stop to the meter horn. In the event of a run greater than 55 ft., then the shortest pipe length shall be 20 ft.*

2.1.2.2.9 Existing laterals not used in a development shall be abandoned at the main when a development, land division or building razing occurs. See Section 2.2 regarding Abandonment.



2.1.2.2.10 HDPE Service Lines

2.1.2.2.10.1 The entire laying length shall be carefully inspected before placement into the trench for cuts or gouges or kinks. If a cut or gouge is found to be deeper than 10% of the minimum standard wall thickness of the pipe, the entire affected length shall be removed and discarded. If there is any kink in the laying length, the entire affected length shall be removed and discarded. The pipe to be placed shall not be kinked, cut or gouged during installation, or the preceding requirements shall be applied.

2.1.2.2.10.2 Laying length of HDPE lines shall afford enough slack to allow for thermal contraction of the plastic and in such manner as to avoid placing it under any undue tension. The pipe shall be laid by snaking the pipe in the bottom of an 18" wide trench and continuously supporting it on a smooth bedding surface. Before placing cover and backfill materials in the trench, water is to be run through the pipe to check connections for leaks and to cool the pipe to ambient ground temperature, and NOT ambient air temperature.

2.1.2.2.10.3 Cover materials shall be placed immediately after the leak check and while the pipe is still at ambient ground temperature. A minimum of two (2.0) feet of material, referenced in Section 2.1.13, shall be placed over the pipe before additional backfill material may be plowed or dumped into the trench to final grade. HDPE pipe shall be carefully placed to ensure minimum cover to final grade to be not less than 6.0-ft. in turf areas and not less than 7.0-ft. under paved areas.

2.1.2.2.11 Prior to applying curing material on the curb and gutter, the face of the curb shall be "branded" with a "W" designating the location(s) of water services. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective service.

2.1.3 TRENCH CHECK DAM

2.1.3.1 MATERIALS

2.1.3.1.1 Clay material shall have no organic material and shall be compacted to 95 percent standard proctor. Or;

2.1.3.1.2 Pre-approved equals such as: AquaBlok®, slurry and others.

2.1.3.2 DESIGN STANDARDS

2.1.3.2.1 Trench check dam shall be installed on all water services.

2.1.3.2.2 The check dam shall be located on the property side of the curb stop.

2.1.3.2.3 See Detail Figure No. 20.



2.1.4 VALVES

2.1.4.1 MATERIALS

All valves shall be Resilient type; acceptable valves are:

2.1.4.1.1 Butterfly Valves - for 12" and larger diameters, conforming to AWWA C504-94, stems sealed by at least two O-Rings, and worm gear operators for 2" square valve key operation from above, turn left (CCW) to open. Install with operating nut on North or East side of water main. Acceptable valves include:

- *M & H 4500*
- *Pratt Groundhog*
- *Mueller LineSeal III-3211-20 or XP-5227-20, or*
- *Pre-approved equal.*

2.1.4.1.2 RW Gate Valves - for 10" and smaller diameters, conforming to AWWA C-509-94, non-rising stems sealed with two O-Rings, MJ ends (or MJ-F), turn left (CCW) to open, 2" square operating nut. Acceptable valves include:

- *Clow R/W*
- *Kennedy R/W – 4571*
- *Mueller R/W A-2361 or 2362*
- *Waterous Series 2500*
- *Pre-approved equal.*

2.1.4.1.3 All exposed and non-epoxy coated bolts and nuts on hydrants and valves shall be stainless steel; T-Bolts shall be Cor-Blue or have a fluoropolymer coating as pre-approved by the City Engineer.

2.1.4.1.4 All valves shall be furnished with interior and exterior epoxy coatings per AWWA C-550-90. All valves not installed in vaults or manholes shall be installed per SWS File No. 37, and shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.4.2 DESIGN STANDARDS

2.1.4.2.1 Valve locations.

- *On all legs of branch lines: Mega-lugged to watermain*

2.1.4.2.2 Maximum spacing between valves:

- *At each intersection.*
- *Every 800 feet.*
- *Not greater than 24 residential equivalent units. (i.e.: 24 SF units; 3 – 8 Family Units).*



2.1.5 VALVES BOXES

2.1.5.1 MATERIALS

2.1.5.1.1 Valve boxes shall be cast iron, manufactured in the USA, and shall properly accommodate the selected valves. Acceptable manufacturers are:

- *Tyler Series 6860 US Domestic*
- *Pre-approved equal.*

2.1.5.1.2 Valve & enclosure type.

<u>Size</u>	<u>Box</u>	<u>Type</u>	<u>Manhole Vault</u>
4"	Yes	RW – GV	
6"	Yes	RW – GV	
8"	Yes	RW - GV	(Special circumstances)
12"	Yes	RW – BV	(Special circumstances)
16"	Yes**	RW - BV	(6 foot diameter option**)

2.1.5.1.3 All valve boxes deeper than 12.0 ft. from top of the operating nut to finish grade shall have solid extension rods with a centering ring. The extension rod shall be pinned to operating nut as approved by the Utility Department. In these cases, tracer wire connected to each valve shall be attached and run up the outside of each valve box to avoid interference with the extension rod(s).

2.1.5.1.4 A valve box adaptor by Adapter, Inc., or pre-approved equal, shall be furnished as part of the complete valve box for direct-bury gate & butterfly valves.

2.1.5.1.5 Top sections of valve boxes shall be whole factory lengths. Breaking of the top section to shorten its length is not acceptable.

2.1.5.1.6 Screw-in risers are acceptable and preferred. Slip in risers may be used with prior approval.

2.1.5.1.7 Valve box cover shall have the word "Water" stamped on the top surface.

2.1.5.1.8 All valve boxes shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.5.1.9 All valve boxes shall be installed straight and plumb when initially installed during new construction, as well as during rehabilitation or repaving projects. The top of the valve box shall be set 3/8" – 1/2" below pavement grade to avoid damage from snowplows and streets cleaning equipment.

2.1.5.1.10 Valve boxes shall be operable, cleaned and free of debris after installation, after rehabilitation or repaving projects or after any work done by non-Utilities and Streets Department personnel.



2.1.6 VALVE VAULTS

2.1.6.1 MATERIALS

- 2.1.6.1.1 When designated on the plans or required by the City Engineer, valve vaults/manholes shall be installed in accordance with this Section.
- 2.1.6.1.2 All manholes shall be pre-cast concrete with integral base and reinforced concrete flat slab top, or approved equal.
- 2.1.6.1.3 All pre-cast manhole barrel joints shall be made with preformed butyl rubber gasket material (ie. 'Easy Stik' or equal).
- 2.1.6.1.4 All manhole steps shall comply with SWS, Section 8.40.1.A or B.
- 2.1.6.1.5 All pre-cast manhole barrel sections shall be rotated to align all manhole steps vertically in the manhole.
- 2.1.6.1.6 All manhole lids shall be equal to Neenah R-1900-D with gasketed lid.
- 2.1.6.1.7 All frame/casting adjusting rings shall be reinforced concrete rings having 36" I.D. The minimum height for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. The maximum height of adjusting rings above the cone as measured from the slab top is 16". If more than 16" of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole. Paving rings which have an adjustable diameter are not allowed.
- 2.1.6.1.8 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a premixed, non-metallic, high-strength, non-shrink cementitious grout such as Pennegrout by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621.
- 2.1.6.1.9 Waterproofing mastic shall be placed over all lift holes and exterior of manhole chimneys that are approved to remain raised above existing grade. Trowelable grade mastic, Tremco 60 or approved equal, shall be applied to a minimum 50 mil WFT.
- 2.1.6.1.10 An external sealing wrap shall be placed at all joints between pre-cast manhole sections. The external sealing wrap shall meet, or exceed, the requirements of ASTM C-877, Type II. External joint seals shall be MacWrap, as manufactured by Mar-Mac Manufacturing Co. Inc. or pre-approved equal.



- 2.1.6.1.11 Coal-tar epoxy coating (two coats @ 8.0 mils DFT each) shall be applied to the exterior of ALL manholes in accordance with SWS 8.7.0. Alternate waterproofing materials and application may be pre-approved by the City Engineer.
- 2.1.6.1.12 Pipe-Manhole Connection device shall be Kor-N-Seal boot with stainless steel Snap-In banding rings or pre-approved equal.

2.1.7 HYDRANTS

2.1.7.1 MATERIALS

2.1.7.1.1 Acceptable Manufacturers are:

- *Clow Medallion*
- *Kennedy Guardian*
- *Mueller Super Centurion 250, Model A423*
- *Waterous 5.25" Pacer*
- *Pre-approved equal.*

2.1.7.1.2 All hydrants shall be provided as follows:

- *MJ connection*
- *Turn left to open*
- *depth of bury 6.5'*
- *Weather shield top*
- *Painted Brite Hydrant Red (5 mil DFT)*
- *Break flange (traffic) type*
- *5.25" main valve opening*
- *Two 2.5" hose nozzles*
- *One 4.5" pumper nozzle*
- *One 5' long Heavy Duty Candy Cane Fire Hydrant Marker with a spring-equipped L-bracket for hydrant flange bolt mounting. Available at Ferguson Waterworks (Part # CHMHRW), HD Supply (Hydra Finder Flag) or USA Bluebook (Part # ME-22516).*

2.1.7.1.3 Hydrant leads shall be six (6) inch, Class 52 ductile iron pipe.

2.1.7.1.4 Hydrants shall be connected to watermain with a Clow F1217 Anchoring Tee or pre-approved equal, a branch RW Gate Valve at main, a valve box and adaptor base.

2.1.7.1.5 All hydrants and valves shall be restrained by Mega-lugs or pre-approved equal from the main to the hydrant. Any push on joints in hydrant leads need to be harness restrained.



- 2.1.7.1.6 Contractor shall provide for a 6.5' burial depth for all hydrant leads shown on plans. If a water main burial depth is greater than 6.5', Contractor shall install fitting(s) to raise the hydrant lead to meet the required burial depth.
- 2.1.7.1.7 Hydrants that are not placed in service shall have a "Not in Service" tag attached to the pumper nozzle.
- 2.1.7.1.8 All pumper nozzle caps on private fire hydrants shall be painted safety yellow.
- 2.1.7.2 DESIGN STANDARDS**
- 2.1.7.2.1 Location:
- *Maximum spacing: 400-ft. diameter from center of hydrant to center of hydrant.*
 - *At all high points in distribution system.*
 - *At lot lines extended, where practical. In the event a hydrant location conflicts with a valve location at an intersection, the hydrant tee shall be located 10 feet away from the main valve.*
 - *Rural: 3 feet off of Right-of-Way. Provide 5-ft. deep x 10-ft. wide hydrant easement.*
 - *Urban: 4 feet behind back of curb line.*
 - *Sidepaths, recreation trails and other pedestrian ways: Minimum separation distance from edge of pathway to closest physical feature of the hydrant shall be 18".*
- 2.1.7.2.2 Design height: Pumper nozzle above surrounding finish ground = 18" to 24".
- 2.1.7.2.3 Design cover: 6.5 feet minimum bury.
- 2.1.7.2.4 Branch pipe design cover:
- *Turf - 6 feet minimum (Ultimate grade)*
 - *Paved areas - 7 feet minimum*
 - *Special Situation (i.e.: ditches, etc.) - 5 feet minimum cover with insulation*
- 2.1.7.2.5 Break flange must be at grade or not greater than 6 inches above grade.
- 2.1.7.2.6 Branch tee shall be anchor-style with gate valve at the tee.
- 2.1.7.2.7 An asphalt service drive with culvert shall be installed in all ditch crossings greater than 2.0 feet deep or that have traverse slopes greater than 4H:1V.
- *The service drive shall be 7 feet wide and extend to 2 feet behind the hydrant. The drive shall be constructed with 8 feet wide by 6" deep of No.2 open graded base course and 7 feet wide by 3" depth of asphalt.*



- *Culverts shall be hydraulically sized for each location consistent with Section 4 of the Development Handbook.*

2.1.8 FITTINGS

2.1.8.1 MATERIALS

- 2.1.8.1.1 All pipe fittings used for water main shall comply with SWS and be manufactured in the USA.
- 2.1.8.1.2 All fittings shall be Ductile Iron and be Class 350 or greater, conforming to the current ANSI/AWWA C-153/A21.53.
- 2.1.8.1.3 Fittings shall have a standard asphaltic coating and shall have a cement mortar lining on the interior in accordance with current (USA Domestic Only) ANSI/AWWA C-104/A21.4.
- 2.1.8.1.4 Fittings and accessories shall be furnished with mechanical-type joints with lugged retainer glands in accordance with current (USA Domestic Only) ANSI/AWWA C-111/A21.11.
- 2.1.8.1.5 All nuts and bolts shall be stainless steel on hydrants and valves. All T-Bolts shall be Cor-Blue.
- 2.1.8.1.6 All tees and fittings shall be anchored with restraints or pre-approved equal.
- 2.1.8.1.7 Angle Fittings shall be as follows:
- *All 90° bends: Full body, long radius, anchored, and mega-lugged or buttressed.*
 - *Other Angle Fittings: Short body acceptable; anchored and buttressed.*
- 2.1.8.1.8 Acceptable Manufacturers of Ductile Iron pipe fittings include the following:
- *American Cast Iron Pipe Co.*
 - *Clow Water Systems, Co.*
 - *Tyler Union*
- 2.1.8.1.9 Acceptable restraints include the following:
- *EBAA Mega-lug*
 - *Romac Roma Grip*
 - *Or approved equal*

2.1.8.2 DESIGN STANDARDS

- 2.1.8.2.1 All fittings shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.



2.1.9 WATER METERING REQUIREMENTS

2.1.9.1 DESIGN STANDARDS

- 2.1.9.1.1 Refer to Municipal Code Chapter 267-13 for general requirements.
- 2.1.9.1.2 Two-Family units shall require a split service lateral into the building in accordance with Standard Detail Figure No. 19.
- 2.1.9.1.3 Multi-Family Condominium buildings: A water metering room shall be required at the water service entrance location. Each water meter room shall be designed to meet the requirements of the New Berlin Water Utility, including an outside doorway. An entry key shall be provided to the New Berlin Water Utility.
- 2.1.9.1.4 Multi-Tenant Commercial and Industrial buildings: A water metering room shall be required at the water service entrance location. Each meter room shall be designed to meet the requirements of the New Berlin Water Utility, including an outside doorway. All commercial and industrial buildings shall have ball valves installed on the inlet, outlet, and bypass for water meters. An entry key shall be provided to the New Berlin Water Utility.
- 2.1.9.1.5 The water meter room shall:
- *Be large enough to allow work on the water meters. The size of the meter room would vary depending on the meter size(s) and number of meters going into the building. The Utility Department must approve the size of the meter room.*
 - *Be unobstructed by water softeners, vacuum cleaners, garbage cans, electric service, phone services, etc.*
 - *Not be used for cleaning supply storage or storage area.*
 - *Have adequate heating and lighting*
 - *Have a floor drain*
 - *The size of the water meter shall be on the plan to make sure the room is big enough to house the entire meter.*
- 2.1.9.1.6 Irrigation and/or Sprinkler Meter:
- *Must be connected prior to the main water meter of the residence or building.*
 - *Shall not be connected after the main meter under any circumstances.*

2.1.10 POLYETHYLENE WRAP

2.1.10.1 MATERIALS

- 2.1.10.1.1 Polyethylene film materials shall comply with SWS, Chapter 8.21.0.



- 2.1.10.1.2 Wrap all ductile iron pipe, valves, fittings and valve boxes with polyethylene film. When wrapping valve boxes, only wrap the bell portion and the bottom of the first section.

2.1.11 TRACER WIRE

2.1.11.1 MATERIALS

- 2.1.11.1.1 Copperhead high strength Tracer Wire or pre-approved equal.
- 2.1.11.1.2 Tracer wire shall be a #12 AWG fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor, insulated with a 30 mil, high-density, high molecular weight polyethylene insulation, and rated for direct burial use at 30 volts.
- 2.1.11.1.3 Tracer wire shall be laid parallel with and above centerline of the main, fittings and service line, and taped at maximum of 10-foot intervals.

2.1.11.2 DESIGN STANDARDS

- 2.1.11.2.1 Tracer Wire Required on ALL mains and services:.

2.1.11.3 INSTALLATION

- 2.1.11.3.1 Branch or connections with the tracer wire shall require 10 full turns of exposed and undamaged copper-to-copper contact and water-tight wrap to prevent corrosion or any deterioration of electrical conductivity (i.e.: Western Union splice).
- 2.1.11.3.2 Tracer wire shall be terminated behind hydrant barrels and curb stop boxes using a ½" PVC electrical conduit to carry the wire from bottom to top of structure, with a 1.5 foot pigtail. The tracer wire shall be run from each curb stop box and terminate at the meter or meter horn location within the building.
- 2.1.11.3.3 Tracer wire on service laterals shall be terminated at the marker board (maple hearth) in a ½" conduit taped to the board.
- 2.1.11.3.4 When installing ductile iron mains and fittings, provide and install "Cable Bond" type conductors on/at each joint. Note that epoxy coated valve bodies are not to be compromised. As an alternative, install tracer wire.



