Town of Somers
Development Engineering Submittal Guide

Subdivisions and Non-Residential Development

REVISED: FEBRUARY, 2008

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Chapter 1 – Submittal Overview
Development Engineering Submittal Guide

1.0 INTRODUCTION

The purpose of this Handbook is to provide a guide for the steps and requirements needed for the developer's engineer to prepare and submit engineering plans for proposed subdivisions and non-residential development within the Town of Somers.

This handbook is not intended to list every established design standard but rather to help ensure an expeditious approval process, since it is the Town's policy not to initiate a review until all required information is submitted. Complete submittals should help reduce the applicant's cost by accelerating the approval process.

1.1 OTHER REFERENCES

In conjunction with this Handbook, the developer should reference the following which have planning and design guidelines.

a. Town of Somers Chapter 18 – Land Division and Platting Control.
b. WDNR Chapter NR 151 of the Wisconsin Administrative Code.
c. WDNR Technical Standards. http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm
d. WDOT Facility Development Manual.
e. Standard Specifications for Sewer & Water Construction in Wisconsin.

1.2 PLAN SUBMITTAL / GENERAL PROCEDURES

The following outlines the general procedures for the plan submittal and review process:

a. Plan submittals should be addressed and mailed to the following address or personally delivered to the Town Hall.

Town of Somers
P.O. Box 197
Somers, WI 53171

Attn: Mr. Bill Morris
Town Administrator

b. The submittal must include a cover letter by the applicant indicating the review request and a listing all items being submitted.

c. The submittal must contain all required plan(s) and supplemental information.

d. Once a submittal has been received by Town, the Town's Engineer will conduct an initial review of the application to check the submittal for completeness and accuracy.

e. If the submittal is found to be incomplete, a letter of incompleteness will be sent to the applicant indicating additional items which need to be submitted prior to a plan review being initiated. If the additional items are not submitted within 30 calendar days from the date of the deficiency letter, the submittal will be considered null and void and discarded. A complete separate submittal will then need to be made by the applicant upon readiness.

f. If the submittal is found to be complete, the Town's Engineer will conduct an office review of the plans, specifications, and submitted materials and provide plan review comments or a recommendation of approval to the Town. The Town will then forward review comments or an approval letter to the applicant. At the discretion of the Town, the applicant may be carbon copied on review letter(s).

g. Review comments must be addressed by the Engineer of Record for the project or Developer as applicable. Plans may be re-submitted only once all review comments have been addressed. Re-submittals must include a cover letter addressing each review comment, item by item, and revised plans and requested material(s) or the re-submittal will be considered incomplete and a review will not be initiated.

h. Once a plan review has been initiated the applicant may expect to receive correspondence from the Town within 2-3 work weeks.

i. Review fees are based on the Town Engineer's current hourly rate schedule and actual time spent reviewing plans.

j. The Town may, at their discretion, require an escrow credited to the Town for plan review fees. Escrow amount(s) are subject to the complexity of the project. The developer is responsible for costs of actual time spent for the review of plans submitted if they exceed the escrow amount. An appropriate refund will be made if the cost is below the escrow amount.

1.3 ENGINEERING PLAN AND SUBMITTAL FORMAT STANDARDS

The Town has established the following standards for engineering plans submittals.

a. All plans and materials shall be submitted at one time in duplicate and separated into two packages for distribution. One package will be kept by the Town and the second package will be forwarded to the Town's Engineer.

b. Engineering plan sheets should be standard 24-inch x 36-inch or smaller and must be bound.

c. Engineering plans should include a title/cover sheet and be sealed by a Wisconsin Registered Licensed Professional Engineer.

d. Reports including storm water management plan(s) and construction specification manual(s) should be comb bound and sealed by a Wisconsin Registered Licensed Professional Engineer.

e. The initial submittal for a subdivision engineering review must include a copy of the preliminary plat.

f. Plans for non-residential development must include within the bound plan set a dimensioned site plan and landscaping plan.

Chapter 2 – Engineering Plan Title Sheet
Development Engineering Submittal Guide

2.0 ENGINEERING PLAN TITLE SHEET CHECKLIST

The following is a checklist of the general requirements and items to be contained on the title/cover sheet of the submitted engineering plans.

a. The official project title and a location map.

b. Listing of project benchmarks.

c. A legend of symbols and index of sheets.

d. Date of preparation and applicable revision date(s).

e. A note warning that Diggers Hotline must be contacted to locate underground utilities prior to the start of construction.

f. If the plan contains the construction of any public road, storm sewer, sanitary sewer, water main, or other Town owned facility the following note should be provided: "Prior to construction, a pre-construction conference must be held at the Town Hall. The preconstruction conference shall be scheduled and moderated by the designing Engineer of Record".

Chapter 3 – Non-Residential Site Plan Development Engineering Submittal Guide

3.0 NON-RESIDENTIAL SITE PLAN CHECKLIST

The following is a checklist of the general requirements and items to be contained on the site plan sheet for non-residential development (business, commercial, industrial, etc.).

a. Building footprint and all setbacks.

b. Property lines and dimensions.

c. Existing and proposed utility, drainage, and cross-access easements.

d. Dimensioned site layout.

e. Landscape buffer areas.

f. Property zoning classification, required number of parking spaces, and actual proposed parking spaces.

g. Property size (acreage).

h. Site calculated amount of impervious surface area and amount of open space landscape area(s).

i. See Town ordinance Chapter 18 for other requirements.

3.1 LANDSCAPING PLAN CHECKLIST

j. Show all trees, shrubs, sodded areas, enclosures, and fencing.

k. Details and specifications for all plantings, enclosures, and fencing.

l. See Town ordinance Chapter 18 for other requirements.

Chapter 4 – Grading / Erosion Control Plan Development Engineering Submittal Guide

4.0 GRADING / EROSION CONTROL CHECKLIST

The following items should be provided within the grading and erosion control plan(s):

a. Existing and proposed topographic contours at intervals of 1-foot. Topography information should extend at least 25-feet onto the adjoining properties. Drawings should be based on USGS Elevations and the State Plane Coordinate System.

b. Location and contours of proposed detention and infiltration facilities with normal and high water (100-year) elevations indicated.

c. Location and design of emergency overflow weirs and direction of emergency overland flow paths.

d. The limits of any wetlands, lakes, ponds, streams, or primary environmental corridors and limits of applicable WDNR Chapter NR 151 protective area setbacks.

e. The limits of floodplain and floodway boundaries with appropriate base flood elevations noted. Note: Floodplain(s) are regulated by Kenosha County.

f. Proposed top of foundation elevation(s) and finished grade elevation(s) at the foundation of proposed buildings.

g. Earthwork calculations for the entire development with the engineer's estimate of the amount of import or export of fill needed for the site grading plan. Offsite borrow areas and surplus disposal areas must be addressed and identified.

h. Copies of Applicable permits: WDNR Notice of Intent, Chapter 30 permit, DOC Notice of Intent, Kenosha County Highway and/or DOT permits, Kenosha County Shoreland permit.

i. Location of temporary soil stockpiles.

j. Erosion control provisions, meeting WDNR standards.

k. Details of erosion control provisions.

l. A construction sequence schedule.

Chapter 5 – Storm Water Management Plan Development Engineering Submittal Guide

5.0 STORM WATER MANAGEMENT PLAN CHECKLIST

Storm water management is regulated by requirements set forth in Chapter NR 151 of the Wisconsin Administrative Code, in addition to Town and Kenosha County Ordinances. Storm Water Management approvals must be obtained from the Town, Kenosha County, and WDNR as applicable.