2.1.12 TAPPING

2.1.12.1 MATERIALS

2.1.12.1.1 Service saddles shall be used on all corporation valve sizes larger than 1", subject to specific pipe manufacturer restrictions for the pipe to be tapped. Saddles shall be all 304 stainless, double bolt saddle. Acceptable products for service sizes through 2" corps include:

- *Cascade Series CSC2 and CS22*
- *Ford FS303*
- *PowerSeal 3412AS*
- *Romac Style 306*
- *Smith-Blair 372*
- *Pre-approved equal.*

2.1.12.1.2 Tapping sleeves, that have a flanged outlet, shall be used when tapping all existing pipe in service for branch lines 3" and larger in size. The body shall be 304 stainless steel, have a minimum of 1/3 of the interior surface fully lined with a raised "donut" area around the branch opening, and a test port. All bolts, washers, and nuts shall be stainless steel. Acceptable tapping sleeves include:

- *Cascade CST-EX*
- *Mueller H304SS*
- *Power Seal 3490AS & AS-MJ*
- *Romac Series SST*
- *Smith-Blair 662*
- *Ford Style FTSS*
- *Pre-approved equal.*

2.1.12.2 DESIGN STANDARDS

2.1.12.2.1 Location of all taps, tapping devices or fittings/valves for ALL water pipes shall be in accordance with the following:

2.1.12.2.2 The minimum distance from the beginning/end of the Bell or MJ of a water pipe, fitting or another tap shall be:

- *Corporation direct tap = 2.0 ft.*
- *Corporation Tapping Saddle (up to 2" size) = not less than 2.0 ft.*
- *Branch Tapping Sleeve = not less than 4.0 ft.*



2.1.12.3 INSTALLATION

- 2.1.12.3.1 Activation of tap can only be authorized by the Water Utility after passing pressure tests and safe water tests. **A Utility representative shall be present on-site during tapping and sleeve work and any connection(s) to existing main(s).** Two working days advance notice before making the connection is required by the Water Utility.
- 2.1.12.3.2 All taps to water mains shall be made under full system pressure, with the main full of water. No taps may be made on an inactive or non-pressurized main.
- 2.1.12.3.3 All curb stops shall be installed under full system pressure prior to hydrostatic testing for acceptance of installation.
- 2.1.12.3.4 When tapping, thoroughly clean and inspect the pipe surface. Wet the pipe surface with a soap/water solution prior to placing a saddle, sleeve or repair clamp. Confirm that the main OD falls with the tapping device's OD range. Ensure that the tapping device is properly aligned to connect with the branch pipe. Ensure that the tapered ends of the gasket are smooth, not folded or rolled in any manner.
- 2.1.12.3.5 The saddle, sleeve or repair clamp shall be installed and all bolts finger-tightened for uniform gap. Tighten all bolts working from the ends to the center using torque wrenches in accordance with manufacturers specifications. After approximately 10 minutes to allow the gasket to fully compress, all bolts shall be re-tightened to manufacturer's specifications, but not exceeding 150 ft-lbs torque. Make sure the tapping device and tapping machine are fully supported and all cutting edges sharpened. Teflon tape or Teflon pipe dope shall be used on the corporation stop and all other pipe threads.
- 2.1.12.3.6 If tapping device is for 3" or larger branch line, the sleeve shall have a test port and be tested at 100 psi for 5 minutes by the Contractor BEFORE the actual tap proceeds. A Water Utility representative shall witness the tapping device installation, pressure test and tapping procedure.
- 2.1.12.3.7 All taps to existing and new mains shall be "live" or "wet" taps, utilizing a tapping machine with appropriate cutting tools and sharp cutting heads. All tap cut-outs shall be given to the Construction Inspector or Water Utility representative witnessing the tap.
- 2.1.12.3.8 No taps will be permitted to begin after 1:00 P.M. Additionally, pre-approval by the Water Utility is required for tapping on a Friday or preceding a holiday.
- 2.1.12.3.9 Two business days prior notice to Water Utility is required to be given prior to installation of new taps on existing mains.



2.1.12.3.10 Notice shall also be given to the Plumbing Inspector (Department of Community Development, 262-797-2445) for new taps on existing mains.

2.1.13 BEDDING/COVER/BACKFILL

2.1.13.1 MATERIALS

2.1.13.1.1 Pipe Bedding: In accordance with SWS, Section 8.43.2 to 1.0 foot above pipe: 3/8" limestone chips for PVC/PVCO pipe, HDPE services. All Ductile Iron pipe, fittings, and copper services shall use "torpedo" sand. No. 1 clean stone shall be placed within a 5 ft. radius of valves and valve boxes.

2.1.13.1.2 Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

2.1.13.1.3 Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted. In spot construction in trench lengths less than 50' Granular Backfill shall be crushed limestone per SWS, Section 8.43.6.

2.1.13.1.4 Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3-inches shall be permitted within 2.0 ft. above or beside the pipe. For HDPE service lines, the sieve size shall not be greater than 1¼" within 2.0 ft. above or beside the pipe.

2.1.13.1.5 Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8, or in accordance with a street opening permit, when issued. In special cases, City Engineer may require Sand Slurry consisting of 50 pounds of flyash and a ½ bag of Portland cement per cubic yard of mix.

2.1.13.2 DESIGN STANDARDS

2.1.13.2.1 Mechanically compact all trench backfill per Section 2.6.14(b) of SWS.

2.1.13.2.2 Backfill in accordance with all street opening permit(s); generally this will be slurry aggregate. All areas not within 5 ft. of paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

2.1.14 CAPS & PLUGS

2.1.14.1 MATERIALS

2.1.14.1.1 Acceptable caps & plugs include:

- *Clow F-1155, F-1159 and F-1165 solid cap or pre-approved equal.*
- *Poured buttresses shall be used*
- *Mega-lugs or pre-approved equal shall also be used when appropriate.*



2.1.15 CASING/CARRIER PIPE

2.1.15.1 MATERIALS

2.1.15.1.1 Installation of water lines within casings shall be accomplished by using Stainless Steel Casing Spacers installed in accordance with the manufacturer's recommendations. Spacers shall be:

- *Style CCS by Cascade Waterworks Mfg. Co. of Yorkville, IL*
- *Model 4810 by PowerSeal Pipeline Products of Wichita Falls, TX*
- *Pre-approved equal.*

2.1.15.1.2 End seals, installed on both ends of each casing, shall be:

- *Cascade Style CCES*
- *PowerSeal 4810ES*
- *Pre-approved equal.*

2.1.15.1.3 Water mains within the casing shall be installed with mechanical joints and mega-lugs or pre-approved equal.

2.1.15.2 DESIGN STANDARDS

2.1.15.2.1 Casing watermain shall be used for all plastic pipe crossing a right-of-way and for all arterial crossings.

2.1.16 INSULATION

2.1.16.1 MATERIALS

2.1.16.1.1 Minimum of 2" thick polystyrene board as manufactured by:

- *UpJohn*
- *Dow*
- *Pre-approved equal.*

2.1.16.2 DESIGN STANDARDS

2.1.16.2.1 Under 4 feet of cover or separation, offset is required to achieve 6 feet of cover or separation. All water system pipes (mains, hydrant leads, services, stubs) having less than 5 feet of cover material over the pipe or passing within 4 feet of an underground structure which may experience freezing temperatures shall be insulated in accordance with SWS, Sections 4.17.0 and 5.5.20



2.2 ABANDONMENT

2.2.1 General

2.2.1.1 All existing water mains and service lines that will not be used in new construction, or re-used for reconstruction of existing building sites shall be abandoned at the main.

2.2.1.2 **A representative from the City Water Utility shall be present to witness the abandonment.**

2.2.1.3 All excavations within public rights-of-way shall require City (Department of Community Development, 262-797-2445) and/or County Permits.

2.2.1.4 Excavations within 5 ft. of and under paved surfaces shall be backfilled with Slurry Aggregate per the SWS to within 1.0 ft. of surface, followed by appropriate street restoration and not less than 3-inches of binder and 2-inches of wearing surface bituminous pavements.

2.2.1.5 In special circumstances, when approved in writing by the City Engineer, water service lines may be temporarily made inactive at the right-of-way or easement boundary. The service shut-off valve shall be turned off and the pipe plugged or capped at the property line. Water services not abandoned at the main shall meet the following conditions:

- *As part of the demolition permit, a certified check or Letter of Credit, in the amount of \$5,000 per lateral, shall be submitted to the City Engineer to guarantee the permanent abandonment of the service at the main is completed in a timely manner.*
- *Any service line that is not abandoned at the main shall be subject to separate “availability” or “ready to serve” charges in the interim period until properly abandoned.*
- *Water lines made inactive in this manner shall be marked with a marker post placed 1 ft. from the end of the pipe and extending from the pipe to 3 ft. above the ground surface and painted a blue color.*
- *The location of the terminal pipe locations shall be surveyed or otherwise “tied” to permanent objects that will remain undisturbed at the site, with an as-built drawing provided to the City Engineer and Utility Department for record purposes.*

2.2.2 Water Services

2.2.2.1 All water services 2” diameter and smaller shall be abandoned at the street main by turning off the corporation tap stop valve, disconnecting and removing 2 - 3 ft. of the service line and installing a standard brass cap on the corporation valve.



- 2.2.2.2 The brass cap (& plug) shall be:
- *Ford copper tube nut with FIP on small end and MIP nut (P/N: C01.xx and C08.xx)*
 - *Mueller brass cap (P/N: H-15540)*
 - *Or pre-approved equal.*
- 2.2.2.3 The remaining service line may be left in place, but the valve box/curb stop shall be removed.
- 2.2.2.4 The completed work shall be double wrapped with polyethylene per SWS, Chapter 6.21.0.
- 2.2.2.5 For water service lines larger than 2" diameter, the abandonment procedure would consist of:
- *Removal of the service shut-off valve (if at the main), plus 2 - 3 ft. of service pipe at the street main branch fitting.*
 - *Installation of a gasketed blind flange or MJ plug at the branch fitting, as appropriate.*
- 2.2.2.6 All bolts and gaskets shall comply with these standards.
- 2.2.2.7 In the event that the shut-off valve is not at the street main branch fitting, then 2 - 3 ft of the service pipe shall be removed and a gasketed blind flange or plug installed onto the branch fitting at the main.
- 2.2.2.8 The valve box/curb stop shall be removed.

2.3 INSPECTION

2.3.1 SUBMITTALS AND SAMPLES

- 2.3.1.1 Material samples shall be taken as provided in SWS 8.1.0 and the Contract Documents.
- 2.3.1.2 All materials delivered to the Work Site shall have legible markings in accordance with ANSI, ASTM, AWWA and SWS 8.3.0.
- 2.3.1.3 All materials of each type or use shall be from a single manufacturer for the entire Contract.
- 2.3.1.4 Prior to the start of work, the Contractor shall submit six (6) sets of the following for approval:
- *Letter of Certification and representative test reports by manufacturer for all pipe delivered to the Work Site for EACH material item furnished.*



- *Representative test reports for EACH material item furnished to the Work Site.*
- *Installation manuals for all valves, operators, hydrants, etc.*
- *Maintenance manuals for all mechanical equipment furnished to the Work Site.*
- *Generally, installation shall be in accordance with SWS and as modified by these Specifications.*

2.3.2 DISINFECTING

- 2.3.2.1 No chlorination or flushing between safe samples.
- 2.3.2.2 Use only chlorine tablets glued to the top interior wall of the pipe (no powder) to disinfect pipelines and service/fire lines in accordance with SWS, Section 4.3.12. The Water Utility will collect samples of the chlorinated water for safe water testing. Contractor shall supply all labor assistance to flush mains and to take sample(s).
- 2.3.2.3 Water wasted to surface may not contain any substances in concentrations that adversely affect the water as determined by the Wisconsin Administrative Code, NR 105 and 106. For chlorine, no total residual chlorine may be measured in the water being discharged to a surface water greater than ambient total chlorine residual in system water supply (typically 0.5 mg/L). Advise the Water Utility and City Engineer of proposed discharge schedule to arrange DNR-required chlorine residual measurements for main flushing water.

2.3.3 ACCEPTANCE TESTING

2.3.3.1 General

- 2.3.3.1.1 Pressure and leakage testing shall include all installed system components, such as mains, branches, services and fire protection taps to terminus of all lines to be installed under the Contract.
- 2.3.3.1.2 Two (2) business days advance notice to the Engineering Project Inspector and Water Utility shall be required.
- 2.3.3.1.3 Water for filling, testing and flushing for safe sampling of watermain will be supplied only by permission of the Water Utility via permit. All water that is used for filling new mains, pressure testing, flushing of mains, trench flushing, and safe sampling etc., will be witnessed by an inspector or Utility employee. Water used will be charged at the current rate.



2.3.3.2 Tests

- 2.3.3.2.1 Prior to pre-punch list work, tracer wires shall be tested by Contractor prior to City accepting the work. The Utility Department has the option to spot check the continuity of the tracer wires.
- 2.3.3.2.2 Pressure and leakage tests shall be performed in accordance with SWS and under the jurisdiction of the Engineering Project Inspector and Water Utility.
- 2.3.3.2.2.1 *Pressure Test: After the test connections are made and the main filled with water, the test section shall be subjected to water pressure normal to the area. After examination of exposed parts of the system, the test pressure will be increase to 150 psi on the main at the lowest elevation. The main shall be examined and if any defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The pressure test shall be repeated until no defects can be found. The duration of the final pressure test shall be one hour. If it is found unnecessary to add water during the duration of the pressure test, the leakage test may be waived at the direction of the Inspector and Water Utility. If waived by the Inspector and Water Utility, a combination leak/pressure test will be performed.*
- 2.3.3.2.2.2 *Leakage Test: The leakage test, if required, shall be conducted after satisfactory completion of the pressure test. The test section shall be subjected to approximately 100 psi gauge pressure at eh point of highest elevation of the main under test. The duration of the leakage test shall be two hours unless otherwise specified. Should any test section fail to meet the leakage test, the Contractor shall immediately make the necessary repairs at his own expense. The duration of the final leakage test shall be one continuous hour.*
- 2.3.3.2.3 Fire and Combination water/fire service lines shall be tested at 200 psi for 2.0 hours.
- 2.3.3.2.4 The Water Utility shall take the water samples. The first 2 water samples are at the utilities expense. After the initial 2 samples are taken, the Developer/Contractor shall pay all utility expenses until the system is considered safe.
- *Approximate cost per sample trip is \$250*
 - *No first sample will be taken on a Friday, weekend, or adjacent to a holiday.*
 - *Note: In order for acceptance, 2 consecutive samples must pass in a 24 hour period.*



TABLE OF CONTENTS

3	SANITARY SYSTEM	2
3.1	SPECIFICATIONS	2
3.1.1	SANITARY SEWER MAIN	2
3.1.2	SANITARY SEWER LATERALS (From main to lot line)	4
3.1.3	LATERAL CONNECTIONS.....	5
3.1.4	TRENCH CHECK DAM	6
3.1.5	SANITARY FORCE MAIN.....	7
3.1.6	POLYETHYLENE WRAP & CORROSION PROTECTION.....	8
3.1.7	SANITARY MANHOLES	8
3.1.8	SAMPLING MANHOLES	12
3.1.9	GREASE INTERCEPTORS	13
3.1.10	LIFT STATIONS	15
3.1.11	TRACER WIRE.....	15
3.1.12	BEDDING/COVER/BACKFILL	15
3.1.13	CASING PIPE.....	17
3.1.14	INSULATION	17
3.2	ABANDONMENT	17
3.3	INSPECTION.....	19
3.3.1	SUBMITTALS AND SAMPLES	19
3.3.2	ACCEPTANCE TESTING.....	19
3.3.3	CLEANING	21
3.3.4	CCTV.....	22



3 SANITARY SYSTEM

All labor and material shall be governed by requirements of the Milwaukee Metropolitan Sewerage District (MMSD) and the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS), Public Service Commission (PSC) Rules and Wisconsin Department of Natural Resources (WDNR) Regulations, unless otherwise specified in these Specifications, whichever is more restrictive.

3.1 SPECIFICATIONS

3.1.1 SANITARY SEWER MAIN

3.1.1.1 MATERIALS

3.1.1.1.1 All pipe used for sanitary and private main interceptor sewers shall be:

- *Non-reinforced concrete, SWS 8.5.0*
- *Reinforced concrete, SWS, Section 8.6.0*
- *PVC (solid wall) SWS Section 8.10.0, ASTM D-3034, SDR-26*
- *PVC (solid wall, green in color for in-ground identification) SWS Section 8.20.0, AWWA C-900 or C-905*

3.1.1.2 DESIGN STANDARDS

3.1.1.2.1 Design flow coefficients as determined by the City Engineer, subject to the following:

3.1.1.2.1.1 *Residential/Multi-Family (Per MMSD Flow Allocation Worksheet):*

<i>Base Sanitary Flow</i>	<i>102 gpcd</i>
<i>Max. Daily</i>	<i>1,269 gpcd</i>
<i>Residential densities are to be determined per MMSD Annual Cost Recovery Manual.</i>	

3.1.1.2.1.2 *Industrial & Institutional Areas (Per MMSD Flow Allocation Worksheet):*

<i>Base Sanitary Flow</i>	<i>1,500 gpd/Acre</i>
<i>Max. Daily</i>	<i>3,250 gpd/Acre</i>

3.1.1.2.1.3 *Large Commercial (Per MMSD Flow Allocation Worksheet):*

<i>Base Sanitary Flow</i>	<i>2,250 gpd/Acre</i>
<i>Max. Daily</i>	<i>4,000 gpd/Acre</i>

3.1.1.2.2 Design flows and peaking factors are to be referenced to MMSD Rules and Regulations and as determined by the Engineering Services Division. Design objectives shall result in elimination, to the greatest extent possible, of all infiltration and inflow.



3.1.1.2.3 Minimum Main sizes:

<i>Residential:</i>	<i>8"</i>
<i>Industrial / Commercial / Multi-Family & PUD:</i>	<i>8"</i>
<i>Shall accommodate future tributary areas as directed by the City Engineer.</i>	

3.1.1.2.4 Minimum slopes.

3.1.1.2.4.1 *Pipes slopes shall achieve self-cleansing velocities for peak design flows as directed by the City Engineer. Generally, minimum velocity of 2.0 fps shall be met at half-full conditions.*

<i>Pipe Size</i>	<i>Minimum Slope</i>
<i>8"</i>	<i>0.40 % (Dead end reach 0.60%)</i>
<i>10"</i>	<i>0.28 % (Dead end reach 0.40%)</i>
<i>12"</i>	<i>0.22 %</i>
<i>15"</i>	<i>0.15 %</i>
<i>18"</i>	<i>0.12 %</i>
<i>21"</i>	<i>0.10 %</i>
<i>Other sizes</i>	<i>Per Engineering Services Division.</i>

3.1.1.2.5 Complete sewer design calculations and sewer system plans are required with construction plan submittals.

3.1.1.2.6 Conceptual sewer system plans are required for proposed developments located within the Ultimate MMSD Service Area even if sanitary sewer currently is not available. A determination is needed at the conceptual stage that future gravity sewer systems will work when needed.

3.1.1.2.7 Center of manhole shall coincide with street centerline, and center of main shall be within 5 feet of centerline on curvilinear street segments.

3.1.1.2.8 Invert shall not be less than:

<i>Distance below the centerline grade of the street</i>	<i>Road ROW Width</i>
<i>11.0 feet</i>	<i>60/66-ft</i>
<i>12.0 feet</i>	<i>80-ft</i>
<i>13.0 feet</i>	<i>>80-ft and cul-de-sacs</i>

3.1.1.2.9 Minimum sewer depth shall be 8 feet from finished grade to top of pipe under exceptional circumstances and approval of City Engineer.

3.1.1.2.10 All sewer pipes shall be laid in accordance with SWS, Chapter 3.2.0

3.1.1.2.11 All connections to manholes shall be in accordance with SWS, Section 3.5.7. Connections to manholes with preformed troughs in the base shall be made in accordance with the procedure described in Section 3.1.7.3.5.



3.1.1.2.12 All sewer pipes shall terminate at the inside wall of the manhole. All annular spaces shall be filled with a mastic or cementitious filler to prevent the breakage of the pipe while jetting.

3.1.2 SANITARY SEWER LATERALS (From main to lot line)

3.1.2.1 MATERIALS

3.1.2.1.1 All pipe used for sanitary laterals shall be:

- *PVC (solid wall) SWS 8.10.0, ASTM D-3034, SDR-35 or 26*
- *PVC (solid wall) SWS, Section 8.20.0, AWWA C-900 or C-905*

3.1.2.1.2 Risers shall be as required by the plans in accordance with these standards or as pre-approved by the City Engineer.

3.1.2.1.3 Risers (shall be tees): Minimum depth below road centerline shall be per Section 3.1.1.2.8, or 5 feet below basement, whichever is greater. Sewer depth to be greater than 14 feet for riser. (Per SWS File Nos: 10A, 10B, 10C, 10D, & 10E).

3.1.2.2 DESIGN STANDARDS

3.1.2.2.1 Sites are allowed one (1) sanitary lateral connection. In special circumstances, additional laterals may be allowed with the written permission of the City Engineer and the Utility Manager.

3.1.2.2.2 Minimum size shall be 6" diameter.

3.1.2.2.3 Slope at ¼" per foot. Under exceptional conditions, the City Engineer may permit minimum slope = 1/8" per foot in ROW/easement.

3.1.2.2.4 All connections to existing mains and manholes shall be in accordance with Section 3.1.3.

3.1.2.2.4.1 *Lateral connections to manholes shall be pre-approved by the City Engineer. Connections to manholes in new construction shall not be above the outlet sewer crown and have a smooth paved channel constructed to convey lateral waste to main outlet channel.*

3.1.2.2.4.2 *Laterals may not connect to manholes except in cul-de-sacs (permanent end of line). In cul-de-sacs, special manhole detail and construction of benches and lateral pipe connections are required.*

3.1.2.2.4.3 *If it is deemed necessary to install a lateral to an existing manhole, and the manhole has to be cored and booted to accept this lateral, this manhole shall be vacuum tested according to the SWS.*

3.1.2.2.5 Existing laterals not used in a development shall be abandoned at the main when a development, land division or building razing occurs. See Section 3.2.



3.1.2.2.6 Each habitable building shall have a separate lateral connection to the sewer main.

3.1.2.2.7 Sanitary laterals shall have a trench check dam installed at the property line. See Specification 3.1.4 and Detail Figure 20.

3.1.3 LATERAL CONNECTIONS

3.1.3.1 Connection of New Sanitary Laterals to Existing Mains shall be as follows based on existing main material:

3.1.3.1.1 ABS - Truss Pipe

- *Location - not closer than 36" to an existing joint or fitting.*
- *Hole - Core drill or saw-cut with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.*
- *Connection Device - PREDCO Saddle System, or GPK or SEALTITE Gasketed PVC Saddle with stainless steel bands.*

3.1.3.1.2 Concrete Pipe

- *Location - not closer than 24" to an existing joint or fitting.*
- *Hole - Core with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.*
- *Connection Device - PREDCO Saddle System or TAPRITE "MD" Cut-in.*

3.1.3.1.3 PVC Pipe

- *Location - Not closer than 36" to an existing joint or fitting.*
- *Hole - Core drill or saw-cut with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.*
- *Connection Device - GPK or SEALTITE Gasketed PVC Saddle with stainless steel bands or PREDCO Saddle System.*

3.1.3.1.4 Vitriified Clay Pipe

- *Location - not closer than 24" to an existing joint or fitting.*
- *Hole - Core with appropriate cutting tools. Deliver "cut-out" to Construction Inspector or Utility Department representative.*
- *Connection Device - PREDCO Saddle System or TAPRITE "MD" Cut-in.*



- 3.1.3.1.5 Due to increasing incidents with plugs being left in sewer lines, the City of New Berlin Utility Department is requiring Contractors using muni-ball plugs in sanitary sewer mains to have their company name permanently applied to the plug. This shall be witnessed and documented by the project inspector and witnessed by a New Berlin Utility personnel. The New Berlin Utility shall be notified when this plug is installed and removed. This plug shall also be chained to the manhole step. The Contractor is required to remove the plug after the repair of punch list items is completed and then only when witnessed by a qualified inspector and a New Berlin Utility personnel
- 3.1.3.1.6 Prior to applying curing material on the concrete, the face of the curb shall be “branded” with a “S” designating the location(s) of sanitary laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.

3.1.3.2 Connection of New Sanitary Laterals to Existing Sanitary Manholes will only be allowed on a case-by-case basis and when pre-approved by City Engineer and the Utility Department, and shall be subject to following requirements:

- 3.1.3.2.1 Location: Invert of new lateral may be permitted a maximum of 12” above spring line of outlet sewer, or use outside drop inlet per SWS for main sewers;
- 3.1.3.2.2 Hole: Core with appropriate cutting tools Deliver “cut-out” to Construction Inspector or Utility Department representative;
- 3.1.3.2.3 Connection Device: Kor-N-Seal boot or pre-approved equal with stainless steel snap-in ring.
- 3.1.3.2.4 Any lateral that is connected into a manhole shall have a smooth concrete bench/channel placed to convey lateral waste flow into mainline channel.
- 3.1.3.2.5 Prior to applying curing material on the concrete, the face of the curb shall be “branded” with a “S” designating the location(s) of sanitary laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.

3.1.4 TRENCH CHECK DAM

3.1.4.1 MATERIALS

- 3.1.4.1.1 Clay material shall have no organic material and shall be compacted to 95 percent standard proctor. Or;
- 3.1.4.1.2 Pre-approved equals such as: AquaBlok®, slurry and others.



3.1.4.2 DESIGN STANDARDS

- 3.1.4.2.1 Trench check dam shall be installed on all sanitary laterals.
- 3.1.4.2.2 The check dam shall be located at the property line.
- 3.1.4.2.3 See Detail Figure No. 20.

3.1.5 SANITARY FORCE MAIN

3.1.5.1 MATERIALS

- 3.1.5.1.1 All pipe used for sanitary force (pressure) mains shall be:
 - *PVC (solid wall) SWS 8.51.2, AWWA C-900 or C-905*
 - *PVCO AWWA C-909, Class 150*
 - *High density black Polyethylene Force Main Pipe SWS 8.51.3, ASTM F-714;*
or
 - *Ductile Iron Pipe SWS 6.18.x;*
- 3.1.5.1.2 All pipe shall conform to Ductile Iron Pipe OD.
- 3.1.5.1.3 Valves shall be:
 - *Dezurik Series 100 Eccentric Valves*
 - *cast iron epoxy-coated body, hard rubber-lined*
 - *MJ*
 - *low friction Buna-vee packing*
 - *neoprene plug facing*
 - *ABG6H6 actuator*
 - *with stainless steel bolts*
 - *and plug valve adaptor bracket with valve box*
 - *Alternatives must be pre-approved by the City Engineer.*

3.1.5.2 DESIGN STANDARDS

- 3.1.5.2.1 Valve spacing not to exceed: 800 feet or $\frac{1}{2}$ the length of the force main for mains less than 1,000 feet. For force mains in excess of 2,400 feet, valves shall be located at the $\frac{1}{4}$ points of the main up to noted maximum.
- 3.1.5.2.2 Minimum design depth shall have 8 feet of cover.
- 3.1.5.2.3 Buried tracer location wire is required above the force main.
- 3.1.5.2.4 Maximum spacing of location boxes: 400 feet or as directed by the City Engineer.



3.1.5.2.5 Velocity/Size:

- Hazen-Williams formula “C” value of 120.
- Velocity 2.0 – 6.0 fps for lowest energy pumping cost, as approved by the City Engineer.

3.1.5.2.6 High/Low Points:

- Air relief valve sizing calculations shall be submitted with Plans.
- Clean-outs shall be installed at designated points.
- 6-ft. diameter manhole enclosures shall be installed.

3.1.6 POLYETHYLENE WRAP & CORROSION PROTECTION

3.1.6.1 MATERIALS

3.1.6.1.1 Polyethylene film materials shall comply with SWS, Section 8.21.0.

3.1.6.2 DESIGN STANDARDS

3.1.6.2.1 All metallic pipe, fittings and valves shall be wrapped and protected per SWS, Section 4.4.4 and 4.4.5.

3.1.7 SANITARY MANHOLES

3.1.7.1 MATERIALS

3.1.7.1.1 All sanitary manholes shall be pre-cast concrete with integral base, with cone top section, Comply with ASTM C-478; 4,000 psi concrete.

3.1.7.1.1.1 Reinforced concrete flat slab as optional, with pre-approval required by the City Engineer and as shown on the Plans.

3.1.7.1.2 The manholes shall be sized as follows:

<u>Downstream Pipe Size</u>	<u>Minimum Manhole I.D.</u>
24” or less	48”
> 27”	Special Design requiring City Engineer Approval
Sampling Manhole	48”

3.1.7.1.3 All sanitary manhole cone sections shall have a minimum 3” internal vertical surface at the bottom and 2” outside vertical surface at the top.

3.1.7.1.4 All pre-cast manhole barrel joints shall be made with preformed butyl rubber gasket material (ie. ‘Easy Stik’ or equal).



- 3.1.7.1.5 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout® by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or “plastic” consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively. Dry stacking of riser rings or flat decks shall not be permitted. They shall be laid in a bed of grout as described above.
- 3.1.7.1.6 All manholes constructed with a frame/cone internal rubber seal shall conform to SWS 8.42.0 and the following:
- *Cretex 26” LSS 0-6 Internal Chimney Seal Part No. 092845; or*
 - *Cretex 26” LSS 6-12 Internal Chimney Seal Part No. 092855, or*
 - *Cretex 26” LSS 12-18 Internal Chimney Seal Part No. 092865; or*
 - *Pre-approved equal.*
- 3.1.7.1.6.1 *Only one rubber sleeve and one additional extension shall be allowed in a newly constructed manhole. The internal seal and extension, if needed, shall overlap a minimum of 2” with the frame and cone for proper sealing.*
- 3.1.7.1.7 The installation of external chimney seals may be used in all new construction, including easement areas, with pre-approval of the City Engineer. External seals shall be marked on the asbuilt.
- 3.1.7.1.8 An external sealing wrap shall be placed at all joints between pre-cast manhole sections. The external sealing wrap shall meet, or exceed, the requirements of ASTM C-877, Type II. External joint seals shall be MacWrap, as manufactured by Mar-Mac Manufacturing Co. Inc., or pre-approved equal.
- 3.1.7.1.9 Coal-tar epoxy coating (two coats @ 8.0 mils DFT each, totaling 16 mil DFT) shall be applied in accordance with SWS 8.49.2 to the exterior of ALL manholes prior to delivery to the project site. The coating material shall be equal to:
- *Tnemec Series 253 H.S. Tnemec Tar; or*
 - *ICI Devoe DEVTAR 5A; or*
 - *Pre-approved equal.*
- 3.1.7.1.9.1 *Each manhole section shall be inspected and marked for proof of inspection prior to delivery to the project site. Manholes sections that are not properly coated with coal-tar epoxy will be rejected and shall be removed from the project site.*
- 3.1.7.1.10 Any manhole located within 1,000 feet of a facility with food service/grease trap must have internal surfaces coated with Strong Seal and Raven Coating or a pre-approved alternate. Due to premature deterioration of concrete from hydrogen sulfide gases, this has become necessary. This is in addition to the external application of 16 mils of coal tar epoxy.



- 3.1.7.1.11 Internal back-plastering of the cone and chimney will not be permitted.
- 3.1.7.1.12 Waterproofing mastic shall be placed over all lift holes and exterior of manhole chimneys that are approved to remain raised above existing grade. Trowelable grade mastic, Tremco 60 or approved equal, shall be generously applied to a minimum 50 mil WFT.
- 3.1.7.1.13 All frame/casting adjusting rings shall be reinforced concrete rings having 26" I.D. The minimum height for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. Paving rings which have an adjustable diameter are not allowed.
- 3.1.7.1.13.1 *For new manholes, the maximum height of adjusting rings above the cone as measured from the top of the cone or slab top is 16". If more than 16" of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole.*
- 3.1.7.1.13.2 *When rehabilitating existing manholes, the maximum height of adjusting rings above the cone as measured from the top of the cone or slab top shall be 22". If more than 22" of adjusting rings are needed to adjust the casting to finished grade, then an additional barrel section shall be installed on the manhole.*
- 3.1.7.1.14 All manhole steps shall comply with SWS, Section 8.40.0 A or B.
- 3.1.7.1.15 All sanitary manhole lids (except for sampling manholes) shall be solid, gasketed lids (self sealing) with "T" gasket equal to Neenah or approved equal on style R-1660 or R-1661 "K" Platen.
- 3.1.7.1.16 All new and rehabilitated manholes located in easements and floodplains shall have Neenah Foundry R-1915-S1 water tight frames, gasket, and bolt down covers.
- 3.1.7.1.17 All manhole lids installed on manholes in public sanitary systems shall have the words "City of New Berlin" stamped on the top surface. Reference #1660 – 5260 Neenah Foundry.
- 3.1.7.1.17.1 *The maximum number of lids that can be order through the Utility Department is 50. Manhole lid price is subject to change, contact the Utility Department for pricing. The costs of the lids would be paid to the Utility Department. CONTRACTOR shall pick up the lids from the Utility Department with a 24 hour advance notice. Payment is due before the lids can be picked up.*
- 3.1.7.1.17.2 *Sampling manholes are described in Section 3.1.8.*

3.1.7.2 DESIGN STANDARDS

- 3.1.7.2.1 Maximum distance between manholes = 400 feet, per Administrative Code NR-110.



3.1.7.2.2 Slope through manhole:

Angle (degrees)	Drop (feet)
0 to 10	0.10-ft. drop
>10 and <30	0.15-ft. drop
≥30 degrees	0.25-ft. drop

3.1.7.2.3 Finished frame grade

- *Floodplain areas: 2.0 feet above the 100-yr flood elevation. When practicable, grade earth at 5H:1V slope around manhole.*
- *Turf & easement areas: at finished grade*
- *Pavement areas: 3/8" – 1/2" below pavement surface, set parallel with centerline gradient.*

3.1.7.2.4 Frame/Lid: All sanitary manholes shall have a heavy duty frame with solid, gasketed self-sealing lid (T-Gasket) with concealed pick holes. Sealed bolted-down lids/frames shall be required in ROW/easement areas in floodplains.

3.1.7.2.5 Frame/Cone Seals: External seals are preferred and acceptable. Internal rubber boot and a maximum of one extension may be installed in new manholes. An additional extension may be required when rehabilitating existing manholes.

3.1.7.2.6 Manhole chimney height: 16" maximum and 2" minimum for manholes.

3.1.7.2.7 Sampling manholes and exterior grease tanks shall be required as directed by City Engineer. See the Sampling Manholes section of these specifications.

3.1.7.2.8 All pre-cast manhole barrel sections shall be rotated to align all manhole steps vertically in the manhole.

3.1.7.2.9 Outside drop connections shall be provided in accordance with SWS. Inside drop connections for mains or laterals will not be permitted

3.1.7.2.10 As subsequent improvements are made to any existing manhole, chimney heights shall be reconstructed to meet the requirements of this section.

3.1.7.3 INSTALLATION

3.1.7.3.1 Manhole barrel joint(s) gasket material ('E-Z-Stik') shall be placed firmly against the lower third of the vertical slope of each joint and shall be of the volume necessary to fill the annular space of the joint. Lifting holes shall be grouted with Pennegrout and struck smooth on the interior and exterior surfaces, followed by an application of waterproofing mastic on the exterior surfaces. The chimney joints shall be grouted with Pennegrout. The grout shall extend the full width of each grade ring and each joint shall be struck-off vertically, even with the inside and outside chimney surfaces.



- 3.1.7.3.2 Rim elevations for manholes located in paved areas shall be set $3/8'' - 1/2''$ below the asphalt binder grade elevation. Ramping of manholes will not be allowed.
- 3.1.7.3.3 Internal rubber frame-cone seals shall be installed within 5 working days after the binder pavement coarse has been placed, or the finished grading completed for the project or site on non-pavement area manholes. The internal seal bands shall be lubricated per manufacturer's recommendations prior to installation and tightening.
- 3.1.7.3.4 Final adjustments to raise rim elevations to $3/8'' - 1/2''$ below the grades shown on the final paving plans shall be made by installing adjusting reinforced concrete rings as needed just prior to placement of the final lift of the pavement (surface course).
- 3.1.7.3.5 When sewer pipes are connected to manholes with a preformed trough in the base, any pipe placed in the trough and extending beyond the interior wall of the manhole, shall have the portion of the pipe extending above the edges of the trough trimmed back to the interior wall of the manhole. The top edges of the pipe shall match in elevation the top edges of the trough.

3.1.8 SAMPLING MANHOLES

3.1.8.1 MATERIALS

- 3.1.8.1.1 Sampling manholes shall be 48" I.D. pre-cast concrete with integral base, with cone top section as standard and reinforced concrete flat slab as optional, with pre-approval required by the City Engineer.
- 3.1.8.1.2 Sampling manholes shall be equipped with Neenah R-1740 B or R-1916 H or approved equal frame and lids and internal chimney seal(s). External seals are allowed.
- 3.1.8.1.3 Sampling manholes shall be vacuum tested, have chimney seals installed, and have bolt down gasket covers.
- 3.1.8.1.4 The exterior walls of the manhole shall be coated with coal-tar epoxy per SWS, Chapter 8.49.2, (2 coats at 8 mil DFT minimum each, totaling 16 mil DFT minimum) to the exterior of all sampling manholes prior to delivery to the project site. The coating material shall be equal to:
- *Tnemec Series 253 H.S. Tnemec Tar; or*
 - *ICI Devoe DEVTAR 5A; or*
 - *Pre-approved equal.*
- 3.1.8.1.4.1 *Each manhole section shall be inspected and marked for proof of inspection prior to delivery to the project site. Manholes sections that are not properly coated with coal-tar epoxy will be rejected and shall be removed from the project site.*



3.1.8.1.5 An external sealing wrap shall be placed at all joints between precast manhole sections. The external sealing wrap shall meet or exceed the requirements of ASTM C-877, Type II. The external joint seals shall be MacWrap, as manufactured by Mar-Mac Manufacturing Company, Inc. or pre-approved equal.

3.1.8.2 DESIGN STANDARDS

3.1.8.2.1 The approach section of pipe approaching the primary gauging device must be straight for a distance of at least 20 pipe diameters with no connections, drops, or bends.