The following is a list of items which should be included in the bound storm water management plan.

Storm Water Management Plan Narrative

a. Title sheet with official project name, date of preparation, and applicable revision dates.

b. Narrative of required storm water management performance goals for the development. In addition, to WDNR NR 151 requirements, by design, storm water practices shall be employed to reduce the 100-year, 24-hour, post-development runoff rate to the 10-year, 24-hour, pre-developed runoff rate. The post-developed 2-year, 24-hour, runoff rate shall be controlled to be not greater than the 2-year, 24-hour, runoff rated. If there is insufficient capacity in the storm sewer facilities downstream from the proposed development, the Town reserves the right to further restrict the allowable peak discharge rates for the development.

c. Description of project site location and existing conditions including, land use, topography, existing drainage patterns, points of discharge, identification of wetland(s) and floodplain(s), and other relevant features effecting storm water drainage.

d. Description of site soil type(s) and identification of the Hydrologic Soil Classification(s) used (Type A, B, C, D).

e. Description of the proposed development and post-construction site conditions including storm water management facilities being used to meet the performance goal(s), drainage patterns, points of discharge, protective areas, and other relevant features effecting storm water drainage.

f. Description of the analytical procedures used to quantify the pre-developed and post-developed storm water runoff rates, volumes, and water quality performance standards.

g. Summary of the pre-developed and post-developed hydrologic and hydraulic parameter used in the evaluation including runoff curve number(s), time of concentration(s), drainage basin and sub-basin delineations.

h. Summary of the project site's pre-developed and post-developed peak storm water runoff rates for the 2-year, 10-year, and 100-year frequency, 24-hour duration design rainstorm event(s) and comparison with the peak flow performance goal(s).

i. Summary of the post-developed water quality analysis results and comparison with the performance goal.

j. Summary of the post-developed storm water infiltration analysis and comparison with the performance goal.

k. Maintenance plan / agreement covering all privately owned storm water management facilities.

Storm Water Management Plan Appendices

a. Pre-developed and post-developed drainage area maps with topographic contours, time of concentration path(s), basin identification numbers and acreages.

b. Hydrologic computer model printouts including a model schematic, table of contents, model input summary sheets, time of concentration calculations, model output summary sheets. Note: Each model run should be separated by a divider sheet with an appropriate description heading.

c. Water quality computer model printout including input parameters and output results.

d. Infiltration design worksheets, if applicable.

e. Soil investigation report(s), if applicable.

Chapter 6 – Storm Sewer and Overland Drainage Development Engineering Submittal Guide

6.0 STORM SEWER AND OVERLAND DRAINAGE

Storm sewer facilities may be privately or publicly owned as deemed appropriate by the Town. Publicly owned facilities will be owned and maintained by the Town unless determined otherwise. Privately owned facilities must have a maintenance agreement with the Town designating the owner and long term maintenance responsibilities.

6.1 General Requirements

a. In general, all storm sewers shall be designed for a 10-year reoccurrence frequency storm event as defined by the Southeastern Wisconsin Regional Planning Commission (SEWRPC).

b. Public storm sewers alignments within new public roadways should be on located 8-feet minimum west or south of the roadway centerline. Appropriate manholes should be provided to maintain the alignment on curvilinear roads to keep the storm sewer under the pavement.

c. Manhole castings within new public roadways shall initially be constructed to 1/2-inch below the top of the first layer of asphalt and subsequently adjusted at the time the final asphalt layer is placed.

d. Sewers crossing existing Town roads shall be backfilled using granular backfill. Roadway pavements must be saw-cut and replaced "in kind".

e. New sewer connections to existing manholes shall be cored.

f. Drainage shall not adversely affect adjacent or downstream properties or cause upstream ponding or back-water problems. Design shall accommodate increased runoff created onsite and also consider potential for increased runoff from upstream areas, where applicable.

g. Storm water management performance standards shall meet the WDNR NR 151, Town, and County requirements.

h. Storm sewer pipe for public sewers shall be reinforced concrete pipe (RCP). Minimum sewer size is 15-inches for mains and 12-inches for catch basin leads.

i. Inlets / outfalls greater than 12-inches in diameter shall have trash grates.

j. Double inlets shall be provided at sag curves within public roadways.

k. For parking lots and other large paved areas, a minimum of one catch basin should be provided for every 20,000 square feet of impervious surface area, or as determined by the Town.

l. Roadways and isles should be crowned where possible, to prevent icing problems in cold weather.

m. Side slopes for open channels and swales should be 4:1 but no steeper than 3:1.

n. Culverts under driveways, where required, shall be a minimum of 15-inches in diameter, but not less in diameter than adjacent upstream and downstream culverts, unless otherwise approved by the Town.

o. Storm sewer outfalls and culverts should have flared end sections with geotextile fabric and riprap stone placed at the outlet.

p. Sump pump laterals must be provided within new subdivisions.

6.2 General Plan Submittal Checklist

a. Identification of public vs. private facilities must be indicated on the plans.

b. Sizing computations and storm sewer drainage area map.

c. Rim and invert elevations of all drainage facilities.

d. Sewer diameter, distance, and percent grade between manholes.

e. Sump pump lateral locations and invert elevations at the right-of-way.

f. Plan/Profile sheets are required for public sewers.

g. Limits of gravel, spoil, and/or slurry backfill.

h. Material and size of any existing storm sewers to be tied into.

i. Proposed public right-of-ways and/or easements (20-foot minimum) should be shown on the plans. Copies of complete easement documents should be provided, if applicable.

j. Manhole, catch basin, end section, pond outlet structure, and riprap details.

k. Swale or open channel detail(s).

l. Project construction and specification manual for public storm water facility construction.

Chapter 7 – Sanitary Sewer
Development Engineering Submittal Guide

7.0 SANITARY SEWER

Public sewers within the Town of Somers are owned and maintained by the Town. Wastewater flows are treated by the City of Kenosha Water and Sewer Utility.

New sewer extensions must be approved by the Town, City of Kenosha, and the WDNR. Plan submittals to the Town and City may be done concurrently. City approval must be obtained prior to final Town approval of the plans. Plan submittal to the WDNR must be done after Town approval of the plans.

7.1 General Requirements

a. Sewers along public roadways shall follow the centerline of the right-of-way. Additional manholes shall be provided in curvilinear roads to closely follow the centerline.

b. Sewer alignments along existing roads or in easements shall be approved on a case-by-case basis. Alignment must be approved prior to completing / submitting construction plans.

c. Sanitary laterals cannot be directly connected to manholes. Standard laterals for single-family residential lots shall be 4-inches in diameter. Laterals for multi-family, commercial, business, or industrial lots must be sized based upon anticipated wastewater flows.

d. Risers shall be provided for all laterals over 14 feet in depth.

e. Outside drop manholes may only be used where the proposed drop exceeds 3.0 feet.

f. Manhole castings within new public roadways shall initially be constructed to 1/4-inch below the top of the first layer of asphalt and subsequently adjusted at the time the final asphalt layer is placed.

g. Sewers crossing existing Town roads shall be backfilled using slurry backfill. Roadway pavements must be sawcut and replaced "in kind".

h. New sewer connections to existing manholes shall be cored.

i. A temporary plug must be installed in the downstream manhole during construction to prevent sediment / debris from entering the downstream sewer. All plugs must be removed prior to the Town acceptance of the new services.