3.1.8.2.2 The slope of the approach distance shall be no more than 1%.

3.1.8.2.3 When installing a primary gauging device, the slope of the downstream outlet pipe should not be less than the upstream pipe slope. Free fall conditions should exist.

3.1.8.2.4 There should be no grade changes, angle points, or connections at the structure.

3.1.8.2.5 The sides of the channel must be plumb and straight throughout the manhole.

3.1.9 GREASE INTERCEPTORS

All buildings with food service preparation on-site (now or at any future time) shall be required to install, maintain and operate an exterior or interior grease interceptor tank sized in accordance with the Department of Safety and Professional Services (DSPS). State plumbing reviews by the DSPS must be completed before a plumbing permit will be issued. Construction of the Grease Interceptor shall, in addition to requirements of the Plumbing Code, conform to the following standards. These standards are intended to minimize the potential for groundwater infiltration and inflow or rainwater from entering the sanitary sewer system via this system component.

3.1.9.1 MATERIALS

3.1.9.1.1 INTERIOR GREASE INTERCEPTOR

3.1.9.1.1.1 Interior grease interceptors shall be constructed in a watertight manner of one of the following materials

- *Precast reinforced concrete*
- *Reinforced monolithic concrete*
- *Cast iron*
- *Coated 12-gauge steel*
- *Vitrified Clay*
- *Fiberglass*
- *Plastic*



- *Other approved materials*

3.1.9.1.2 EXTERIOR GREASE INTERCEPTOR

- 3.1.9.1.2.1 Exterior grease interceptors shall be pre-cast concrete with integral base when required by the City Engineer and shown on the Plans.
- 3.1.9.1.2.2 Exterior grease interceptors shall be equipped with water-tight locking frame and lids.
- 3.1.9.1.2.3 The exterior walls of the tank shall be coated with coal-tar epoxy per SWS, Chapter 8.49.2, (2 coats at 8 mil DFT minimum each, totaling 16 mil DFT minimum). The coating material shall be equal to:
- *Tnemec Series 253 H.S. Tnemec Tar; or*
 - *ICI Devoe DEVTAR 5A; or*
 - *Pre-approved equal.*
- 3.1.9.1.2.3.1 *Coating(s) shall be applied in accordance with the coating manufacturer's recommendations and preferably at the place of tank manufacture. Each manhole section shall be inspected and marked for proof of inspection prior to delivery to the project site. Alternate waterproofing materials and application may be used if pre-approved by the City Engineer. Manhole sections that are not properly coated with coal-tar epoxy will be rejected and shall be removed from the project site.*
- 3.1.9.1.2.4 All barrel joints shall have a mastic or gasket type joint seal. The exterior shall be wrapped with an additional joint seal that meets requirements of ASTM C-877, Type II, such as "Mac-Wrap" or pre-approved alternate.
- 3.1.9.1.2.5 All manhole or tank access or inspection chimneys shall be back-plastered on the exterior with mortar and a trowelable grade mastic. Mastic shall be Tremco 60 or approved equal. The interior of the access or inspection chimney(s) shall not be backplastered and shall have an internal chimney boot or seal installed after construction is inspected. The internal chimney seal shall be equal to Cretex or approved equal.

3.1.9.2 DESIGN STANDARDS

- 3.1.9.2.1 The approach section of pipe approaching the tank must be straight for a distance of at least 20 pipe diameters with no connections, drops, or bends.
- 3.1.9.2.2 There should be no grade changes, angle points, or connections at the structure.
- 3.1.9.2.3 In Flood Plain Areas: Tank access or inspection chimneys shall be 2.0 feet above 100-yr Flood elevations as determined via FEMA Mapping.
- 3.1.9.2.4 When practicable, grade earth at 5H:1V slope around manhole openings. In paved areas, slope drainage away from the manhole openings.



- 3.1.9.2.5 Because inlet and outlet pipe slopes are critical, the location of the exterior grease trap tank shall require prior approval of the City Engineer for location and grades. For projects requiring prior Site Plan Approval requirements, this site element must be included on the Site Plan Submittal(s).

3.1.10 LIFT STATIONS

Consult with Engineering Services Division and the Utility Wastewater Department for design requirements.

3.1.11 TRACER WIRE

3.1.11.1 MATERIALS

- 3.1.11.1.1 A solid copper #10 AWG, THHN coating, shall be laid parallel with and above the centerline of the main and taped at not greater than 10-foot intervals.

3.1.11.2 DESIGN STANDARDS

- 3.1.11.2.1 Tracer wire on sanitary sewer shall be installed as required by the Utility Department.
- 3.1.11.2.2 Tracer wire shall be required on all force mains.

3.1.11.3 INSTALLATION

- 3.1.11.3.1 Contractor shall verify during backfilling of cover material that the tracer wire has remained on top of the main.
- 3.1.11.3.2 Branch or connections with the tracer wire shall require 10 full turns of exposed and undamaged copper-to-copper contact and watertight wrap to prevent corrosion or any deterioration of electrical conductivity (i.e. Western Union Splice).
- 3.1.11.3.3 Tracer wire shall be terminated at start-end points and all intermediate valve boxes.
- 3.1.11.3.4 A ½" diameter PVC electrical conduit placed inside of the valve box shall carry the wire from bottom to top of each valve box. A 1.5-ft. pigtail of excess tracer wire shall stick out of the top of the conduit.

3.1.12 BEDDING/COVER/BACKFILL

3.1.12.1 MATERIALS

- 3.1.12.1.1 Pipe Bedding/Cover: In accordance with SWS, as follows -
- *Flexible wall pipe shall be Class "B" up to 12" above top of pipe; 3/8" limestone chips.*



- *Rigid wall pipe with diameters equal to or less than 21" shall have 3/8" limestone chips up to 12" above top of pipe.*
- *Rigid wall pipe with diameters greater than 21" shall have 3/4" limestone chips up to 12" above top of pipe.*
- *Ductile Iron pipe shall be Class B to 12" above top of pipe, torpedo sand.*
- *Fittings/Valves shall be Class B to 12" above top of pipe, torpedo sand.*

3.1.12.1.2 Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

3.1.12.1.3 Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted. In spot construction in trench lengths less than 50 feet, granular backfill shall be crushed limestone per SWS, Section 8.43.6.

3.1.12.1.4 Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted within 2.0 ft. above the pipe.

3.1.12.1.5 Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8 and requirements of City Engineer, or in accordance with street opening permit, when issued. In special cases, City Engineer may direct the use of Sand Slurry consisting of 50 pounds of fly ash and a 1/2 bag of Portland cement per cubic yard of mix.

3.1.12.2 DESIGN STANDARDS

3.1.12.2.1 Backfill in accordance with all street opening permit(s), generally will be slurry aggregate. All areas greater than 5 ft. from a paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

3.1.12.3 INSTALLATION

3.1.12.3.1 Care shall be taken by the Contractor when backfilling to prevent any movement of the pipe from proper alignment and grade. Contractor is responsible for determining that the finished sewer remains at the required elevation and grade.

3.1.12.3.2 Mechanically compact all trench backfill to a minimum 95% standard Proctor density per SWS, Section 2.6.14(b). The initial lift to be compacted shall have a 2 ft. loose thickness. Each subsequent lift to be compacted shall have a maximum 18" loose thickness. Contractor shall place smaller lifts if the required compaction cannot be achieved.



3.1.13 CASING PIPE

3.1.13.1 MATERIALS

3.1.13.1.1 Installation of sewer lines and force mains within casings shall be accomplished by using Stainless Steel Casing Spacers installed in accordance with the manufacturer's recommendations. Spacers shall be:

- *Cascade Style CCS; or*
- *PowerSeal 481; or*
- *Pre-approved equal.*

3.1.13.1.2 End seals shall be installed on either end of each casing and shall be one of the following:

- *Cascade Style CCES; or*
- *PowerSeal 4810 ES; or*
- *Pre-approved equal.*

3.1.13.1.3 Force main piping within the casing shall be installed with mechanical joints and mega-lugs.

3.1.14 INSULATION

3.1.14.1 MATERIALS

3.1.14.1.1 Minimum of 2" thick styrofoam plastic foam boards as manufactured by :

- *Upjohn; or*
- *Dow Chemical Compan, or*
- *Pre-approved equal.*

3.1.14.2 DESIGN STANDARDS

3.1.14.2.1 All sanitary sewer pipes (mains, force mains & laterals), having less than 5.0 ft. of cover material, shall be insulated.

3.2 ABANDONMENT

3.2.1.1 General

3.2.1.1.1 All existing sanitary sewer mains and service lines, that will not be used in new or re-used in reconstruction of existing building sites, shall be abandoned at the main.

3.2.1.1.2 Abandonment shall be witnessed by the City Inspector or a Utility Representative.

3.2.1.1.3 Main and/or service abandonment at the street main shall be a condition of any site demolition permit(s) issued or in the case of duplication, service lines that will remain unused on new construction.



3.2.1.1.4 All excavations within public rights-of-way shall require City and/or County Permits.

3.2.1.1.5 Excavations within 5 ft. of and under paved surfaces shall be backfilled with Slurry Aggregate per the SWS to within 1.0 ft. of surface, followed by appropriate street restoration and not less than 3-inch of binder and 2-inch of wearing surface bituminous pavements.

3.2.1.1.6 In special circumstances, when approved in writing by the City Engineer and the Utility Manager, sanitary sewer service lines may be temporarily made inactive at the right-of-way or easement boundary. Sanitary sewer lines shall be plugged or capped to be made water tight at the property line. Sewer service lines not abandoned at the main shall meet the following conditions:

- *As part of the demolition permit, a certified check or Letter of Credit, in the amount of \$5,000 per lateral, shall be submitted to the City Engineer to guarantee the permanent abandonment of the service at the main is completed in a timely manner.*
- *Any service line that is not abandoned at the main shall be subject to separate “availability” or “ready to serve” charges in the interim period until properly abandoned.*
- *Sanitary lines made inactive in this manner shall be marked with a marker post placed 1 ft. from the end of the pipe and extending from the pipe to 3 ft. above the ground surface and painted a brilliant green color.*
- *The location of the terminal pipe locations shall be surveyed or otherwise “tied” to permanent objects that will remain undisturbed at the site, with an as-built drawing provided to the City Engineer and Utilities Department for record purposes.*

3.2.1.2 Sanitary Sewer

3.2.1.2.1 All sanitary lines shall be abandoned at the street main fitting by disconnecting and removing 2 - 3 ft. of pipe and installing a water-tight cap or plug at the main fitting and on the abandoned line.

- *For Poly Vinyl Chloride (PVC) gasketed fittings, a Spigot Plug shall be installed.*
- *A cured in-place plug will be allowed to abandon services deemed by the Utility to be 100% effective.*
- *For PVC solvent weld or glued joint fittings, a gasketed Cap shall be installed on an undisturbed and undamaged max. 1.0 ft. spool piece.*
- *For Concrete, Vitrified Clay, ABS/Truss, DIP or CIP (NOT soil pipe), a PVC Spigot Plug shall be installed using the appropriate Fernco coupling onto an undisturbed and undamaged max. 1.0 ft. spool piece.*
- *All Cast Iron Soil Pipe shall be removed and ONE of the above procedures used.*



- *If connection to the main is via a “break-in”, then an appropriate length of main shall be cut and removed, with an identical length of PVC SDR 35 or 28 installed using appropriate Fernco couplings.*
- *“Buffalo type” saddles are not acceptable for concrete and PVC pipe materials. Use of solvent weld or glued caps or plugs will not be acceptable.*

3.2.1.2.2 Sanitary or other special manholes or structures that are part of an abandoned system shall also be abandoned by removing the casting, chimney and cone or corbel sections, followed by plugging the outlet and inlet pipe(s) with non-shrink cementitious grout.

3.2.1.2.3 The manhole barrel shall be filled with crushed stone compacted to 95% minimum standard Proctor density.

3.2.1.2.4 The property owner shall be responsible for proper disposal of all manhole components removed. All waste materials shall be removed from pipelines and structures before abandonment.

3.3 INSPECTION

When starting an installation, the farthest downstream location of the new sanitary sewer system shall have a plug installed and maintained by the utility Contractor. That plug shall not be removed until the system has been accepted by the City Engineer and deemed operational by the City and/or the Utility Department.

3.3.1 SUBMITTALS AND SAMPLES

3.3.1.1 All materials of each type or use shall be from a single manufacturer. Contractor shall submit for approval six (6) sets of material specifications, certification and testing results by manufacturer on EACH material item required on the Project.

3.3.2 ACCEPTANCE TESTING

3.3.2.1 General

3.3.2.1.1 Deflection and Leakage tests in accordance with SWS and under supervision of the Engineering Project Inspector and the Wastewater Utility.

3.3.2.1.2 All sewer pipes shall be laid uniformly to line and grade. Noticeable variation from true alignment and grade will be considered to be sufficient cause for rejection of the work by the City. Care should be taken to insure that the entering pipe is forced tightly against the last pipe laid.



- 3.3.2.1.3 Sanitary main and lateral alignment shall be uniform in line and grade as measured from the inlet to the outlet of the pipe section. Vertical misalignment of greater than $\frac{3}{4}$ " in a single pipe section or a sag in the pipe grade extending for more (longer) than one-and-one-half (1.5) sections of pipe shall be cause for rejection. Any correction by the Contractor shall be at no cost to the City or Utility.
- 3.3.2.1.4 Two (2) business days notice is required to be given to the City's Inspector and the Wastewater Utility.
- 3.3.2.1.5 All water that is used for construction purposes will be charged at the current rates for such use. A PERMIT IS REQUIRED FROM THE WATER UTILITY PRIOR TO ANY WATER USE.

3.3.2.2 Tests

- 3.3.2.2.1 Deflection testing for flexible mains shall be at the 95% of specified minimum I.D.
- 3.3.2.2.2 Leakage testing shall include all installed system components, such as mains, branches, laterals, risers and taps to the terminus of lines installed. For each foot that the test section is below ground water level, the test pressure shall be increased by 0.43 PSI for each foot that the average ground water height for the test section is above the spring line. In absence of recorded data on ground water table above pipe invert, it shall be assumed to begin at six (6) feet below finished manhole grade. Therefore, the minimum increase in test pressure shall be 6.6 psi and the maximum test pressure shall be 10.0 psi.

- 3.3.2.2.3 Sanitary Manholes shall be vacuum tested for leakage in accordance with standard test methods outlined in ASTM C-1244-93 or current edition, and minimum test time periods of:

42" & 48" dia. manholes	60 sec.
60" dia. manholes	75 sec.
72" dia. & greater manholes	90 sec.

- 3.3.2.2.4 Interior manhole walls to be vacuum tested shall be dry. As required by MMSD, sanitary manholes shall be vacuum tested from the lid down to the invert. If a vacuum test fails, all remedial sealing is to be done on the exterior of the manhole prior to re-testing following proper curing time. Manholes receiving repairs shall be vacuum tested again after repairs are completed.
- 3.3.2.2.5 As an alternative, sanitary manholes may be vacuum tested from the top of the cone to the invert provided that the frame/cone internal seal and extension, if installed, are water tested during installation as required by MMSD. Reports summarizing the vacuum testing shall be submitted to the Utility Department.



- 3.3.2.2.6 Follow hydrostatic testing procedures outlined in SWS, Section 4.15, at 100 psi and no leakage.
- 3.3.2.2.7 Testing of both internal and external seals must be with a gallon of dyed water behind the seal for a period of 1 minute without any leakage through the bottom clamp.
- 3.3.2.2.8 Prior to pre-punch list work, tracer wires shall be tested by Contractor prior to City accepting the work. The Utilities Department has the option to spot check the continuity of the tracer wires.
- 3.3.2.2.9 As part of the pre-punch list work, Contractor shall be required to clean newly installed sewer mains and have a closed circuit television (CCTV) inspection of all sanitary sewer mains at no cost to the City or Utility Department. Contractor shall also be required to clean sewer mains and have a closed circuit television (CCTV) inspection of any sewer main at new lateral connections or abandonment.

3.3.3 CLEANING

3.3.3.1 Cleaning Precautions

- *During the cleaning process, all efforts shall be made to keep foreign materials and water from adjoining sewer systems.*
- *Contractor shall clean all sanitary sewer line sections between manholes using high-velocity jet, or mechanically powered equipment. All dirt, sand, rocks, and other solid or semi-solid material resulting from the construction of the system shall be removed before acceptance.*

3.3.3.2 Contractor shall be required to repair all visible damage and leaks in the mains.

3.3.3.3 This procedure is in addition to any testing required by SWS and/or MMSD.

3.3.3.4 Acceptance of sewer line cleaning and construction will be made upon the successful completion of the CCTV inspection and to the satisfaction of the Utility Department. If the CCTV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory.

3.3.3.5 During Manhole Rehabilitation Projects:

- *Verify the cleanliness of all manholes that were adjusted as part of the Contract including cleaning of the steps. Advise the contracted inspector of any questionable manholes where cleanliness may be in question. Contractor shall be responsible for bringing this information to the attention of the Utilities Department contact identified at the Pre-Construction Meeting.*



- *All sanitary sewers shall be left in a completely cleaned condition after manhole rehabilitation has been completed. All mortar, construction debris and asphalt shall be removed from lid slots, between the manhole lid and frame, as well as on the manhole walls and bench to the sewer flow line. All flow lines must be cleaned, allowing flow without obstructions. If Utilities Department personnel have to remove any debris that is left in structures and/or sewer lines after the manhole adjustments have been completed, time and equipment costs will be billed to the Prime Contractor.*

3.3.4 CCTV

- 3.3.4.1 Contractor has the option to contract directly with the Utility Department for performing CCTV inspection. A copy of the CCTV video and report shall be provided to the Utility Department.
- 3.3.4.2 Color videotape recordings of the data shall be made by the Contractor. Copies of each videotape, in USB digital format (USB flashdrives) or approved media, shall be provided to the Utility Department. PipeTech Compatible P.A.C.P. codes are required.
- 3.3.4.3 A set of system map Plan Sheets shall be included with all CCTV report books.
- 3.3.4.4 Videotape recording playback shall be at the same speed that it was recorded. Slow motion or stop motion playback features may be supplied at the option of the Contractor. Title to the tape will remain with the Contractor. Contractor shall have all necessary playback equipment readily accessible for review by the Utilities Department during the project. Cost of making DVD or CD-ROM copy sets shall be paid by the Contractor.
- 3.3.4.5 Video Recorded data shall follow NASSCO PACP Guidelines.

3.3.4.6 Record Keeping Standards

3.3.4.6.1 General:

- 3.3.4.6.1.1 *The primary objective of the CCTV phase of the project is to compile accurate information as to the general and specific conditions of the sewer pipe being inspected from a structural, maintenance and physical dimension perspective. Accordingly, the most important tool in assessing the condition of the sewer pipe is via a uniform and accepted consistent standardized mode of categorizing, designating and quantifying the observations.*
- 3.3.4.6.1.2 *All CCTV Operators shall be trained and certified via NASSCO in the Pipeline Assessment and Certification Program (PACP) to provide standardization and consistency in the proper and accurate interpretation of observations for defects and other conditions, and the categorizing, designating and quantifying and recording their observations.*



3.3.4.6.2 Documentation of the CCTV Results

- *Television inspections may be documented through the use of in-house or in-vehicle computer system that incorporates Pipeline Assessment and Certification Program (PACP) standard data format. This system must be Windows compatible on DVD, CD-ROM, or USB flash-drives.*
- *All defects and general information on the pipe being viewed along with a detailed index for retrieving the information shall be supplied to the Utility Department as part of the final report.*
- *One set each of DVD, CD-ROM, or USB flash-drives shall be delivered to the Utility Department.*
- *This media material shall become property of the New Berlin Utility.*
- *Television inspection logs shall be typed or computer printed and shall be acceptable to the Utility Department.*
- *Printed location reports shall clearly show the location, in relation to the adjoining manholes, of each source of infiltration discovered.*
- *Other data of significance including location of building and house service connections and other discernible features shall be recorded.*
- *A voice recording on DVD, CD-ROM, or USB flash-drive shall make brief and informative comments on the sewer conditions.*



TABLE OF CONTENTS

4	STORM SYSTEM	2
4.1	SPECIFICATIONS	2
4.1.1	STORM SEWER PIPE.....	2
4.1.2	STORM LATERALS (From main to lot line)	3
4.1.3	CULVERTS	4
4.1.4	MASONRY ENDWALLS	5
4.1.5	FLARED END SECTIONS	5
4.1.6	DITCHES.....	6
4.1.7	STORM MANHOLE & JUNCTION CHAMBERS	7
4.1.8	CATCH BASINS	7
4.1.9	FIELD INLETS	9
4.1.10	ROAD UNDERDRAINS	9
4.1.11	BEHIND CURB COLLECTORS	10
4.1.12	FRAMES, GRATES AND LIDS.....	11
4.1.13	FRAME ADJUSTMENTS.....	11
4.1.14	SUMP PUMPS, DOWN SPOUTS, AND ROOF DRAINS	12
4.1.15	BEDDING/COVER/BACKFILL	12
4.1.16	PIPE TO MANHOLE CONNECTIONS.....	13
4.2	INSPECTION.....	14
4.2.1	SUMBITTALS AND SAMPLES	14
4.2.2	ACCEPTANCE TESTING.....	14



4 STORM SYSTEM

4.1 SPECIFICATIONS

All labor and material provided under this contract shall be governed by the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS) and State of Wisconsin Department of Transportation Standard Specifications for Road and Bridge Construction, unless otherwise specified in these Specifications, whichever is more restrictive. A full-time inspector is required to be at the project site to observe pipe unloading, inspect construction materials, and observe and document the construction of storm sewers and laterals. THESE STANDARDS SHALL APPLY TO ALL PUBLIC STORM SEWERS. Any and all modifications to these Specifications must be approved by the City Engineer.

Design shall follow SWS Specifications, Milwaukee Metropolitan Sewerage District (MMSD) Rules, City of New Berlin Municipal Code 275-55.1 and be designed in accordance with the Rational Method or TR-55 Method. For private property in new development, if Department of Commerce procedures are used, the designer shall verify that off-site flows meet all of the requirements of the Rational Method or TR-55 Method. Design shall also conform to the following:

4.1.1 STORM SEWER PIPE

4.1.1.1 MATERIALS

- 4.1.1.1.1 All storm sewers shall be constructed with a minimum Class III reinforced concrete pipe per SWS, Section 8.6.0 or as approved by City Engineer
- *Reinforced Concrete Pipe – ASTM C76*
 - *Horizontal Elliptical Reinforced Concrete Pipe – ASTM C507.*
 - *Joints for concrete storm sewer pipe shall have rubber gaskets conforming to SWS, Section 8.41.2.*

4.1.1.2 DESIGN STANDARDS

- 4.1.1.2.1 Minimum size: 12”
- 4.1.1.2.2 Location:
- *In streets and easements: 10 feet west or south of the sanitary sewer.*
- 4.1.1.2.3 Pipe cover:
- *3 feet minimum from finish design grade to outside top of storm sewer.*
- 4.1.1.2.4 Storm sewers with diameters greater than 24” equivalent, daylighting in ditches shall have safety grates, meeting design standards, installed at the upstream and downstream ends.



- 4.1.1.2.5 Mainline and conveyance storm sewer design storm: 25-yr.; Storm sewers may not be surcharged in a 25-yr. or less design storm condition. Surge condition is defined as to the crown of pipe (full pipe flow - no pressure).
- 4.1.1.2.6 Minimum slope shall be 0.2% and achieve minimum velocity = 2.0 feet per second when pipe is flowing half-full or full. City Engineer may waive the 0.2% minimum slope for runs of pipe longer than 400 feet. City Engineer may limit maximum velocities.
- 4.1.1.2.7 Complete sewer design calculations are required with submittals, including Drainage Areas Map.
- 4.1.1.2.8 Storm sewer shall be required in public Rights-of-Way in new developments where the depth of proposed ditches exceed 3 feet as measured from the edge of pavement.

4.1.2 STORM LATERALS (From main to lot line)

4.1.2.1 MATERIALS

- 4.1.2.1.1 Unless otherwise specified, All pipe used for storm laterals shall be:
- *Class III concrete sewer pipe; or*
 - *PVC (SDR 26) pipe*

4.1.2.2 DESIGN STANDARDS

- 4.1.2.2.1 Minimum size in ROW/easement areas shall be 6" diameter.
- 4.1.2.2.2 The minimum slope on laterals shall be 1/8" per foot.
- 4.1.2.2.3 The maximum slope on laterals shall be 1/2" per foot.
- 4.1.2.2.4 Minimum cover for storm sewer laterals in paved areas shall be 12" as measured from the top of the pipe to the top of the subgrade.
- 4.1.2.2.5 A clay dam across the trench shall be constructed adjacent to pavement low points with all storm sewer laterals.
- 4.1.2.2.6 Connection of laterals to storm sewer shall be subject to following:
- *Location of invert of new lateral may be permitted a maximum of 12" above spring line of outlet sewer, or use outside drop inlet per SWS for main sewers.*
 - *Hole - Core drill only. Deliver "cut-out" to the Construction Inspector.*
 - *Connection Device - Kor-N-Seal boot, or pre-approved equal with stainless steel snap-in ring.*



- *Any lateral that is connected into a manhole shall have a smooth concrete bench/channel placed to convey lateral flow into the storm sewer.*

- 4.1.2.2.7 Storm sewer lateral lines shall be designed to receive the storm water runoff from window wells, footing drains and sump pumps.
- 4.1.2.2.8 In areas with storm sewer, a storm sewer lateral shall be provided for each lot or building. The City Engineer may waive this requirement for lots that are adjacent to and drain to adjacent public drainage easements, wetlands or waters of the State.
- 4.1.2.2.9 Sump discharges for all buildings shall be located at the front of building (facing street). City Engineer may waive this requirement for lots that are adjacent to and drain directly to public drainage easements, wetlands or waters of the State.
- 4.1.2.2.10 Storm laterals shall be located to the right of sanitary sewer lateral when looking from the street.
- 4.1.2.2.11 Covers installed on lateral cleanouts shall not be bolted to the cleanout pipe.

4.1.3 CULVERTS

4.1.3.1 MATERIALS

- 4.1.3.1.1 Culverts shall be manufactured and installed in accordance with the requirements of the Standard Specifications for Highway and Bridge Construction in Wisconsin.
- 4.1.3.1.2 Damaged or rusted culvert pipes shall not be reused.

4.1.3.2 DESIGN STANDARDS

- 4.1.3.2.1 Culverts located in a Primary Storm Water Management System (PSMS) shall provide at least the 100-year level of protection for capacity and road overtopping.
- 4.1.3.2.2 Culverts located in a minor storm water management system shall be designed to safely convey surface water runoff from a 10-year storm event. Culverts may not be surcharged in a 10-year or less design storm condition. Surcharge condition is defined as to the crown of pipe (full pipe flow – no pressure).
- 4.1.3.2.3 Minimum size shall be 12” diameter for driveways and 15” for roadway cross culverts.
- 4.1.3.2.4 Minimum culvert lengths:

<i>< 24” diameter</i>	<i>20 feet</i>
<i>24” – 30” diameter</i>	<i>22 feet</i>
<i>36” – 42” diameter</i>	<i>24 feet</i>
<i>48” and larger diameters</i>	<i>26 feet</i>



- 4.1.3.2.5 Culverts less than 24 feet in length shall consist of one piece of pipe.
- 4.1.3.2.6 All crossroad culverts shall be designed to provide a minimum of 12" of cover to the top of the pipe at the edge of the finished pavement of the road.
- 4.1.3.2.7 See Masonry Endwalls Section 4.1.4 or Flared End Sections Section 4.1.5 of these specifications for end treatment specifications.

4.1.4 MASONRY ENDWALLS

4.1.4.1 MATERIALS

- 4.1.4.1.1 Endwalls shall be:
 - *poured or pre-cast concrete; or*
 - *mortared stone; or*
 - *Other masonry material as approved by the City Engineer.*
- 4.1.4.1.2 Endwalls shall be manufactured and installed in accordance with the requirements of the Standard Specifications for Highway and Bridge Construction in Wisconsin.

4.1.4.2 DESIGN STANDARDS

- 4.1.4.2.1 In areas with less than 35 miles per hour posted speed limit, masonry endwalls shall be required to be installed on the ends of driveway culverts.
- 4.1.4.2.2 Endwalls shall be extended through the entire cross section of the ditch to prevent water infiltrating around the culvert.

4.1.5 FLARED END SECTIONS

4.1.5.1 MATERIALS

- 4.1.5.1.1 The end sections shall be manufactured and installed in accordance with the requirements of the WisDOT Standard Specifications, Section 521 or Section 522 as applicable.

4.1.5.2 DESIGN STANDARDS

- 4.1.5.2.1 In areas with greater than 35 miles per hour, flared end sections shall be required to be installed on the ends of driveway culvert.



4.1.6 DITCHES

4.1.6.1 DESIGN STANDARDS

4.1.6.1.1 Slopes.

4.1.6.1.1.1 Grassed Invert

- *1½% minimum*
- *4% maximum*

4.1.6.1.1.2 Concrete Invert:

- *Greater than 4% or less than 1½%.*
- *10 % maximum, 0.7% minimum.*
- *Invert shall be placed on a minimum of 3" of crushed aggregate base course.*
- *Place sod within the initial 1½ feet of ditch side slopes adjacent to the concrete invert.*
- *2-ft. minimum width, v-bottom*
- *V-bottom formed by 4H:1V sloped top surface*
- *Minimum concrete thickness: 6"*

4.1.6.1.1.3 *Alternative methods may be used after approval of the City Engineer is obtained.*

4.1.6.1.2 Foreslope: 4H:1V maximum.

4.1.6.1.3 Backslope: 4H:1V maximum.

4.1.6.1.4 The minimum ditch depth shall be 12" below the shoulder point at roadway high points. Other ditch locations shall have a minimum depth of 20" below the shoulder point and be graded to accommodate a properly sized driveway culvert.

4.1.6.1.5 Adopt and administer the WDNR Technical Standards 1053, 1058, and 1059 for erosion control. All roadside ditches shall be covered with a minimum of 4" of topsoil, and either seeded, fertilized and matted or sodded. Sod placement shall be required on longitudinal slopes greater than 4%.

4.1.6.1.6 If the back slope of a ditch extends beyond the right-of-way, drainage easements shall be required adjacent to the street right-of-way at a uniform distance from the road centerline, as approved by the City Engineer.

4.1.6.1.7 Turf reinforcement may be used as a substitute for concrete invert in ditches with slopes between 4% - 5%. City Engineer must pre-approve turf reinforcement type.



4.1.7 STORM MANHOLE & JUNCTION CHAMBERS

4.1.7.1 MATERIALS

4.1.7.1.1 All storm manholes shall be pre-cast concrete with integral base, with pre-cast flattops (slab or deck) with an opening for the casting.

4.1.7.1.2 The manholes shall be sized as follows:

Downstream Pipe O.D.*	Minimum Manhole I.D.
27" or less	42"
28" – 30"	48"
31" – 36"	60"
37" – 42"	72"
> 42"	Special Design Requiring City Engineer Approval
*O.D. is the largest horizontal outside pipe dimension	

4.1.7.1.3 Where field conditions allow, the manhole shall be constructed with an offset cone.

4.1.7.1.4 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout® by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or "plastic" consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively. Dry stacking of riser rings or flat decks shall not be permitted. They shall be laid in a bed of grout as described above.

4.1.7.1.5 Steps meeting the requirements of SWS, Section 6.40.1 shall be installed in all manholes or junction chambers deeper than 4', from floor to rim.

4.1.7.1.6 Drop pipes or other energy-dissipating structures shall be provided for all sewers entering a manhole with their invert at an elevation more than 24" above the invert of the sewer leaving the manhole.

4.1.8 CATCH BASINS

4.1.8.1 MATERIALS

4.1.8.1.1 Shall consist of masonry, pre-cast or monolithic construction in accordance with Chapter 3.6.1 and File No. 25 or 26 of SWS. All catch basins shall be designed and constructed to allow easy access for maintenance and cleaning.

4.1.8.1.2 Steps meeting the requirements of SWS shall be installed in all catch basins deeper than 4', from floor to rim.



4.1.8.1.3 Size (minimum).

- *Rectangular 24" x 36" (Internal Dimensions).*
- *Round 48" ID.*
- *Manhole inlets - Allowed only in cases where an angle point in the storm sewer occurs under the curb line. (These shall be avoided whenever possible.)*

4.1.8.1.4 A continuous 4" diameter perforated, corrugated polyethylene drain pipe, meeting the requirements of AASHTO Designation: M-252, shall be installed under the curb and gutters and extend 50 feet in either direction from storm water catch basins located at low points. For catch basins in other locations, the 50-ft length of drainage pipe shall be connected only to the upstream side.

4.1.8.1.5 Where underdrain pipe is specified, a 4" diameter hole shall be cored in opposite sides of each catch basin located at low points to allow the connection of 4" diameter perforated, corrugated polyethylene underdrain pipe. Catch basins located in other locations shall have a 4" diameter hole cored in the upstream side to allow the connection of 4" diameter underdrain pipe. The holes must be cored at an elevation that is below the subgrade elevation to allow for positive drainage and proper placement of the underdrain.

4.1.8.1.6 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout bed with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout® by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or "plastic" consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively.

4.1.8.2 DESIGN STANDARDS

4.1.8.2.1 Inlet capacity design storm: 25-yr. storm event. In a 25-yr. storm event, the maximum spread of ponded storm water shall be 8 feet as measured from the face of curb.

4.1.8.2.2 Inlet capacity design storm: 50-yr. storm event for areas with no overland flow relief. In roadways, storm water ponding shall not exceed 6" on paved parking areas and 4" at the centerline in a 100-yr. storm event.

4.1.8.2.3 At low points, curb pan shall be pitched a ½ inch five feet on both sides of catch basins.



4.1.8.2.4 Where only front yard drainage flows to the curb, maximum separation or run to a catch basin is 300 feet unless in the opinion of the City Engineer a lesser distance is required. Where the collective drainage from more than one lot discharges over the curb at a single point, a catch basin shall be required at the lot line extended

4.1.9 FIELD INLETS

4.1.9.1 MATERIALS

- 4.1.9.1.1 Shall consist of masonry, pre-cast or monolithic construction in accordance with Chapter 3.6.3 and File No. 28 or 29 of SWS.
- 4.1.9.1.2 Inlets shall be designed and constructed to allow easy access for maintenance and cleaning.
- 4.1.9.1.3 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a cementitious grout bed with a struck joint. Grout shall be premixed, non-metallic, high-strength, non-shrink, Pennegrout® by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621. When mixed to a mortar or “plastic” consistency, the grout shall have a minimum 1-day and 28-day compressive strength of 6,000 and 9,000 psi, respectively.

4.1.9.2 DESIGN STANDARDS

- 4.1.9.2.1 Inlet capacity design storm: 25-yr. storm event. In a 25-yr. storm event, the maximum spread of ponded storm water shall be 8 feet as measured from the face of curb.
- 4.1.9.2.2 Inlet capacity design storm: 50-yr. storm event for areas with no overland flow relief. In roadways, storm water ponding shall not exceed 6” on paved parking areas and 4” at the centerline in a 100-yr. storm event.

4.1.10 ROAD UNDERDRAINS

4.1.10.1 MATERIALS

- 4.1.10.1.1 Underdrain systems shall be installed under curb and gutters to collect water and convey it to catch basins.
- 4.1.10.1.2 The underdrain system shall be constructed with:
- *4” diameter perforated, corrugated polyethylene drainage pipe meeting the requirements of AASHTO Designation: M-252.*
 - *Pipe perforations may be holes or slots and may be in 3 or 4 lines spaced around the circumference of the pipe at 120° or 90° respectively.*



4.1.10.1.3 The trench shall be backfilled with open graded $\frac{3}{4}$ " crushed stone.

4.1.10.1.4 Geotextile fabric, as specified in Section 612.2.8 of the Standard Specifications, shall be used to line the underdrain trench before the drainage pipe is installed and backfilled. Enough fabric must be provided as to cover the sides and bottom of the trench and overlap across the top of the trench by a minimum of 4 inches.

4.1.10.2 DESIGN STANDARDS

4.1.10.2.1 The 4" drainage pipe shall be laid in an 8" deep by 8" wide trench with flat bottom with square sides as shown in the Figure 7 of the Details. The trench, constructed at an elevation lower than the base course, shall extend 50 feet in either direction from a storm water catch basin located at the low point of the road, aligned with the proposed centerline of the flange of the curb and gutter. For catch basins in other locations, the 50' drainage pipe shall be connected only to the upstream side.

4.1.10.2.2 The drainage pipe shall be connected to catch basins in cored holes and grouted in-place in the cored holes. The end of drainage pipe opposite the catch basin shall be capped with a cap suitable for installing on the drainage pipe.

4.1.11 BEHIND CURB COLLECTORS

4.1.11.1 MATERIALS

4.1.11.1.1 All behind the curb collector systems shall be constructed with minimum 6" diameter PVC (SDR 35) pipe.

4.1.11.1.2 The clean out shall consist of a standard pre-cast 24" x 36" box inlet with a Neenah R-1878-B7L frame and lid as shown in Figure 15 of the Details.