7.2 General Plan Submittal Checklist

Plans

a. Invert and rim elevations of all sewers manholes.

b. Sewer diameter, distance, and percent grade between manholes.

c. New sewer material.

d. Lateral locations and invert elevation(s) at the right-of-way. Locations and length of any risers.

e. Material and size of any existing sanitary sewer to be tied into.

f. Profiles of all public sewers.

g. Proposed public right-of-ways and/or easements (20-foot minimum) should be shown in plan view. Copies of complete easement documents should be provided, if applicable.

h. Limits of gravel, spoil, and/or slurry backfill.

i. Separation distances between sanitary sewer and other utilities.

j. Manhole and riser detail(s).

Documentation

k. A completed signed copy of the WDNR submittal form with a corresponding sewer service area map must submitted along with a copy of the SEWRPC "208" letter.

l. A copy of the Kenosha Water Utility approval letter shall be provided prior to Town approval of the plans.

m. A copy of the WDNR Sewer Extension approval shall be provided prior to the start of construction, or scheduling a pre-construction conference.

n. Project construction and specifications manual.

Chapter 8 – Water Main
Development Engineering Submittal Guide

8.0 WATER MAINS

Public water within the Town of Somers is supplied by the Kenosha Water Utility. New water mains are owned and maintained by the Town of Somers, unless otherwise determined by the Town and Kenosha Water Utility.

New water main extensions must be approved by the Town, Kenosha Water Utility, and the WDNR. Plans must be submitted to the Town for written approval prior to submitting to Kenosha Water Utility for their system-level review and written approval. Plan submittal to the WDNR must be done after Town and Kenosha Water Utility approval of the plans.

8.1 General Requirements

a. Water main alignment along new roads should be located 8-feet minimum east or north of the roadway centerline. Appropriate bends / fittings should be provided to maintain the alignment on curvilinear roads to keep the water main under the pavement.

b. Water main alignments on existing Town roads or in easements shall be approved by the Town on a case by case basis. Alignment must be approved prior to completing / submitting construction plans.

c. Water mains crossing existing Town roads shall be backfilled using slurry. Roadway pavement must be sawcut and replaced "in kind".

d. The Town of Somers Fire Department approval must be obtained for all proposed hydrant locations prior to construction.

e. Valves must be provided at all branches within intersections.

f. Valve boxes shall initially be constructed to 1/2-inch below the top of the first layer of asphalt and subsequently adjusted at the time the final asphalt layer is placed.

8.2 General Plan Submittal Checklist

Plans

a. Grade breaks, bends, fittings, valves and hydrants should be labeled on the plans with stations and elevations.

b. Profiles are required for all public water mains.

c. Water main size, distance, and percent grade between grade breaks.

d. Material of new water main.

e. Lateral locations and invert elevation at the right-of-way.

f. Limits of gravel, spoil and/or slurry backfill.

g. Material and size of existing water main to be tied into.

h. Separation distance(s) between water main and sanitary sewer.

Documentation

i. Copy of completed and signed WDNR Water Main Extension form(s) and fire flow calculations.

j. Copy of Kenosha Water Utility approval.

k. Copy of any other applicable County, WDOT, or WDNR permits.

l. Project Construction and Specification Manual.

Chapter 9 – Road(s)
Development Engineering Submittal Guide

9.0 ROADS

9.1 General Requirements

a. The following two year road buildout schedule is Town Policy for public road(s):

Year 1: After the installation of all utility and stormwater drainage improvements, the Town Board shall require the developer to proceed with grading, installation of the base course, concrete curb/gutter and the lower layer of asphalt of all roadways and streets proposed to be dedicated in accordance with plans and specifications as reviewed by the Town Engineer. The installation of the curb/gutter and lower layer of asphalt shall only occur after the base course has been proof rolled and any necessary improvements or repairs have been completed to the satisfaction of the Town Engineer. The Town shall stake and inspect all roadway construction.

Year 2: Asphalt (upper layer) - During the second year of construction, the Town Board shall require the developer to proceed with the installation of an asphaltic upper layer in accordance with the approved plans and specifications as reviewed by the Town Engineer. The installation shall only occur after a complete inspection of the lower layer of asphalt by the Town Engineer and any repairs as called for as a result of said inspection have been completed to the satisfaction of the Town Engineer. Second year installation of the asphaltic upper layer may be delayed by the Town Board after review of the lot sales and the number of new buildings under construction.

b. Driveway openings installed after the initial installation of the concrete curb/gutter shall have the existing curb/gutter removed by removing to the nearest 10-foot joint spacing or by removing the curb head using approved sawing equipment for the intended removal.

c. Road cross sections and cul-de-sac details must meet the requirements the Land Division and Platting Control Ordinance (Chapter 18).

d. Vertical curves meeting the WDOT design standards must be provided at all changes of profile that exceed a total change of 1.0%.

e. Deceleration / Acceleration tapers in conformance with WDOT standards should be provided on existing roads at the intersections of new roads unless the existing road has been reconstructed to its ultimate cross section. The need for bypass lanes at all new intersections with existing roads will be evaluated by the Town on a case by case basis.

f. Intersection sight vision must be evaluated and appropriate restrictions provided as necessary.

g. Temporary sloping easements outside the development limits must be shown on the plans. Copies of all approved sloping easements must be provided.

h. Traffic signal plans meeting WDOT design requirements should be provided for any proposed signalized intersection.

i. A project construction and specification manual must be provided.

9.2 Plan Submittal Checklist

a. Road plan / profile(s).

b. Right-of-way limits should be shown.

c. Lot lines and frontages.

d. Vertical and horizontal curve information must be provided on the plans.

e. Typical road cross-section and curb detail(s) must be provided.

f. Where sidewalks are constructed, handicap accessibility ramps should be provided at all cross walks. An accessibility ramp detail must be provided.

g. Actual road cross-sections must be provided at a minimum of 100-foot intervals.

h. Radii of all intersections must be provided. Complete intersection details must be provided for intersections with existing road(s) and/or as deemed necessary by the Town.

i. Plans must contain actual proposed street names as approved by the Town.

j. Temporary T-turnarounds and end of road markers should be shown on the plans. End of Road marker detail(s) should be provided.

Chapter 10 – Construction and Specification Manual Development Engineering Submittal Guide

10.0 CONSTRUCTON AND SPECIFICATION MANUAL (GENERAL)

A Project Construction and Specification Manual (Project Manual) is required for all Town owned public facility construction, including storm sewers, sanitary sewers, water mains, and roadways.

Project bidding and construction contract administration is the sole responsibility of the Developer and/or their agents. The Town, at the developers cost, will provide all staking, inspections, construction related services (not contract administration), and preparation of record drawings for public improvements.

The Project Manual format and specific agreements / contract with the bidders is left to the Developer's and/or their agents' discretion; However, the following items, at a minimum, must be included in the Project Manual for public infrastructure construction. Standard construction specifications to be used are provided in the Special Provisions.

10.1 Project Manual Requirements

a. Title sheet with official project name, date of preparation, and applicable revision dates. The title sheet must be stamped / sealed by a Registered Wisconsin Professional Engineer.

b. Contract Documents.

c. Insurance requirements.

d. Bid Forms with item quantity schedule. Note: The actual bid costs for public infrastructure shall be provided to the Town prior to infrastructure acceptance.

e. Standard Special Provisions.

f. Project Manual must be comb bound.