4.1.11.2 DESIGN STANDARDS

4.1.11.2.1 Connected to sump pump drainage lines in lieu of storm sewer.

- *36" from flow line to surface.*
- *1 % minimum grade.*
- *300-ft. maximum run to outlet.*
- *Maximum run of 250 feet in curvilinear street.*
- *Maximum of 4 lots contributing area.*

4.1.11.2.2 Behind the curb collector systems shall be installed 2' behind the curb at cul-de-sacs and hill crests where storm sewers are not located.

4.1.11.2.3 The collector pipe shall be connected to the nearest catch basin.

4.1.11.2.4 A clean out shall be installed at the upstream end of the collector system.



4.1.11.2.5 Sump lines for lots not served by the storm sewer shall be connected to the PVC collector pipe by a wye or tee fitting.

4.1.11.2.6 Tracer wire installation is required on all behind the curb collector pipe.

4.1.12 FRAMES, GRATES AND LIDS

4.1.12.1 MATERIALS

4.1.12.1.1 Vertical curb catch basin frames and grates shall be Neenah R-3228-BD, or equal as pre-approved by the City Engineer.

4.1.12.1.2 Mountable curb catch basin frames and grates shall be Neenah R-3501-R, or equal as pre-approved by the City Engineer. (Add a flat frame and grate for driveway curb head reductions)

4.1.12.1.3 Field inlet frames and grates shall be Neenah R-3210-A, or equal as pre-approved by the City Engineer. A Neenah R-2560-E1 or R-2561 series beehive grate shall be used where required by the City.

4.1.12.1.4 Manhole frames and grates in field inlet applications shall be Neenah R-2577-1, or equal as pre-approved by the City Engineer.

4.1.12.1.5 Manhole frames and lids in pavement applications shall be Neenah R-1661, or equal as pre-approved by the City Engineer. Covers shall have machined bearing surface and will be permitted to have eight (8) vent holes.

4.1.12.1.6 A pipe grate with maximum opening size of 6" shall be installed on storm sewer inlets 18" or larger. Grate shall be hot-dipped galvanized after fabrication or be constructed of corrosion resistant material approved by City Engineer.

4.1.13 FRAME ADJUSTMENTS

4.1.13.1 MATERIALS

4.1.13.1.1 All frame/casting adjusting rings for manholes, catch basins and inlets shall be:

- *Reinforced concrete rings having 26-inch I.D., or*
- *Pro-Ring™ by Cretex, or*
- *approved equal*

4.1.13.1.2 The minimum for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. The maximum height of adjusting rings above the cone or slab top is 16 inches as measured from the top of cone or slab top. If more than 16 inches of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole.



4.1.13.1.3 The minimum thickness of individual pre-cast concrete adjusting rings shall be a nominal 2". The maximum thickness shall be a nominal 4".

4.1.14 SUMP PUMPS, DOWN SPOUTS, AND ROOF DRAINS

4.1.14.1 DESIGN STANDARDS

4.1.14.1.1 Sump pumps shall be connected to a storm sewer system if one exists adjacent to the lot.

4.1.14.1.2 Down spouts and roof drains, if not buried, may be connected to a storm sewer or behind the curb collector pipe. If buried, they shall be connected to the storm sewer or behind the curb collector pipe.

4.1.14.1.3 If storm sewer is not provided or if a rural roadway section exists, then sump pumps shall be installed to receive and discharge ground water from footing drains.

4.1.14.1.4 Sump pumps, down spouts and roof drains shall discharge on the ground to the front of the lot so that:

- *Adjoining properties are not adversely affected.*
- *If no drainage easement exists along a side or rear lot line, the discharge point within the site, shall be at least 10' from the lot line.*
- *If a public open drainage easement exists adjacent to any lot, the discharge point for down spouts and/or roof drains may be discharged directly into the easement.*

4.1.15 BEDDING/COVER/BACKFILL

4.1.15.1 MATERIALS

4.1.15.1.1 Pipe Bedding/Cover: In accordance with SWS as follows -

- *Flexible wall pipe shall be Class "B" up to 12" above the top of pipe; 3/8" limestone chips.*
- *Rigid wall pipe with diameters equal to or less than 21" shall have 3/8" limestone chips up to 6" above the top of pipe.*
- *Rigid wall pipe with diameters greater than 21" shall have 3/4" limestone chips up to 6" above the top of pipe.*

4.1.15.1.2 Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

4.1.15.1.3 Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted.



4.1.15.1.4 Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3-inches shall be permitted. In areas where excavated material(s) are determined to be not acceptable, in the judgement of the City Engineer, then imported backfill material meeting the requirements of SWS will be required.

4.1.15.1.5 Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8 and requirements of the City Engineer, or in accordance with street opening permit, when issued. In special cases, the City Engineer may direct the use of Sand Slurry consisting of 50 pounds of fly ash and a ½ bag of Portland cement per cubic yard of mix.

4.1.15.2 DESIGN STANDARDS

4.1.15.2.1 Backfill in accordance with all street opening permit(s), generally this will be aggregate slurry. All areas greater than 5 ft from a paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

4.1.15.3 INSTALLATION

4.1.15.3.1 Care shall be taken by the Contractor when backfilling to prevent any movement of the pipe from proper alignment and grade. Contractor is responsible for determining that the finished sewer remains at the required elevation and grade.

4.1.15.3.2 Mechanically compact all trench backfill per SWS, Section 2.614(b). The initial lift to be compacted shall have a 2' loose thickness. Each subsequent lift to be compacted shall have a maximum 18" loose thickness. Contractor shall place thinner lifts if the required compaction cannot be achieved.

4.1.16 PIPE TO MANHOLE CONNECTIONS

4.1.16.1 MATERIALS

4.1.16.1.1 In accordance with SWS, Section 3.5.7, except as modified below:

4.1.16.1.1.1 *Amend the last sentence of Section 3.5.7(a) by adding the following:*

- *“using boots or cast-in-place cementitious material.”*

4.1.16.1.1.2 *Delete the last paragraph of Section 3.5.7 (c) & replace with:*

- *“To maintain seal flexibility, the annular space between the pipe and manhole wall shall be plugged with flexible butyl rubber gasket material prior to pouring the manhole invert and bench in accordance with SWS, Section 6.41.6. When connecting pipe to existing pre-cast concrete manholes, core hole in manhole wall prior to installing pipe to manhole seal.”*



4.2 INSPECTION

4.2.1 SUBMITTALS AND SAMPLES

4.2.1.1 All materials and installations shall conform to SWS and are subject to the City Engineer's approval. All materials of each type or use shall be from a single manufacturer. Contractor shall submit for approval six (6) sets of material specifications, certification and testing results by manufacturer on EACH material item required on the Project.

4.2.2 ACCEPTANCE TESTING

4.2.2.1 General

4.2.2.1.1 Installation shall be in accordance with SWS, and these specifications.

4.2.2.1.2 All storm sewer pipe shall be laid uniformly to line and grade. Noticeable variation from true alignment and grade will be considered, by the City, sufficient cause for rejection of the work. Care should be taken to insure that the entering pipe is forced tightly against the last pipe laid.

4.2.2.1.3 Storm sewer, storm sewer inlets, storm sewer catch basins, and lateral alignment shall be uniform in line and grade as measured from the inlet to the outlet of the pipe section. Vertical misalignment of greater than $\frac{3}{4}$ " in a single pipe section or a crest in the pipe grade extending for more (longer) than one-and-one-half (1-1/2) sections of pipe shall be cause for rejection and correction by the Contractor at no cost to the City.

4.2.2.1.4 Manhole barrel joint(s) gasket material ("E-Z-Stik") shall be placed on the vertical slope of each joint and shall be of the size necessary to fill the annular space of the joint. Lifting holes shall be grouted with Pennegrout and struck smooth on the interior and exterior surfaces. Chimney joints shall be grouted with Pennegrout. The grout shall extend the full width of each grade ring and each joint shall be struck-off vertically, even with the inside and outside chimney surfaces.

4.2.2.1.5 Rim elevations for manholes located in paved areas shall be set $\frac{3}{8}$ " – $\frac{1}{2}$ " below the asphalt binder grade elevation. Ramping of manholes will not be allowed.

4.2.2.1.6 Final adjustments to raise rim elevations to $\frac{1}{2}$ " below the grades shown on the final paving plans shall be made by installing adjusting rings as needed just prior to placement of the final lift of the pavement (surface course).



- 4.2.2.1.7 Catch basins shall be initially constructed to approximate $\frac{3}{4}$ " below binder grade prior to the curb and gutter construction. When curb and gutter is constructed, the concrete curb and gutter shall be stopped 5 feet on either side of the inlet. At intersections, catch basins are to be constructed 5 feet from the end of radii (to side of inlet). Temporary curb and gutter in the 5-foot gap on either side of the inlet shall be constructed with asphalt transitioning from the final grades of the concrete curb and gutter to the grade of the grate set at binder grade.
- 4.2.2.1.8 At the time of placement of the final surface course of pavement, the temporary asphaltic curb and gutter shall be removed and the inlet frame shall be set to final grade by adding one 2" adjusting ring and applying Type "M" mortar per SWS, Section 6.37.1. The concrete curb and gutter shall be completed. No wood shims shall be left in place. With this method, tuck pointing beneath the frame should not be required.
- 4.2.2.1.9 Any catch basin out of horizontal alignment by more than 2 inches shall be reconstructed to match the curb and gutter.
- 4.2.2.1.10 Contractor shall furnish and place a temporary 2" x 6" stake at the end of each storm lateral.
- 4.2.2.1.11 Existing field tiles shall be connected to a storm sewer or have a positive outfall provided.
- 4.2.2.1.12 All storm sewers shall be free from debris, sedimentation, or garbage prior to City acceptance.
- 4.2.2.1.13 Downspout cleanouts and catch basins shall be inspected by the City prior to acceptance by the City.



TABLE OF CONTENTS

5	ROAD SYSTEM.....	2
5.1	GEOMETRICS.....	2
5.1.1	RIGHT-OF-WAY WIDTHS	2
5.1.2	PAVEMENT WIDTHS.....	2
5.1.3	BOULEVARD SECTIONS.....	2
5.1.4	CUL-DE-SACS	3
5.1.5	CLOSE/LOOP STREET.....	3
5.1.6	STREET GRADES.....	3
5.1.7	CROSS SLOPE	4
5.1.8	HORIZONTAL CURVES.....	4
5.1.9	VERTICAL CURVES	4
5.1.10	SIGHT DISTANCE.....	4
5.1.11	CORNER RADII.....	4
5.1.12	ACCELERATION/DECELERATIONS/BYPASS LANES	4
5.1.13	TRANSITIONS.....	5
5.2	SPECIFICATIONS.....	5
5.2.1	SUBGRADE	5
5.2.2	GEOTEXTILE FABRIC	6
5.2.3	BASE COURSE.....	6
5.2.4	FROST BARRIER.....	7
5.2.5	SHOULDERS	7
5.2.6	ASPHALT PAVEMENT.....	7
5.2.7	CONCRETE PAVEMENT	9
5.2.8	ADMIXTURES	11
5.2.9	CURB AND GUTTER	11
5.2.10	ROAD UNDERDRAIN PIPE.....	13
5.2.11	DRIVEWAYS	13
5.2.12	PARKING LOTS	15
5.2.13	SIDEPATHS AND TRAILS.....	16
5.3	INSPECTION.....	17
5.3.1	ACCEPTANCE TESTING.....	17



5 ROAD SYSTEM

Follow AASHTO guidelines unless otherwise noted. Street designs shall be consistent with the City's adopted Comprehensive Plan. All local roadways shall be posted at 25 mph and have a design speed of 30 mph. Private roads must be designed in accordance with public road standards, even in PUD's.

5.1 GEOMETRICS

5.1.1 RIGHT-OF-WAY WIDTHS

Type	Minimum ROW Width (feet)
Local Street	66
Local Street (R-6 Zoning District)	60*
Manufacturing and Industrial	80
Collectors and arterials	Per adopted County Highway Width Map and/or Official City Map.

Note: Zoning Code Section 275-33D(18) was added during the 1/12/2016 Zoning Code amendment.

* Per Zoning Code Section 275-33 D (18), *in the R-6 District, the Plan Commission and Common Council may approve sixty (60) foot right-of-way widths where determined acceptable by DCD.*

5.1.2 PAVEMENT WIDTHS

5.1.2.1 Pavement widths are measured from edge of pavement to edge of pavement.

standard <u>urban</u> residential section using curb and gutter	24 feet
standard <u>rural</u> residential section with open ditches	28 feet
standard <u>commercial or industrial</u> section	40 feet

5.1.3 BOULEVARD SECTIONS

5.1.3.1 Entrance

- *Minimum pavement width (flange to flange of curb and gutter) shall be 16 feet for a single lane.*
- *Minimum pavement width (flange to flange of curb and gutter) shall be 24 feet for a double lane.*

5.1.3.2 Exits

- *Minimum pavement width (flange to flange of curb and gutter) shall be 24 feet (double lane).*

5.1.3.3 Minimum median width shall be 8 feet back of curb to back of curb.

5.1.3.4 Median length shall be adequate for queuing, but generally shall not extend beyond the first side street.



5.1.4 CUL-DE-SACS

- 5.1.4.1 Local streets open at one end only shall end with a cul-de-sac.
- 5.1.4.2 No less than 3 parcels and no more than 15 parcels may be served by a cul-de-sac. Block length between intersections shall not exceed 1,500 feet nor be less than 500 feet. Block length is measured from the center line of the right-of-way to the center line of the right-of-way of the two cross streets.
- 5.1.4.3 Residential:
- *All pavement widths for a standard residential cul-de-sac shall have a minimum bulb radius of 42 feet as measured from the center of the cul-de-sac to the edge of pavement.*
 - *The minimum bulb radius for the Right-of-Way shall be 66 feet as measured from the center of the cul-de-sac.*
- 5.1.4.4 Commercial or Industrial:
- *All pavement widths for a standard commercial or industrial cul-de-sac shall have a 45-ft. radius measured from the center of the cul-de-sac to the edge of pavement.*
 - *The minimum radius for the Right-of-Way shall be 66 feet.*
- 5.1.4.5 Central planting islands are acceptable in the middle of the cul-de-sac.
- *Minimum pavement width (edge of pavement to edge of pavement for rural cross-section or flange to flange for curb and gutter) shall be 16 feet for a single lane.*
 - *Plantings should be installed outside of the 5' clear zone for snow plowing.*

5.1.5 CLOSE/LOOP STREET

- 5.1.5.1 The close or loop street, may be used in lieu of a short cul-de-sac, and shall be designed as two parallel lanes, 16-ft. wide lanes separated by a central planting strip or bio-retention area having a minimum width of 50 feet.
- 5.1.5.2 Maximum length for a close or loop street shall be 1,000 feet.

5.1.6 STREET GRADES

Type	Max Grade
Arterial	4 %
Collector	7 %
Local	10 %

- 5.1.6.1 Urban roadway sections shall have a minimum 0.7% centerline profile gradient.



5.1.7 CROSS SLOPE

5.1.7.1 All roadway sections (urban or rural) shall have a crown, with a cross slope of 3% from the pavement centerline to the edge of pavement.

5.1.8 HORIZONTAL CURVES

5.1.8.1 Minimum horizontal curve requirements, per AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.8.2 Compound Curves

5.1.8.2.1 Compound curves are only allowed on roads with a posted speed limit of 25 mph or less.

5.1.8.2.2 A minimum horizontal curve radius of 250 feet is required along the roadway centerline.

5.1.8.2.3 A horizontal curve radius of 200 feet may be accepted when a 100' long tangent length is provided between curves.

5.1.9 VERTICAL CURVES

5.1.9.1.1 Maintain "K" Values per AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.10 SIGHT DISTANCE

5.1.10.1 For minimum sight distance requirements at intersections and driveways, refer to AASHTO Geometric Design of Highways and Streets, Current Edition including all updates.

5.1.11 CORNER RADII

5.1.11.1 Internal to development for minor streets (measured from the edge of pavement/flange line):

- *Residential and multi-family: 25 feet*
- *Commercial and industrial: 42 feet*

5.1.11.2 Corner radii at intersections to external roadways, shall be as approved by the City Engineer.

5.1.12 ACCELERATION/DECELERATIONS/BYPASS LANES

5.1.12.1 Any roadway intersecting with a collector or arterial street projected to have more than 100 ADT shall require Acceleration/Decelerations/Bypass Lanes per Detail Figure No. 4.



5.1.13 TRANSITIONS

5.1.13.1 Transitions areas, such as lane additions, bypass lanes, traffic shifting lanes, and areas between existing pavement and new pavement sections with varying widths, shall be transitioned at a ratio of 15:1 (widen 1 foot in 15 feet).

5.2 SPECIFICATIONS

These standards shall apply to all public and private roadways. Any and all modifications to these Specifications must be approved by the City Engineer.

5.2.1 SUBGRADE

5.2.1.1 DESIGN STANDARDS

5.2.1.1.1 Soil borings to a minimum depth of 10 feet below finish grade shall be taken every 500 feet along the proposed centerline of the roadway. A site map showing the location of the borings along with laboratory soils classifications for each boring shall be submitted to the City Engineer.

5.2.1.1.1.1 *Should the geotechnical data submitted to the City not be sufficient to satisfy the City Engineer, the Developer shall grant the City with a right of entry to obtain the required data. Costs associated with obtaining the required data shall be at the Developer's sole expense.*

5.2.1.2 INSTALLATION

5.2.1.2.1 The subgrade must be proof rolled, checked for proper grade and approved by the City Engineer or designee before the geotextile fabric and crushed stone base is to be applied.

5.2.1.2.2 All earth fills under roadways shall be placed in 12" maximum lifts and a Proof Roll shall be approved by the City Inspector.

5.2.1.2.3 All soft spots located as a result of proof rolling with a fully loaded tri-axle truck approved by City Engineer or designee shall be undercut, and filled in a manner agreed upon by the Contractor and the City Engineer.

5.2.1.2.4 All repaired soft spots shall be re-proof rolled after subgrade elevation has been re-established. Process shall be repeated until the project passes proof roll.

5.2.1.2.5 In unstable soil conditions, undercutting in excess of 3' shall be backfilled with 3" TB or breaker run or other materials as approved in writing by the City Engineer.

5.2.1.2.5.1 *If open graded material is used, drainage at the bottom of the undercut is required by use of a French drain or perforated pipe bedded in crushed stone, where grades allow. In many situations, dense graded coarse TB shall be used to eliminate water that would be trapped if clear stone was used.*



5.2.1.2.6 In unstable soil conditions, additional subdrains may be required as directed by the City Inspector.

5.2.1.2.7 Method of drainage of the filled area shall be approved by the City Inspector.

5.2.1.2.8 Geotextile fabric shall be installed on all roadways. Type based on field conditions per WisDOT.

5.2.2 GEOTEXTILE FABRIC

5.2.2.1 MATERIAL

5.2.2.1.1 Geotextile fabric conforming to WisDOT Standard Specification, Section 645 shall be pre-approved by the City Engineer prior to installation for :

- *subgrade separation and stabilization (Type SAS)*
- *drainage filtration (Type DF)*
- *subgrade reinforcement (Type SR)*
- *under riprap (Types R & HR).*

5.2.2.2 INSTALLATION

5.2.2.2.1 Geotextile fabric shall be placed on the subgrade on all areas that will receive crushed aggregate base course material, unless a Clear Stone Frost Barrier is to be used. Geotextile fabric is not required where Clear Stone Frost Barrier is to be used.

5.2.2.2.2 Geotextile fabric shall have a minimum 24" overlap for longitudinal seams and minimum 36" overlap for transverse seams.

5.2.2.2.3 Subsequent open cuts of the pavement requiring excavations below the subgrade of roadways having geotextile fabric in place shall be backfilled with approved compacted granular fill up to original subgrade elevation. Pavement and base shall be removed a minimum 6" on each side of excavation or extent of damaged fabric to allow new geotextile repair fabric to be installed with a minimum 6" overlap on all sides.

5.2.3 BASE COURSE

5.2.3.1 MATERIALS

5.2.3.1.1 The crushed aggregate base course for the roadway shall consist of dense graded base conforming to WisDOT Standard Specification Section 305.2.2.1 for 1 ¼-inch.



5.2.3.2 INSTALLATION

- 5.2.3.2.1 The finished base course elevation shall be a minimum of:
- *8" above the approved subgrade for a local roadway,*
 - *14.5" above the approved subgrade for a commercial or industrial roadway*
- 5.2.3.2.2 The dense graded base shall be spread, shaped, compacted, and proof-rolled to produce a stabilized base which conforms to the required cross-sections.
- 5.2.3.2.3 Special compaction testing may be required dependent on site conditions in accordance with 301.3.4.3 of the WisDOT Standard Specifications.

5.2.4 FROST BARRIER

5.2.4.1 MATERIALS

- 5.2.4.1.1 The Frost Barrier shall be #3 Clear Stone with a minimum depth of 12" or as specified for a given project.

5.2.4.2 DESIGN STANDARDS

- 5.2.4.2.1 Where specified by the City, a layer of Clear Stone Frost Barrier shall be required to prevent or minimize future frost heave damage to the roads.

5.2.5 SHOULDERS

5.2.5.1 MATERIALS

- 5.2.5.1.1 The aggregate for shoulder shall consist of :
- *Crushed stone conforming to WisDOT Standard Specification Section 305.2.2.1 for ¾-inch dense graded base; or*
 - *Recycled asphalt as approved by the City Engineer.*

5.2.5.2 DESIGN STANDARDS

- 5.2.5.2.1 For rural cross sections, a 3-ft. wide shoulder shall be constructed along both edges of pavement.

5.2.6 ASPHALT PAVEMENT

5.2.6.1 MATERIALS

- 5.2.6.1.1 Asphalt pavement materials shall conform to the requirements of WisDOT Standard Specification Section 460. Asphaltic concrete shall be PG 58-28 or PG 64-22.



5.2.6.1.2 When a “Superpave” mix design is proposed to be used, the Contractor must submit the mix design and receive the approval of the City Engineer two weeks prior the preconstruction conference. The following applies:

	Binder			Surface		
	Mix Design	Aggregate	Thickness	Mix Design	Aggregate	Thickness
residential streets	E-3	19 mm	3” (one lift)	E-1	12.5 mm	2”
commercial and industrial	E-3	19 mm	4” (two lifts)	E-3	12.5 mm	2”

5.2.6.1.2.1 *Mix designs for all other classifications shall be as approved by the City Engineer.*

5.2.6.1.2.2 *Mix designs are anticipated to change in 2016. Follow the WisDOT mix design at that time.*

5.2.6.2 **INSTALLATION**

5.2.6.2.1 All asphalt binder courses shall be constructed on a substantially surface-dry, rolled and compacted crushed stone base, free of loose and foreign materials. Hand operated vibrating compactors shall be used around all manholes and valve boxes.

5.2.6.2.2 A tack coat, meeting the requirements of WisDOT Standard Specification Section 455.2.5, shall be used as a bonding agent between binder and surface courses, and the separate lifts of binder when not placed on the same day. The binder surface shall be thoroughly cleaned and any vegetation removed prior to applying the tack coat. Tack coat shall be uniformly applied at a rate of 0.05 gallon per square yard with an allowable variation of +/- 0.02 gallon per square yard over the entire receiving surface. Daily application of the tack coat shall be limited to approximately that area of surface that can reasonably be expected to be paved during the same day.

5.2.6.2.3 Sawcutting

5.2.6.2.3.1 *When sawcutting existing concrete or asphalt pavements, curb and gutter, driveways, or sidewalks, the saw cut shall be straight, and shall be full depth.*

5.2.6.2.3.2 *No payment shall be made for sawing that is not straight or for sawing where the sawing debris is not washed off of the pavement or driveways that are open to traffic.*

5.2.6.2.4 Longitudinal joints in the surface course shall at no time be placed immediately over similar joints in the binder course beneath, with the exception of the centerline. A minimum distance of 6” shall be required between the location of the joints in any given course and the location of similar joints in the course placed above it.



- 5.2.6.2.5 Paving shall be done in lengths so that the first pass does not cool below 125° F, prior to second pass of the next lane.
- 5.2.6.2.6 Any asphalt paving after October 1st of any year shall be done only with special, alternate methods approved by the New Berlin City Engineer.
- 5.2.6.2.7 If the roadway will not receive the final lift prior to October 1st, a minimum 18" wide wedge of asphalt shall be placed against the curb and gutter for protection.
- 5.2.6.2.8 On roadways with rural cross-section, the edge of the pavement shall be sloped and no materials shall extend beyond the limits of the previous layer. Irregularities in alignment along the outside edges shall be corrected by adding or removing asphalt. Excess asphalt deposited on the existing base, binder or surface course outside the limits of the lane being laid, shall be immediately removed.
- 5.2.6.2.9 Prior to placement of the surface course:
- 5.2.6.2.9.1 *All foreign matter shall be removed from the binder course surface.*
- 5.2.6.2.9.2 *On streets with curb and gutter, the 18" wide wedge of protective asphalt previously placed against the curb and gutter shall be removed.*
- 5.2.6.2.9.3 *Developer/Contractor, at his sole expense, shall repair any depressions or other signs of failure in the binder course as directed by the City Engineer.*
- 5.2.6.2.9.4 *Developer/Contractor, at his sole expense, shall repair any damaged curb and gutter as directed by the City Engineer.*
- 5.2.6.2.9.5 *All manhole rims and water valve boxes shall be left 3/8" –1/2" below binder course and adjusted to 3/8" –1/2" below the final pavement elevation just prior to placement of surface course of asphalt. Paving rings which have an adjustable diameter are not allowed.*
- 5.2.6.2.10 All excavations associated with manhole adjustments shall be backfilled with aggregate slurry as specified in Standard Specification for Sewer and Water Construction in Wisconsin Section 8.43.8. The aggregate slurry shall be backfilled to 5-inches below final pavement elevation for residential streets and 6-inches below the final pavement elevation for commercial and industrial streets.
- 5.2.6.2.11 Asphalt pavement installation will not be permitted after October 15th unless approved by the City Engineer.

5.2.7 CONCRETE PAVEMENT

The use of concrete pavement requires the approval of the City Engineer.

5.2.7.1 MATERIALS

- 5.2.7.1.1 Portland Cement used in all concrete mixes shall conform to WisDOT Standard Specification Section 501.



5.2.7.1.2 Aggregates used in concrete shall conform to the requirements of WisDOT Standard Specification Section 501.

5.2.7.1.3 Concrete shall be air entrained, Grade A, conforming to WisDOT Standard Specification Section 501, and in particular, meet the following requirements:

- *Minimum concrete content, 6.0 sacks per cubic yard;*
- *Compressive strength after 28 days cured: 3,500 psi;*
- *Maximum amount of water per bag of cement: 6.0 gallons;*
- *Size of course aggregates required: No. 1 plus No. 2;*
- *Slump: 1"-3"; and*
- *Air content: 4.5% - 7.5%.*

5.2.7.2 **DESIGN STANDARD**

Local streets	Non-Reinforced	7"
All other streets	Doweled	8"

5.2.7.2.1.1 *Alternative designs shall be as approved by the City Engineer.*

5.2.7.3 **INSTALLATION**

5.2.7.3.1 Contractor must submit a mix design and receive the approval of the City Engineer prior to paving.

5.2.7.3.2 A pre-pour meeting must be scheduled with the Engineering Division prior to paving to discuss materials and joint locations.

5.2.7.3.3 Water used shall conform to WisDOT Specification Section 501.2.4. If City water is used, it will be charged at the current rates for such use; a PERMIT IS REQUIRED from the Water Utility for any City water use.

5.2.7.3.4 The consistency of the freshly mixed concrete shall be such that when measured by means of a 4" x 8" x 12" slump cone, the slump shall not exceed 3".

5.2.7.3.5 Test cylinders shall be required meeting AASHTO standards, stored under site conditions and then tested at Contractor expense.

5.2.7.3.6 Concrete pavement shall be constructed in accordance with WisDOT Standards Specifications, Section 415.

5.2.7.3.7 **Curing Time and Cleanup**

5.2.7.3.7.1 *Concrete pavements shall be closed to all traffic for 7 days unless otherwise directed by the City Engineer. When directed to open the street to vehicular traffic, the Contractor shall clean the area of all forms, lumber, dirt and other debris to the satisfaction of the City Engineer. The Contractor shall then flush and sweep the street.*



- 5.2.7.3.7.2 *When a concrete saw has been utilized to cut joints, the Contractor will be required to flush the pavement with water, removing all residual materials of the sawing operation, prior to opening the street to vehicular traffic.*
- 5.2.7.3.8 **Concrete Placement During Cold Weather**
- 5.2.7.3.8.1 *Concrete shall not be placed on a frozen subgrade. The Contractor shall remove and replace at his expense any concrete damaged by frost or freezing.*
- 5.2.7.3.8.2 *When placing concrete during cold weather, the water and the aggregates in the concrete mixture may be heated. When specifically allowed by the City Engineer, the Contractor may use magnesium free calcium chloride as an admixture in the concrete. The maximum quantity to be used shall not exceed 1% of the cement content of the mix.*
- 5.2.7.3.8.3 *When the air temperature is expected to drop below freezing, the Contractor shall cover the surface of the concrete with straw or hay to a sufficient depth to prevent freezing and such protection shall be furnished for at least 5 days after the concrete has been poured. Other methods of protection from freezing may be used when approved by the City Engineer.*

5.2.8 ADMIXTURES

5.2.8.1 Water Reducing

The Contractor may incorporate into the concrete mixture an approved water reducing admixture meeting the requirements of AASHTO Specification M-194, Type A or D when approved by the City Engineer. The cement content may be reduced to 5.8 sacks per cu. yd. when the admixture is used at the manufacturer's recommended rate.

5.2.8.2 Accelerator

When specifically allowed by the City Engineer, the Contractor may use magnesium free calcium chloride as an admixture in the concrete. The maximum quantity to be used shall not exceed 1% of the cement content of the mix.

5.2.9 CURB AND GUTTER

5.2.9.1 MATERIALS

- 5.2.9.1.1 All concrete curb construction shall conform to WisDOT Standard Specification, Section 601.
- 5.2.9.1.2 Concrete for curbs shall be air entrained, Grade A, conforming to WisDOT Standard Specification Section 501, and in particular, meet the following requirements:
- *Minimum concrete content: 6.0 sacks per cubic yard;*
 - *Compressive strength after 28 days cured: 3,500 psi;*
 - *Size of coarse aggregates required: No. 1;*
 - *Slump: 1"- 3"; and*
 - *Air content: 4.5% - 7.5%.*



- 5.2.9.1.3 Concrete that is rejected on the work site for any reason shall not be re-tempered and used in the work without specific approval of the City Engineer.
- 5.2.9.1.4 Concrete Curb and Gutter shall be a standard 6" vertical face curb and gutter type that is 30" wide (6" top curb and 24" flange), 9½" deep at the flange and 14" deep at the back of curb.
- 5.2.9.1.5 A V-Bottom mountable curb and gutter type that is 30" wide, 9" deep at the flange and 12" deep at the back of curb may be allowed at the discretion of the City Engineer, on local streets only.
- 5.2.9.1.6 Where connection is made to existing curb, dowels are required. Dowels conforming to WisDOT Standard Specification Section 505.2.6, shall be installed per WisDOT Standard Specification Section 416.3.6.
- 5.2.9.2 **DESIGN STANDARDS**
- 5.2.9.2.1 Minimum curb grade: 0.7 % (along the gutter flow line).
- 5.2.9.3 **INSTALLATION**
- 5.2.9.3.1 Before the concrete is placed, the crushed aggregate base course under the curb and gutter shall be checked for correct elevation.
- 5.2.9.3.2 The concrete shall be placed in as nearly a continuous operation as possible.
- 5.2.9.3.3 Prior to applying curing material on the concrete, the face of the curb shall be "branded" with a "W" designating the location(s) of water services, "S" designating the location(s) of sanitary laterals and "SS" for storm sewer laterals. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective lateral.
- 5.2.9.3.4 The concrete surface shall be sealed, directly after finishing operations, by spraying a uniform coating of white curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.
- 5.2.9.3.5 Transverse contraction joints for curbs shall be cut or sawed at a maximum 10-foot intervals. One inch expansion joints shall be provided at ends of radii, points of considerable change in grade and alignment, at intervals not to exceed 300 feet and where abutting existing curb and gutter.
- 5.2.9.3.6 Concrete curb and gutter shall cure a minimum of 4 days prior to backfilling and crushed stone base installation.



- 5.2.9.3.7 Four days after the curbs have been placed and the City has approved the concrete work, the Contractor shall immediately backfill behind the curbs to preclude any erosion or undermining.

5.2.10 ROAD UNDERDRAIN PIPE

5.2.10.1 MATERIALS

- 5.2.10.1.1 A continuous 4" diameter perforated, corrugated polyethylene drain pipe, meeting the requirements of AASHTO Designation: M-252, shall be installed under the curb and gutters and extend 50 feet in either direction from storm water catch basins located at low points. For catch basins in other locations, the 50-ft. drain pipe shall be connected only to the upstream side.
- 5.2.10.1.2 Pipe perforations may be holes or slots and may be in 3 or 4 lines spaced around the circumference of the pipe at 120° or 90° respectively. The end of the drainage pipe opposite the catch basin shall be capped with a cap suitable for installing on the drainage pipe.
- 5.2.10.1.3 Enough geotextile fabric must be provided as to cover the sides and bottom of the trench and overlap across the top of the trench by a minimum of 4 inches or the pipe in a sock may be used, see Detail Figure No. 7.
- 5.2.10.1.4 The trench shall be backfilled with open graded ¾" clear stone.

5.2.10.2 INSTALLATION

- 5.2.10.2.1 The 4" drainage pipe shall be laid in an 8" deep by 8" wide trench with flat bottom with square sides. The trench, constructed at an elevation lower than the base course, shall be aligned with the proposed centerline of the flange of the curb and gutter. Any damaged drain pipe shall be replaced before the open graded stone is backfilled in the trench.

5.2.11 DRIVEWAYS

5.2.11.1 DESIGN STANDARDS

- 5.2.11.1.1 Driveway approaches are to be constructed by removing existing curb and gutter and installing poured in-place concrete. This activity requires a Driveway Approach Permit issued by the City.
- 5.2.11.1.2 Driveway slopes shall not exceed 10%.
- 5.2.11.1.3 Driveway slopes shall not exceed 5% in all areas within 25 feet of a building.



5.2.11.1.4 For commercial, industrial and multi-family buildings, if the initial 25 feet of driveway is deemed to be an accessible passenger loading zone, the American Disabilities Act (ADA) requires accessibility routes with longitudinal slopes of not greater than 5% and cross slopes of 2% to be connected to the loading zone and the accessible building entrance.

5.2.11.1.5 AASHTO Sight Distance requirements shall be required at all driveway locations.

5.2.11.2 RESIDENTIAL DRIVEWAYS

5.2.11.2.1 Only one driveway is allowed per parcel for residential developments.

5.2.11.2.2 For multi-family developments, the Plan Commission may grant one or more additional access points, based on the size of the development.

5.2.11.2.3 All residential driveways along roadways with vertical face curb and gutter and sidepath shall be constructed with a driveway apron.

5.2.11.3 COMMERCIAL DRIVEWAYS

5.2.11.3.1 The number of commercial driveways shall be the minimum necessary to provide reasonable access for regular traffic and emergency vehicles, while preserving operations and safety along the public roadway. Unless a Traffic Impact Analysis (TIA) shows that a single driveway cannot provide this, only one driveway access will be permitted unless one or more of the following conditions are met.

- *The continuous frontage of the parcel is over 300 feet long, in which case an additional driveway per each 300 feet or frontage may be granted by the Plan Commission.*
- *Two one-way driveways may be permitted along frontage of at least 150 feet provided the driveways do not interfere with operations at other driveways or along the street.*
- *The Plan Commission may determine additional driveways are justified due to the amount of traffic generated by the use without compromising traffic operations along the public street.*
- *All commercial driveways along roadways with vertical face curb and gutter shall be constructed with a minimum of a driveway apron. Certain locations with heavy amounts of traffic will need to use a street type entrance as directed by the City Engineer.*

5.2.11.4 INSTALLATION

5.2.11.4.1 The concrete surface shall be sealed, directly after finishing operations, with a uniform coating of curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.



5.2.11.4.2 Concrete driveway approaches shall be a minimum of 7" thick.

5.2.11.4.3 Asphalt driveway approaches shall be a minimum of 3" thick.

5.2.11.4.4 The modification of the curb and gutter and the construction of the driveway approach shall be done in accordance with the driveway approach permit.

5.2.11.4.5 Concrete curb and gutter shall not be saw cut horizontally at driveways. Reconstruction of the curb and gutter is required.

5.2.11.4.6 Expansion joint material, ½" thick for full depth of concrete, shall be placed between the curb and gutter and the approach. Dowels shall be required at the joints between existing curb and new curb.