STANDARD SPECIAL PROVISIONS

TOWN OF SOMERS
KENOSHA COUNTY, WISCONSIN

Including the following:

Sanitary Sewer
Force Main
Storm Sewer
Water Main
General Construction Procedures
Erosion Control
Site Grading
Road Construction

Appendix

Design Guidelines
Typical Road Sections
Cul-de-Sac Details
Sanitary Sewer Riser Details
HDPE Adjusting Ring Detail
Tracer Wire Detail
Curb Ramp Details

Prepared by:

Crispell-Snyder, Inc.
Professional Consultants

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STANDARD SPECIAL PROVISIONS

TOWN OF SOMERS
KENOSHA COUNTY, WISCONSIN
REVISED: FEBRUARY, 2008

100. CONSTRUCTION MEANS, METHODS, SAFETY, ETC.

A. The Contractor shall be responsible for compliance with all Federal, State and local laws, including OSHA Standards, and with any other applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. The Contractor shall provide all safeguards, safety devices and protective equipment and shall be responsible for initiating, maintaining and supervising all safety precautions and programs utilized by the Contractor and his sub-contractors in the performance of their work and shall take any other actions necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of work on this project.

B. The Contractor shall be responsible for the construction means, methods, techniques or procedures, equipment, and for safety precautions or programs, unless such means and equipment are specified in these Contract Documents, utilized in the performance of work on this project. The Contractor shall comply with Section 108.5, Equipment, Methods and Materials, of the "State Specifications".

101. GENERAL

A. Definition of Work.

1. The work covered by this Contract(s) shall consist of furnishing all labor, equipment, tools, supervision, machinery, supplies and all materials necessary to complete all work shown on the Plans and described in these Special Provisions.

2. Plans.

a. The work is described in these Special Provisions and shown on the Plans identified _____.

3. Plans/Specifications at Project Site.

a. The Contractor shall have a complete set of plans and specifications at the project site at all times. Specifications shall include:

(1) Project manual, including Special Provisions;

(2) "Standard Specifications", if applicable;

(3) "State Specifications";

(4) Other documents pertaining to the project.

B. Specifications.

1. Utility Construction.

a. The "Standard Specifications for Sewer and Water Construction in Wisconsin", Sixth Edition, December 22, 2003, with Addendum No. 1, will govern all utility work performed on this project and hereinafter will be referred to as the "Standard Specifications".

(1) Delete Part I, General Conditions, from the "Standard Specifications".

2. Road Construction.

a. The State of Wisconsin, Department of Transportation, "Standard Specifications for Highway and Structure Construction", 2008 Edition, and all "Interim Supplemental Specifications"; will govern all road work performed on this project and hereinafter will be referred to as the "State Specifications".

(1) Delete Part I, General Requirements and Covenants, from the "State Specifications", except those sections specifically referenced in these contract documents.

(2) All references to the "Department" or "State" (The "Department" of Transportation of the "State" of Wisconsin) shall be interpreted to mean the Owner.

(3) All references to metric unit(s) shall be converted to their nearest whole equivalent Standard unit(s) (U.S. Standard) in accordance with the conversion tables shown in the Appendix of the "State Specifications". Any necessary adjustments or interpretations shall be made by the Engineer.

3. In the event of a discrepancy between these "Special Provisions" and either the "Standard Specifications" or the "State Specifications", these "Special Provisions" shall govern.

4. Copies of the "Standard Specifications for Sewer and Water Construction in Wisconsin", Sixth Edition, may be obtained for $45.00 each, plus $7.50 shipping, upon request to:

   Public Works Industry Improvement Program
   2835 N. Mayfair Road, Suite 35
   Milwaukee, WI 53222

   Phone: (414) 778-1050

5. The "Standard Specifications for Highway and Structure Construction", 2008 Edition, may be viewed for free via the internet at the following website:

   http://roadwaystandards.dot.wi.gov/standards/stndspec/index.htm

6. Hard copies or CDs of the "Standard Specifications for Highway and Structure Construction," 2008 Edition, may be ordered from WisDOT by downloading their order form available at the following website:

   http://roadwaystandards.dot.wi.gov/standards/stndspec/hidden/order/print.htm

C. Staking Line and Grade.

1. The Engineer will provide a one time staking of the project at no expense to the Contractor. Additional staking will be performed by the Engineer at a per diem charge-out rate. Notification of at least two (2) days is required when making periodic requests for line and grade.

D. Alternate Materials.

1. The Contractor may furnish alternate materials in place of those specified in these Special Provisions where "or equal" is stated and when the following provisions have been complied with.

   "If the Contractor wishes to substitute an alternate material as an "equal" to the material specified, he shall first submit a detailed description of such to the Engineer and Owner for their review and approval/disapproval. The Contractor shall not install any alternate materials prior to receiving approval for their use. Only those materials listed in these Special Provisions or approved as alternates may be used on this project."

E. Work Schedule.

1. The Contractor shall complete the work in accordance with the schedule specified in the Agreement. The Contractor shall provide a construction schedule prior to beginning work on this project.

   a. The Contractor shall update his construction schedule (copy to Engineer) on a weekly basis unless approved otherwise by the Engineer.

2. Work Sequence.

   a. Install erosion control devices prior to beginning other work on this project.

   b. Strip all topsoil from within street right-of-ways prior to beginning utility construction.

   c. Optional - rough grade roadways and site grading areas.

   d. Install utilities.

   e. Complete roadway and site grading.

   f. Place salvaged topsoil and complete lawn restoration.

3. New Subdivision Construction Schedule.

   a. First Year of Construction.

      (1) Complete all grading, utility work, base aggregate dense, asphaltic pavement, curb and gutter, and sidewalk (if required), by November 1st of the year that work began.

      (2) Lawn restoration not completed by October lst shall be completed by the following May 15th.

      (3) Prior to placing asphalt, adjust manhole covers and valve boxes to 1/4" below the top of the first layer of asphalt.

      (4) Set catch basins to final grade except catch basin grates located at low points in the roadway shall initially be placed 2 inches low as to provide for drainage of the roadway until the upper layer of asphalt is placed the following year and require only one ring of adjustment to bring to finished grade.

b. Second Year of Construction. (May be Delayed by the Town Board After Review of the Lot Sales and the Number of New Buildings Under Construction.)

(1) Place the final layer of asphaltic pavement by October 15th.

(2) Prior to placing asphalt, install 1-1/2" adjustment ring in manhole frames and adjust valve boxes to 1/4 inch below final grade.

(3) Prior to placing asphalt, adjust catch basins located at low points to final grade.

4. Cold Weather Work.

a. Refer to Section 604 of these Special Provisions for cold weather scheduling.

102. PERMITS

A. Permits and Approvals.

1. DNR Well Permits.

a. The Contractor shall obtain well permits from the Department of Natural Resources if dewatering wells will be installed or operated for which the single or aggregate capacity will be in excess of 70 gallons per minute. Permits must be obtained before well construction can begin.

b. The DNR's address for well permits is as follows:

Wisconsin Department of Natural Resources
Bureau of Drinking Water and Groundwater
Box 7921
Madison, WI 53707

or

Contact: Mark Putra at (608) 267-7649

c. Permit requirements:

(1) The fee for a High Capacity Well (greater than 70 gpm) is $500.00 and must accompany each application.

(2) Any new well on a high capacity well property requires an approval and is subject to the fee.

(3) Global Positioning Satellite (GPS) location data is required for all wells listed on applications.

(4) Temporary dewatering well installations with multiple wells for one project are subject to a single $500.00 fee.