5.2.12 PARKING LOTS

(The Reader is referred to Zoning Code Section 275-57 for additional Parking Lot Standards)

5.2.12.1 Off street parking lots shall be designed to accommodate traffic volumes and pedestrian circulation based on the land use served.

5.2.12.2 The internal circulation pattern shall be designed with 24-ft. wide driving aisles (measured from edge of pavement marking to edge of pavement marking) for two-way traffic to allow users to maneuver in an efficient & safe manner.

5.2.12.3 The use of landscaped islands & medians shall be used to provide positive guidance to motorist and establish proper driving patterns.

5.2.12.4 Sidewalks adjacent to parking stalls shall be 8 feet wide. Smaller sidewalks may be allowed with prior City approval. Appeals may be made to the Plan Commission.

5.2.12.5 Turning radii for a single unit truck (SU Design Vehicle) shall be provided as a minimum to all portions of the lot.

5.2.12.6 Pavement:

- *General parking areas are recommended to have at least a minimum of 8-inches of crushed aggregate base course and 4-inches of E-3 Asphaltic Concrete.*
- *Areas of heavy traffic, such as loading docks, shall have at least a minimum of 10-inches of crushed aggregate base course and 6-inches of E-3 Asphaltic Concrete.*

5.2.12.7 Inverted parking lots are discouraged.



5.2.13 SIDEPATHS AND TRAILS

5.2.13.1 MATERIALS

5.2.13.1.1 Concrete for sidepaths shall be air entrained, Grade A, conforming to WisDOT Standard Specifications, Section 501, meeting the following requirements:

- *Minimum concrete content, 6.0 sacks per cubic yard;*
- *Compressive strength after 28 days cured: 3,500 psi;*
- *Maximum amount of water per bag of cement: 6.0 gallons;*
- *Size of course aggregates required: No. 1 plus No. 2;*
- *Slump: 1"-3"; and*
- *Air content: 4.5% - 7.5%.*

5.2.13.1.2 Sidepaths are to be constructed of 5-inches of concrete over a 4-inch crushed aggregate base course.

5.2.13.1.3 Driveway crossings shall be 7-inches of concrete over a 6-inch crushed aggregate base course.

5.2.13.1.4 Trails shall be constructed of an E-0.3 "Superpave" mix asphalt 3-inches thick over a 5-inch crushed aggregate base course or as directed by the City Engineer.

5.2.13.2 DESIGN STANDARDS

5.2.13.2.1 Current and future planned sidepath and trail locations are identified in the City's Comprehensive Plan. Any development that occurs on or adjacent to these locations is required to connect to, or construct its portion of the system, if not currently in place, or provide detailed rationale and request a waiver from the Plan Commission and/or Common Council

5.2.13.2.2 Sidepaths shall be separated from the street by a minimum 6-foot wide grassy terrace with shade trees.

5.2.13.2.3 The outside edge of sidepaths shall be located 1-foot from the right-of-way line or as directed by the City Engineer except at intersection crossings. At intersection crossing, the proper placement shall be determined by the location of the crosswalk and as directed by the City Engineer.

5.2.13.2.4 Width of Sidepath:

Local Roads	5 feet
Collectors and Arterials	6 feet

5.2.13.2.5 Trails shall be a minimum of 10 feet wide with 1 foot of gravel shoulder on both sides and in conformance with AASHTO's Guide for the Development of Bicycle Facilities.



5.2.13.2.6 Traverse grade of 2% (1/4" per foot) draining toward the road.

5.2.13.2.7 The maximum allowed longitudinal grade shall be 5%. This grade shall not be exceeded unless the road grade is of a steeper grade, in which case the longitudinal sidewalk grade shall not exceed the road grade.

5.2.13.3 **INSTALLATION**

5.2.13.3.1 Sidewalk shall be placed by formed methods.

5.2.13.3.2 Contraction joints shall be not less than 1/4" wide and 1/2" deep. Contraction joint spacing shall be 5' or as directed.

5.2.13.3.3 Expansion joints shall be located at a minimum 100 ft O.C. Finished joints shall have 1/4" radius. After floating, troweling, and jointing, the concrete shall be brushed with a damp bristle brush.

5.2.13.3.4 The concrete surface shall be sealed, directly after finishing operations, with a uniform coating of white curing material meeting the requirements of WisDOT Standard Specification Section 415.2.4, in such a manner as to provide a continuous water-impermeable film on the entire concrete surface.

5.3 **INSPECTION**

Contractor shall be responsible for the horizontal and vertical control.

5.3.1 **ACCEPTANCE TESTING**

5.3.1.1 **Tests**

5.3.1.1.1 Prior to the installation of stone base, or sub-base, the subgrade shall be proof rolled with a fully loaded tri-axle truck. Proof rolling shall be scheduled with the City Inspector.

5.3.1.1.2 The subgrade shall be inspected before the crushed stone base may be applied. This inspection is done by the City Inspector or its contracted inspection services. An average tolerance of +/- 0.04-ft. from the approved subgrade elevation shall be allowed.

5.3.1.1.3 The base course shall be inspected and approved by the City Inspector before the first layer of asphalt can be placed. An average tolerance of +/- 0.04-ft. from the approved base course thickness shall be allowed. Additional proof rolling of base course may be required if, in the opinion of the City Inspector, conditions have changed.

5.3.1.1.4 A City Inspector shall be present for the placement of all-concrete curb and gutter. This includes the inspection of the base under the curb and gutter, and a check of the alignment and grade of the curb and gutter.



- 5.3.1.1.4.1 *Three test cylinders per 1,000 lineal feet shall be taken during the course of the curb and gutter operations. A testing firm, hired by the Developer, shall pick up the cylinders at the project site within 24 hours of paving, break the cylinders at the appropriate time (7, 14, and 28 days) and submit a test report to the Developer. The Developer shall submit a copy of the report to the City Engineer or designee.*
- 5.3.1.1.4.2 *Curb and gutter elevations will be considered acceptable if certified elevations are within ¼” of design elevations.*
- 5.3.1.1.4.3 *If evidence indicates that there is standing water in the gutter flange, that portion of the curb and gutter shall be reconstructed to establish positive drainage.*
- 5.3.1.1.5 A City inspector shall be present whenever any asphalt pavement is being constructed.
- 5.3.1.1.5.1 *Asphalt to be placed on a roadway, shall arrive at the job site at a temperature of 275° F +/- 25° F. The asphalt inspector will periodically test the temperature of the arriving trucks for the temperature of the asphalt. Any trucks not falling within the guidelines for asphalt temperatures shall be rejected. Paving shall not be done at temperatures below 40 degrees F.*
- 5.3.1.1.5.2 *Both the binder course and the surface course shall be compacted to not less than 91.5% maximum density. Contractor shall have testing done by an independent Lab unless otherwise approved.*
- 5.3.1.1.5.3 *An average tolerance of +/- 0.04-ft. for the binder thickness and +/- 0.04-ft. from the approved final pavement surface elevation shall be allowed.*



TABLE OF CONTENTS

6	PROJECT CLOSE-OUT DOCUMENTS.....	2
6.1	CONSTRUCTION INSPECTOR BINDER.....	2
6.1.1	Material Submittals.....	2
6.1.2	Inspection Reports.....	2
6.1.3	Test Results/Reports.....	2
6.1.4	Change Orders / Substitutions.....	2
6.1.5	Pay Applications.....	2
6.1.6	Final Record Set of Construction Plans.....	2
6.2	LIEN WAIVERS.....	2
6.3	ASBUILTS.....	2
6.3.1	GENERAL.....	2
6.3.2	SANITARY SYSTEM.....	4
6.3.3	WATER SYSTEM.....	4
6.3.4	STORM SYSTEM.....	5
6.3.5	GRADING CERTIFICATION PLAN.....	6
6.3.6	STORM WATER BMP CERTIFICATION PLAN.....	6
6.4	EASEMENTS.....	7
6.4.1	GENERAL.....	7
6.4.2	STORM SYSTEM.....	7



6 PROJECT CLOSE-OUT DOCUMENTS

6.1 CONSTRUCTION INSPECTOR BINDER

City Inspector shall provide the City with a Construction Inspection Binder including the following documents.

- 6.1.1 Material Submittals
- 6.1.2 Inspection Reports
- 6.1.3 Test Results/Reports
- 6.1.4 Change Orders / Substitutions
- 6.1.5 Pay Applications
- 6.1.6 Final Record Set of Construction Plans

6.2 LIEN WAIVERS

Developer shall provide the City with all lien waivers pertaining to the Public Infrastructure prior to final acceptance by the City.

6.3 ASBUILTS

6.3.1 GENERAL

- 6.3.1.1 Plans shall be prepared on sheets measuring 12" high by 36" wide. Sheets shall have minimum margins of ½ inch on all sides.
- 6.3.1.1 The title block shall be in the lower right corner of the as-built and include at a minimum, the following information:
 - City of New Berlin
 - Location of Utility
 - As-built File Number (Provided by City Engineering Services Division)
 - MMSD Plan File Number
 - Date of Plan Approval by Commission
 - Name of Contractor
 - Date of Construction
 - Scale (text and line)
 - Signature Line for City Engineer.
- 6.3.1.2 North shall be to the top or left of the sheet and shall be shown by a 2" long north arrow, clearly, shown without intrusion.



- 6.3.1.3 The scale of the as-built plans shall be same as construction drawings, 1"=50' or 1"=40'. This shall be shown with a line scale and text.
- 6.3.1.4 The seal and signature of the professional engineer responsible for the preparation of the as-builts shall be shown immediately adjacent to the title block.
- 6.3.1.5 All existing lot, property, and utility easement lines in the area in which the utility is located shall be shown.
- 6.3.1.6 Ghost any existing features, including but not limited to building corners and parking lots.
- 6.3.1.7 The address, lot and block numbers, and subdivision or development name shall be indicated. Addresses shall be labeled with *italics*. Unplatted lands and the address of any home on such lands shall be so indicated.
- 6.3.1.8 All street names shall be clearly shown.
- 6.3.1.9 Two SEWRPC reference benchmarks shall be shown on each sheet.
- 6.3.1.10 Plan sheets shall start and terminate at match lines.
- 6.3.1.11 Pipe invert elevations shall be clearly shown.
- 6.3.1.12 Ghosting of existing sanitary sewer, storm sewer and watermain and service locations either in screened or dashed format.
- 6.3.1.13 Concurrent with the hard copy submittal:
 - 6.3.1.13.1 Provide complete set of records in PDF format.
 - 6.3.1.13.2 Provide complete set of records in AutoCAD (.DWG) format on CD tied to the State Plane NAD 1927 Wisconsin South coordinate system.
 - 6.3.1.13.3 Provide digital files in Shapefile or Geodatabase format including the above coordinate system. This will facilitate direct insertion of the subject into the City's Geographic Information System (GIS).
- 6.3.1.14 The cost of archiving the as-built drawings and insertion of the data into the City's GIS System shall be the sole responsibility of the DEVELOPER. Cooperation and submission of the aforementioned data will keep costs to a minimum.



6.3.2 SANITARY SYSTEM

- 6.3.2.1 A general note on each sheet giving the size, class, type, ASTM designation, and manufacturer of every main and lateral shall be shown, with material quantities clearly tabulated. Complete information on manhole frames / lids / barrel structure shall be noted. Manholes shall be ID'd with Design Plan No. and Systems Plan No.
- 6.3.2.2 The percent grade, direction of flow, and center to center length of sanitary sewer installed between manholes and laterals shall be shown.
- 6.3.2.3 All laterals shall have invert elevations at right-of-way lines or easement line and lengths clearly shown.
- 6.3.2.4 The following information shall be shown for each manhole:
- GPS coordinates, using State Plane NAD 1927 Wisconsin South coordinate system, in Excel or CSV (Comma Separated Values) format including latitude, longitude and elevation of the center of the manhole cover
 - Invert elevation of each sewer
 - Pipe size of each sewer
 - Type of frame to chimney seal
 - Indicate External seals or internal chimney seals
- 6.3.2.5 All as-built drawings shall reference Milwaukee Metropolitan Sewerage District datum by using the conversion of 580.58 from 0.00 (MMSD datum) to Mean Sea Level.

6.3.3 WATER SYSTEM

- 6.3.3.1 The size, class, type, and manufacturer of every main shall be shown. The location of the main shall be dimensioned from the centerline of the right-of-way. The center to center length of main installed between valves, fittings, and laterals shall be shown.
- 6.3.3.2 The location of all fittings (including valves, tees, crosses, reducers, air vents, bends, and lateral taps) shall be dimensioned from/to centerline of each fitting. All fittings shall be suitably labeled for identification.
- 6.3.3.3 Curved lines shall indicate deflected pipe (with curve data provided); lines shall be straight between fittings.
- 6.3.3.4 Show which side of the main the operating nut for butterfly valves is located on.



- 6.3.3.5 A general note on each sheet giving the brand and manufacturer (model, size, etc.) for each valve used shall be provided, with quantities of each clearly tabulated. Services shall include footage and count. Complete information on valve boxes and manhole frames / lids / barrel structure shall be noted.
- 6.3.3.6 All laterals shall be shown giving the length and type of material used. The manufacturer and model of tapping saddle or tee, corporation, curb stop, and box shall be given.
- 6.3.3.7 GPS coordinates, using State Plane NAD 1927 Wisconsin South coordinate system, in Excel or CSV (Comma Separated Values) format including latitude, longitude and elevation of the location of all:
- 6.3.3.7.1 Valves, tees, crosses, reducers, air vents, bends and lateral taps.
- 6.3.3.7.1.1 *The location shall be tied-in to at least two permanent surface points. These can be manholes, hydrants, other valves, or other suitable points. The point used should be clearly referenced.*
- 6.3.3.7.2 Hydrants.
- 6.3.3.7.2.1 *The size and type of every hydrant shall be also shown.*
- 6.3.3.7.2.2 *The shutoff valve shall be tied-in to at least two permanent surface points.*
- 6.3.3.7.2.3 *All hydrants differing from 6.5' bury shall have the bury depth or length of extensions installed noted.*
- 6.3.3.7.2.4 *Elevation of each hydrant tied to the northwest nut of the top flange should be shown.*
- 6.3.4 STORM SYSTEM**
- 6.3.4.1 The size and type of all mains and leads shall be shown. Their location relative to the centerline of the right-of-way shall be dimensioned. The total length of sewer installed shall be shown.
- 6.3.4.2 The center-to-center distance between laterals and/or manholes shall be shown.
- 6.3.4.3 GPS coordinates, using State Plane NAD 1927 Wisconsin South coordinate system, in Excel or CSV (Comma Separated Values) format including latitude, longitude and elevation of the location, size, type and manufacturer of all manholes, catch basins, inlets, or outlet sections shall be shown. Material quantities shall be clearly tabulated.
- 6.3.4.4 Elevations of all rims, flow lines, catch basins, gutter inlets, and outlet sections shall be given. Invert elevations shall be given for gutter inlets, catch basins, and manholes. Elevations shall be based on the City of New Berlin datum.



6.3.5 GRADING CERTIFICATION PLAN

- 6.3.5.1 In preparing a Certification Plan, the Developer's Grading Plan shall be shown as screened background.
- 6.3.5.2 As-built grades shown on lot lines shall be no less than 0.30 ft. lower than final grades shown on approved master grading plan or higher than 0.10 ft. above the final grades shown on approved master grading plan. The Developer is required to establish final grades within 5 feet of side lot lines, rear lot lines and the front right-of-way area between the front line lot line and the back of curb in an urban setting or edge of shoulder in a rural setting. These areas shall be described as a "no-touch zone". All grades within the "no-touch zones" shall be certified by Developer's Engineer. Developer shall typically show spot grades along side lot line at front curb, front property corners, front setback, back of house extended, any high points, and rear property corners.
- 6.3.5.3 The grades along side lot lines are needed even in wooded, ungraded areas.
- 6.3.5.4 Existing house pad grade (elevation taken at the center and each corner of a typical 66' x 54' house, except for lots designed for rear exposure house show existing grade at front and back of typical house). House pads are to be left 1.75' below finish yard grade with a +/- 3" tolerance.
- 6.3.5.5 Elevations every 50 feet along developer graded swales and ditches.
- 6.3.5.6 Elevations every 100-ft. Station along the road alignment. Locations shall include:
- Pavement centerline and edges
 - Edge of shoulder
 - Ditch flowline
 - Top of embankment on the backslope of the ditches.
- 6.3.5.7 After analyzing certified grades, Developer shall identify on plan those areas not within above tolerance. Show areas to be regraded, or areas where it may be desirable to revise the proposed grades in the Master Grading Plan.

6.3.6 STORM WATER BMP CERTIFICATION PLAN

- 6.3.6.1 Elevations (minimum of every 50')
- Top of Berm
 - Top of Slope
 - Toe of Slope
 - Safety Shelf Edges
 - Bottom of BMP
 - Spillway-Top of Slope & Toe of Slope (detailing length, width and height)



6.3.6.2 Structure Locations and Elevations

- Outfall (invert elevation and size)
- Overflow structures (corners of opening) and Piping (invert elevation and size)
- Inlet Structures (center of manhole) and Piping (invert elevation and size)
- Outlet Structures (center of manhole) and Piping (invert elevation and size)
- Weirs (invert elevation and size)
- Orifice (invert elevation and size)
- Inlet/Outlet (invert elevation and size)

6.4 EASEMENTS

6.4.1 GENERAL

6.4.1.1 The Developer shall prepare formal written easement documents, including graphics and written legal description attachments for each easement and record the same with the County Register of Deeds after review and approval by the City of New Berlin for each utility easement shown on the subdivision plat (or CSM) as a condition of Final Plat (CSM) approval.

6.4.1.2 No encroachment by structures, berms, trees, shrubs, paved surfaces or changes in grade greater than 4" are allowed in easement areas without approval of the City Engineer.

6.4.1.3 30-ft. wide minimum width for a single utility. The utility shall be located in the center of the final easement. Easement width may be increased to 50 feet based on pipe size and depth.

6.4.1.4 Easements with multiple utilities, the minimum separation from outside of the utility to the easement line shall not be less than 15 feet subject to approval by the City Engineer. Add not less than 10 feet per additional utility in the easement.

6.4.1.5 Maximum ground slope along easements:

- transverse: 25%
- longitudinal: 10%.

6.4.2 STORM SYSTEM

6.4.2.1 The City requires public storm sewer and/or drainage easements for any storm water conveyance system that drains public ROW areas or neighboring off-site areas.



- 6.4.2.2 A storm sewer running along the rear lot lines within a subdivision, specifically to drain backyards, does not warrant a public easement. The City considers this to be a private system built for the lot owners of the subdivision and owned/maintained by the property owners.