2. Construction Pit Dewatering Discharge Permit.

a. The Contractor shall comply with the provisions of Chapter 283.35, Wisconsin Statutes, regulating the discharge of effluent from construction pit (trench) dewatering. These provisions provide for the removal of suspended solids from dewatering effluent prior to the direct discharge to surface waters or wetlands.

b. The Contractor shall apply to the Department of Natural Resources for a permit to discharge effluent from construction pit dewatering. This discharge may be covered by an existing General Permit for discharging Contaminated Storm Water Runoff/Or Construction Pit Dewatering. Application forms for this permit(s) may be obtained at the address shown below and are available at the Engineer's office.

Wisconsin Department of Natural Resources
2300 North Martin Luther King Jr. Drive
P.O. Box 12436
Milwaukee, WI 53212

B. Easements and Construction License Agreements (Permits).

1. The Owner has obtained the necessary easements and construction license agreements (permits) for construction of the Work. The Contractor shall comply with all of the conditions of these easements/permits. Specific easement terms are either noted on the Plans or listed below.

_____

_____

2. Temporary construction permits include the use of land adjacent to permanent easements as shown on the Plans. The Contractor shall restrict his operations to minimize damage within temporary permit areas and shall be allowed to use only that land which is reasonably necessary to

conduct his work operations. The amount of land to be used shall be as mutually agreed to by the Contractor and Engineer.

3. Tree Removal.

   a. Trees shall not be removed from within easement or temporary construction permit areas unless their removal is approved by the Engineer. The Engineer will mark all trees to be removed from easement and permit areas.

C. Soil Boring Permit/Approval.

1. Contractors shall obtain permission from the Owner prior to performing subsurface investigations. Street opening or highway permits may be required for taking soil borings within streets or highways maintained by Town, County or State highway departments.

   a. The State Department of Transportation requires a Highway Permit (Form E-M-405) including a traffic control plan for performing soil borings within State Highway right-of-way.

2. The Contractor is reminded to contact all utilities, as well as Digger's Hotline, before performing soil boring work.

3. Soil borings shall not be taken within existing pavement or shoulder areas without the Owner's specific approval of same. All boring holes shall be completely filled after the work has been completed.

4. Borehole/Drillhole Abandonment.

   a. All boreholes shall be completely filled after the work has been completed. Drillholes (boreholes) shall be abandoned in accordance with DNR regulations. Chapter NR 112, Wisconsin Administrative Code, defines drillholes as "any excavation or opening . . . deeper than it is wide that extends more than 10 feet below the ground surface."

   b. Section NR 112.26 specifies the procedures to be used in drillhole abandonment. Drillholes shall be filled with acceptable materials as specified in Section NR 112.26(7).

   c. An abandonment form (Form 3300 - 5b or 5w) shall be submitted to the appropriate DNR District office for each abandoned drillhole within 30 days of completion of the work.

103. NOTIFICATION OF UTILITIES

A. Utility Location and Coordination.

1. The locations of utilities shown on the Plans are from existing records and/or field locations and may not be complete or accurate. The Contractor shall contact Digger's Hotline at (800) 242-8511, as well as other utilities not served by Digger's Hotline but having facilities in the work area, at least three (3) full business days prior to construction to notify the utilities to locate their underground facilities.

2. A preconstruction meeting will be held, if required, to coordinate the work operations of the Contractor and the utility companies and resolve any conflicts that may exist.

B. Utility Protection.

1. It shall be the responsibility of the Contractor to protect all utilities that are encountered in his work operations. The Contractor shall contact utilities to determine their procedure and schedule for supporting and/or relocating poles and shall notify any above ground utility such as electric and telephone companies to relocate or reinforce any poles, ties or anchors which may be on or near the line of the proposed utility or weakened by excavation for the proposed utility or within road construction grading limits. All costs of protecting existing utilities; such as tunneling, sheathing, bracing or relocation including utility company bracing and relocation charges shall be considered incidental to utility construction.

C. Utility Contacts.

1.	Digger's Hotline	(800) 242-8511
a.	We Energies - Gas Operations Attn: Randy Chase	(262) 552-3241
b.	AT&T Attn: Michael Toyek	(262) 636-0549
c.	We Energies - Electric Attn: Steve Kern	(262) 552-3279
d.	Time Warner Attn: Rob Detert	(414) 277-4280
e.	Qwest Communications Attn: Lamar Lampkins	(414) 416-5191

f.	Sprint Attn: Mike Ball	(920) 251-6632
g.	AT&T Long Distance Attn: Rich Schrank	(262) 521-7765
h.	AT&T Local Network Services Attn: John Kotz	(414) 290-9827
i.	ANR Attn: Larry Huber	(920) 477-2235
j.	American Transmission Co. (ATC) Attn: Dan Wagner	(262) 506-6987
2.	Town of Somers: Attn: George Stoner, Public Works Supt.	(262) 859-2822
3.	Kenosha Water Utility: Attn: Robert Carlson Director of Engineering	(262) 653-4310
4.	Kenosha County: Attn: Gary Sipsma Director of Division of Highways	(262) 857-1870
5.	Wisconsin Department of Transportation: Attn: Andy Maxwell Permit Coordinator	(262) 521-5344
6.	Wisconsin DOT Utility Locate	(262) 266-1155

104. SUBSURFACE SOIL INVESTIGATION DATA

A. Subsurface soil investigations have been performed by _____ _____. Copies of this information are available to Bidders upon request and are on file for inspection at locations indicated in the Official Notice to Bidders.

Note: If soils data is available, it will be so noted in the Special Conditions.

B. There is no expressed or implied guarantee by Owner, Engineer, or the Soil Testing Consultants as to the accuracy or adequacy of the subsurface soil investigations nor of the interpretation thereof. Each Bidder must form his own opinion of the character of the materials which will be encountered from an

inspection of the ground, from his own interpretation of the soil boring information and from such other investigations that he may wish to employ. The subsurface soil investigation data shall be considered as a reference only and is not a part of the Contract Documents.

105. SEWER AND WATER SERVICE DISRUPTION (NOTIFICATION OF PROPERTY OWNERS)

A. The Contractor shall notify the Owner at least six (6) days prior to shutting off any sewer or water service to allow the Owner time to notify affected properties at least four (4) business days (excluding weekends and holidays) prior to shutting off the service. Coordinate the work schedule with the Owner in order to minimize inconvenience and disruption caused by the temporary discontinuance of water service. The Owner will contact/notify all property owners whose sewer or water service will be temporarily shut off as a result of Contractor's operations. The Contractor shall not interfere with functions previously scheduled by individuals, businesses, or institutions.

1. Refer to Subsection 201.C.5 of these Standard Special Provisions for restrictions in the disruption of sewer service.

2. Refer to Subsection 501.J.2 of these Standard Special Provisions for restrictions in the disruption of water service.

201. SANITARY SEWER CONSTRUCTION

A. Bedding and Cover Material.

1. Sanitary sewer bedding and cover material shall conform to the appropriate sections of the "Standard Specifications", as specified and/or modified below:

a. PVC pipe and FRPM pipe - Section 3.2.6(i), as modified below (Note that the bedding section is essentially Class "B" Bedding including placing a minimum of 12 inches of cover material over the top of the pipe.):

(1) Crushed pea gravel will not be allowed for use as bedding material. Cover material shall be the same material as used for bedding and shall conform to Section 8.43.2(a).

(2) Delete the following sentence from Paragraphs 3.2.6(b)2. and 3.2.6(i)1.:

"If crushed stone chips or other materials conforming to Section 8.43.2(a) are used as cover material, no compaction or staging is required."

(3) Placement and Compaction.

(a) Place bedding material to the springline of the pipe and compact prior to placing cover material. Compaction of bedding material at the level of the pipe springline shall include working bedding material under the haunches of the pipe using shovels or other suitable methods. The Contractor shall take care to completely work bedding material under the haunches of the pipe to provide adequate side support.

(b) Place and compact cover material in one or more lifts after compacting bedding material. Place a minimum of 12 inches of cover material over the pipe.

(c) Refer to Subsection 607.B of these Special Provisions for requirements for recompacting Class "B" bedding disturbed by trench boxes.

2. Limestone Bedding Material.

a. Amend Section 8.43.2(a) of the "Standard Specifications" to read in part:

"Crushed stone chips, bedding material, shall be made from crushing sound limestone only."

B. Laterals.

1. Connections to the Main Sewer.

a. Building sewer (lateral) connections to the main sewer 18″ in diameter or less shall be made with wyes except as noted below. The ends of laterals shall be plugged in accordance with Paragraph 3.2.5(f) of the "Standard Specifications".

(1) All lateral connections to new flexible pipe shall be made with factory fabricated or injection molded in-line wyes unless otherwise approved by the Engineer.

b. Place wyes at a typical vertical angle of 45° to the horizontal except install wyes flat or level when the Plans state to install laterals as low as possible.

c. Building sewer (lateral) connections to main sewer 21″ diameter and larger shall be made with INSERTA-TEE brand three-piece service connection or approved equal.

2. Bore Laterals Under Existing Roadways.

a. Sanitary sewer laterals shall be installed by boring under existing pavement and shoulder areas.

3. Grade.

a. Install sewer laterals at a typical 2.08% (1/4″/ft.) grade unless shown otherwise on the Plans. Minimum lateral grade is 1.04% (1/8″/ft.).

4. Marker Stakes.

a. The Contractor shall furnish and install a marker stake over the end of each lateral installed. The marker shall be a minimum 2″ x 4″ x 4′ wooden plank or as approved by the Engineer. The marker shall be placed vertically with its top flush with the surface grade. Place a spike or other durable magnetic material in the top of the marker stake to aid in future relocation.

(1) New Subdivisions and Industrial Parks. Place two marker stakes at the end of each lateral installed. Bury one stake vertically with its bottom at the top of the sewer bedding material and place the second stake as indicated above.

(2) Place marker stakes over the top of risers where laterals will be constructed in the future. Place the top of stakes 3 feet below the surface grade.

5. Risers.

a. Shallow Sewers.

(1) Use the following methods for constructing risers up to 6 feet in height and/or for mains not exceeding 16 feet in depth measured from the flowline of the sewer.

(a) Flexible Riser to Flexible Sewer Main 8″ Through 18″ Diameter (Shallow Sewers).

1) Risers on shallow flexible gravity sewer mains shall be constructed of flexible gravity sewer pipe in accordance with File No. 10E of the "Standard Specifications".

2) Riser connections shall be made with factory fabricated or injection molded in-line tees. Do not use saddles for riser connections.

(b) Flexible Riser to Flexible Sewer Main 21″ Diameter and Larger (Shallow Sewers).

1) Risers on shallow flexible gravity sewer shall be connected to the main with INSERTA-TEE brand three-piece service connection or approved equal. The service connection shall include a PVC hub conforming to the requirements of ASTM D3034-SDR 26, rubber sleeve conforming to ASTM C477, and stainless steel band. Refer to the detail in the Appendix.

b. Deep Sewers.

(1) Use the following methods for constructing risers greater than 6 feet in height and/or for mains exceeding 16 feet in depth measured from the flowline of the sewer.

a) Flexible Riser to Flexible Sewer Main (Deep Sewers).

1) Risers on deep flexible gravity sewer mains shall be constructed of flexible gravity sewer, ASTM 3034-SDR 26, encased within a corrugated polyethylene drainage tubing conforming to ASTM F405 in accordance with the details in the Appendix.

a On sewer sizes 8″ through 18″, riser connections shall be made with factory fabricated or injection

molded in-line tees. The use of saddles is not allowed.

b On sewer 21″ in diameter and larger riser connections shall be made with INSERTA-TEE brand service connection or approved equal. The service connection shall include a PVC hub conforming to the requirements of ASTM D3034-SDR 26, rubber sleeve conforming to ASTM C477 and stainless steel band. Refer to the detail in the Appendix.

b) Flexible Pressure Pipe Riser to Rigid Tee Installed on Flexible Main (Deep Sewers).

1) Risers on deep flexible gravity sewer mains shall be constructed of flexible pressure pipe connected to a rigid tee in accordance with the details in the Appendix.

c) Flexible Riser to Flexible Main (Deep Sewers).

1) Risers on deep flexible gravity sewer mains (diameters of 15″, 18″, 21″ and 27″) shall be constructed of flexible gravity sewer pipe encased within a corrugated polyethylene drainage tubing conforming to ASTM F405 in accordance with the details in the Appendix.

a) Also, use this riser method only for 15″, 18″, 21″ and 27″ sewer mains. Use Method (b) above whenever ductile iron tees are available.

2) Riser connections shall be made with injection molded in-line tees (if available) or with factory fabricated PVC tees where injection molded tees are not available.

d) Flexible Riser to Flexible Sewer Main - 1:1 Slope (Shallow and Deep Sewers).

1) Install risers using flexible gravity sewer pipe, ASTM D-3034, SDR 35, on a 1:1 slope in accordance with the details in the Appendix.

2) Note that this method may be used for both shallow and deep sewers.

e) Rigid Riser to Rigid Main.

1) Risers on rigid concrete mains shall be constructed of rigid concrete pipe in accordance with File No. 10A of the "Standard Specifications".

2) All riser connections shall be made with factory fabricated tees.

6. Cleanouts.

a. All laterals exceeding 100 feet in length shall have cleanouts installed on them. Cleanouts shall be placed at 100 foot maximum spacings as shown on the Plans or as directed by the Engineer. They shall be constructed in accordance with the details shown on the Plans.

C. Connections to Existing Sewers and Manholes.

1. Sewer Stub Connections.

a. Sewer connections to existing sewer stubs of different type of material or joint shall be made with approved watertight adaptors.

2. Manhole Connections.

a. Sewer connections to existing manholes shall be made in accordance with Section 3.5.7 of the "Standard Specifications". Field tapped holes for connecting sewer pipe to manholes shall be made by coring the manhole except that connections to brick or block manholes may be made by punching out the opening. Flexible pipe connections shall be made with flexible watertight connectors, Kor-N-Seal, Link-Seal or equal. All clamps, bolts, etc. of pipe to manhole seals shall be stainless steel. If Link-Seal

connectors are used, the bolt heads shall be placed on the inside of manholes.

b. Form a new flow line(s) in the existing manhole(s) in accordance with File No. 13 of the "Standard Specifications".

3. Plug Downstream Manhole.

a. Place temporary plugs in all downstream (receiving) manholes to prevent groundwater and debris from entering the existing sewer system.

4. Lateral Connections.

a. Lateral connections to existing sewers shall be made with INSERTA-TEE brand three-piece service connection or approved equal. The service connection shall include a PVC hub conforming to the requirements of ASTM D3034-SDR 26, rubber sleeve conforming to ASTM C477, and stainless steel band.

5. Sewer Service Disruption.

a. Sanitary sewer service to properties directly affected by construction shall not be shut down or interrupted: 1) for a period longer than four (4) hours; 2) between the hours of 4:30 p.m. to 8:00 a.m.; or 3) on weekends without the Owner's permission.

b. Refer to Section 105 of these Standard Special Provisions for sewer service disruption notification requirements.

D. Pipe Flotation.

1. Pipes installed below the groundwater elevation shall be protected against flotation. The Contractor shall lower the groundwater elevation until after adequate cover has been placed to secure pipes.

E. Insulation.

1. Sewer lines shall be insulated where noted on the Plans and wherever the depth of cover is less than five (5) feet when so ordered by the Engineer. Insulation shall be in accordance with Chapter 4.17.0 of the "Standard Specifications" and the details on the Plans.

F. Deflection Testing.

1. Polyvinyl chloride (PVC) sewer pipe shall be deflection tested with an approved go-no-go acceptance testing device. The test shall not be conducted until after all backfill has been placed and consolidated and after riser pipes and sewer laterals have been installed. The entire length of sewer pipe shall be tested.

   a. PVC pipe shall be deflection tested in accordance with Paragraph 3.2.6(i)4. of the "Standard Specifications", as amended below:

      (1) PVC pipe shall not be deflection tested until at least 14 days after all backfill has been placed, including backfilling of laterals and risers. Initial deflection testing shall be done using a 95% mandrel. The use of a 92.5% testing device will not be allowed for initial testing regardless of the time elapsed after backfilling.

      (2) All sections failing to pass the test shall be repaired and retested, however, if at least 30 days have elapsed since the pipe was placed and backfilled, the Contractor will be allowed to retest the sewer line using a 92.5% mandrel.

2. Mandrels.

   a. Go-no go mandrels shall conform to the requirements of File No. 30 and 30A of the "Standard Specifications".

G. Leakage Testing.

1. Low Pressure Air Test.

   a. Amend Paragraph 3.7.1 of the "Standard Specifications" to read in part: "Sanitary sewers less than or equal to 36 inches in diameter shall be tested for leakage using the low pressure air test. The length of laterals included in the test section shall be included in determining the test time."

2. Water Infiltration or Exfiltration Tests.

   a. Sanitary sewers greater than 36 inches in diameter shall be tested for leakage using either the water infiltration or the water exfiltration test depending upon the groundwater level in accordance with Chapter 3.7.0 of the "Standard Specifications".

H. Sewer Stub Inspection.

1. All sewer stubs shall be visually inspected by lamping. Long sewer stubs shall be lamped from both ends of the pipe as required.

2. The pipe shall be inspected for leakage, excessive deflection, offset joints, or any other unacceptable condition. The Contractor shall furnish an adequate light and provide safe access to both ends of the pipe. All leaking joints and other defects shall be corrected. All costs associated with correcting any unacceptable conditions shall be paid for by the Contractor.

3. Existing Stubs.

a. The Contractor shall inspect existing stubs as specified in Paragraphs 1 and 2 above.

b. In addition to the visual inspection, the Contractor may test the existing stub(s) for leakage and deflection to insure that defects in the existing stub do not adversely affect the testing of the new adjoining sewer. Note that existing stubs will be tested with the new sewer when the new sewer line is tested.

I. Televising Sewers.

1. The Contractor shall televise all sewers after successfully completing deflection and leakage testing.

2. The Contractor shall provide the Owner with a copy of the videotape and a written report by the video contractor. The report shall indicate all defects (i.e.; bad joints, cracked pipe, infiltration, standing water, etc.) and shall list locations of all laterals.

3. All defects shall be corrected and any dirt, gravel or foreign material removed from the sewer prior to acceptance by the Owner.

205. SANITARY SEWER MATERIALS

A. Sanitary sewer pipe material shall be polyvinyl chloride (PVC) or "Fiberglass" Reinforced Polymer Mortar (FRPM) pipe conforming to the following:

1. Polyvinyl chloride (PVC) sewer pipe (4 inch through 15 inch diameter) meeting the requirements of ASTM D3034, SDR 35, with a minimum pipe stiffness of 46 psi and having integral bell type flexible elastomeric joints meeting the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. PVC material shall have a cell

classification of 12454B, 12454C, 12364C or 13364B, except that 12364C and 13364B shall have a minimum modulus of elasticity of 500,000 psi. (Option: SDR 26 with a minimum pipe stiffness of 115 psi.)

a. Lateral and riser pipe shall be 4″ diameter meeting the requirements of ASTM D3034-SDR 26 as called for on the details included in the Appendix or on the Plans.

2. Polyvinyl chloride (PVC) large diameter solid wall sewer pipe (18 inch through 42 inch diameter) meeting the requirements of ASTM F679, wall thickness T-1 (SDR 35), with a minimum pipe stiffness of 46 psi and having integral bell type flexible elastomeric joints meeting the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. PVC material shall have a minimum cell classification of 12454C or 12364C and a minimum modulus of elasticity of 500,000 psi.

a. Lateral pipe material shall conform to the requirements of paragraph 1.a. above.

3. Polyvinyl chloride (PVC) large diameter solid wall pipe (14 inch through 48 inch diameter) meeting the requirements of AWWA C905, DR-41, having a minimum pipe stiffness of 46 psi and having integral bell type flexible elastomeric joints meeting the requirements of ASTM D3139, PVC material shall have a minimum cell classification of 12454B. Pipe material supplied under this specification shall not be colored blue. If colors other than blue are not available from the manufacturer, the word "SEWER" in 3″ block letters shall be stenciled along the barrel of the pipe at intervals of not more than 4 feet.

a. Lateral pipe material shall conform to the requirements of paragraph 1.a. above.

4. "Fiberglass" Reinforced Polymer Mortar Pipe for gravity sewer service (12 inch through 102 inch diameter) meeting the requirements of ASTM D3262 for "Fiberglass" sewer pipe, ASTM D4161 for "Fiberglass" pipe joints using flexible elastomeric seals and ASTM D2412 for Standard Test Method for determination of external loading characteristics of plastic pipe by parallel plate loading. The pipe supplied for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 36 psi for pipe installed by direct bury methods and not less than 140 psi for pipe to be installed by augering and jacking.

a. Certified copies of test reports of pipe of similar size and design and manufactured and tested at the same plant as will manufacture

the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

b. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

c. Lateral pipe material shall conform to the requirements of paragraph 1.a. above.

B. Well Protection.

1. Sanitary sewer pipe material located within 25 to 50 feet of private wells or within 50 to 200 feet of public wells, as shown on the Plans or as directed by the Engineer, shall be pressure pipe as specified below. The pressure pipe shall be PVC pipe.

a. Polyvinyl chloride (PVC) pressure pipe conforming to AWWA C-900, Class 150, DR-18, or AWWA C905, P.R. 235, SDR-18, with integral elastomeric bell and spigot joints.

b. Main line wye and tee connections shall be pressure pipe, but laterals and risers may be constructed of gravity sewer pipe materials.

c. Laterals.

(1) Sanitary sewer lateral pipe material within 8 to 25 feet of private wells shall be plastic sewer pipe conforming to the requirements for PVC sewer pipe of this Section of the Special Provisions.

2. Installation.

a. Private Wells.

(1) The pressure pipe shall be installed within the limits shown on the Plans where sewers pass within 25 to 50 feet of private wells.

b. Public Wells.

(1) The pressure pipe shall be installed from manhole to manhole (entire manhole section) on manhole sections passing within 50 to 200 feet of public wells.

(2) The pressure pipe shall be tested for leakage using a combination leak/pressure test in accordance with Chapter 4.15.0 of the "Standard Specifications". The minimum test pressure shall be 50 psi.

205.1. SANITARY SEWER MATERIAL FOR DIRECTIONAL DRILLING

A. Polyvinyl chloride (PVC) sanitary sewer meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (16 inch diameter) with restraining jointing systems and with built-in sealing gaskets. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be CERTA-LOCK C900/RJ or C905/RJ by Certain Teed, Terra Brute by IPEX, or approved equal.

2. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment and his methods of operation.

AWWA C900 (Jointed)

Size	DR	Pressure Class[1]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
4″	14	200 psi	.343″	4.800″	5.964″	100′	10.0%	8,000 lbs.	10,300 lbs.
6″	14	200 psi	.493″	6.900″	8.366″	150′	6.7%	9,300 lbs.	14,700 lbs.
8″	14	200 psi	.646″	9.050″	10.947″	200′	5.0%	18,900 lbs.	28,800 lbs.
10″	14	200 psi	.793″	11.100″	13.361″	250′	4.0%	24,900 lbs.	38,300 lbs.
12″	14	200 psi	.943″	13.200″	15.836″	300′	3.3%	28,300 lbs.	48,300 lbs.
4″	18	150 psi	.267″	4.800″	5.964″	100′	10.0%	6,700 lbs.	8,200 lbs.
6″	18	150 psi	.383″	6.900″	8.366″	150′	6.7%	9,000 lbs.	12,800 lbs.
8″	18	150 psi	.503″	9.050″	10.947″	200′	5.0%	18,000 lbs.	25,200 lbs.
10″	18	150 psi	.617″	11.100″	13.361″	250′	4.0%	25,600 lbs.	35,200 lbs.
12″	18	150 psi	.733″	13.200″	15.836″	300′	3.3%	26,440 lbs.	41,100 lbs.

AWWA C905

Size	DR	Working Pressure Rating[2]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
16″	18	235 psi	0.967″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.
16″	25	165 psi	0.696″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.

[1] 2-1/2:1 safety factor based on working pressure + surge allowance at 2 f.p.s.

[2] 2:1 safety factor based on working pressure only

3. The maximum job site pull-in force shall not exceed the values given in the above table.

B. Polyvinyl chloride (PVC) pipe meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (14 inch through 48 inch diameter) with thermal butt fused joints between pipe sections. Joint gaskets shall not be required. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be Fusible C900, Fusible C905, or Fusible PVC by Underground Solution, Inc., or approved equal.

2. Pipe used for sanitary sewer shall be colored green.

3. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment, and his methods of operation.

AWWA C900, C905 PVC Pipe D.I.P. O.D. (Fusible)						
Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	14[1]	4.80″	.34″	4.11″	100′	13,400
6″	14[1]	6.90″	.49″	5.91″	144′	27,600
8″	14[1]	9.05″	.65″	7.76″	188′	48,000
10″	14[1]	11.10″	.79″	9.51″	232′	71,600
12″	14[1]	13.20″	.94″	11.31″	275′	101,000
14″	14[2]	15.30″	1.09″	13.12″	319′	136,000
16″	14[2]	17.40″	1.24″	14.92″	363′	176,000

[1] Pressure Class = 200 PSI
[2] Working Pressure Rating = 300 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	18[3]	4.80″	.27″	4.27″	100′	10,600
6″	18[3]	6.90″	.38″	6.13″	144′	21,700
8″	18[3]	9.05″	.50″	8.05″	188′	37,600
10″	18[3]	11.10″	.62″	9.87″	232′	57,100
12″	18[3]	13.20″	.73″	11.73″	275′	80,000
14″	18[4]	15.30″	.85″	13.60″	319′	108,000
16″	18[4]	17.40″	.97″	15.46″	363′	140,000
18″	18[4]	19.50″	1.08″	17.34″	406′	175,000
20″	18[4]	21.60″	1.20″	19.20″	450′	215,000
24″	18[4]	25.86″	1.43″	22.94″	538′	306,000

[3] Pressure Class = 150 PSI

[4] Working Pressure Rating = 235 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	25[5]	4.80″	.19″	4.42″	100′	7,700
6″	25[5]	6.90″	.28″	6.35″	144′	16,300
8″	25[5]	9.05″	.36″	8.33″	188′	27,500
10″	25[5]	11.10″	.44″	10.21″	232′	41,100
12″	25[5]	13.20″	.53″	12.15″	275′	59,000
14″	25[6]	15.30″	.61″	14.08″	319′	78,800
16″	25[6]	17.40″	.70″	16.00″	363′	102,000
18″	25[6]	19.50″	.78″	17.90″	406′	128,000
20″	25[6]	21.60″	.86″	19.88″	450′	156,000
24″	25[6]	25.80″	1.03″	23.74″	538′	224,000
30″	25[6]	32.00″	1.28″	29.44″	667′	345,000
36″	25[6]	38.30″	1.53″	35.24″	798′	494,000

[5] Pressure Class = 100 PSI

[6] Working Pressure Rating = 165 PSI

Size	DR[7]	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
24″	32.5[7]	25.80″	.80″	24.20″	538′	175,000
30″	32.5[7]	32.00″	.98″	30.04″	667′	267,000
36″	32.5[7]	38.30″	1.18″	35.94″	798′	385,000
42″	32.5[7]	44.50″	1.37″	41.60″	927′	518,000

[7] Working Pressure Rating = 125 PSI

Size	DR[8]	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
30″	41[8]	32.00″	.78″	30.44″	667′	214,000
36″	41[8]	38.30″	.93″	36.44″	798′	305,000
42″	41[8]	44.50″	1.09″	42.20″	927′	415,000
48″	41[8]	50.80″	1.24″	48.20″	1,058′	539,000

[8] Working Pressure Rating = 100 PSI

Size	DR[9]	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
42″	51[9]	44.50″	.87″	42.60″	927′	333,000
48″	51[9]	50.80″	1.00″	48.70″	1,058′	437,000

[9] Working Pressure Rating = 80 PSI

*Safe Pull Force - Fusible PVC Pipe AWWA C900 and C905.

a. Minimum tensile capability of pipe = 7,000 psi (AWWA)

b. Safe Pull Stress = $\frac{7{,}000 \text{ psi}}{2.5 \text{ F.S.}}$ = 2,800 psi

c. Safe Pull Force = Cross Sectional Area of Pipe in square inches times safe pull stress rounded down.

d. Cross Sectional Area of Pipe = $\frac{\text{O.D.} + \text{I.D.}}{2} \times \pi \times T$

4. The maximum job site pull-in force shall not exceed the values given in the above tables.

C. High density polyethylene (HDPE) sanitary sewer (4 inch through 54 inch diameter) shall meet the requirements of AWWA C906. Pipe material shall have a cell classification of PE 3408 (345434C) as specified in ASTM D3350.

1. Pipe material specified for this project shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating (working pressure rating) appropriate to the job site conditions, the capability of his pull-in equipment and his methods of operation.

AWWA C906; PE PIPE, MATERIAL CLASS PE 3408, D.I.P. O.D.

Size	DR[1]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	7.3	4.80″	0.658″	3.37″	8,600
6″	7.3	6.90″	0.945″	4.85″	17,900
8″	7.3	9.05″	1.240″	6.36″	30,900
10″	7.3	11.10″	1.521″	7.80″	46,400
12″	7.3	13.20″	1.808″	9.28″	65,600
14″	7.3	15.30″	2.096″	10.75″	88,200
16″	7.3	17.40″	2.384″	12.23″	114,000
18″	7.3	19.50″	2.671″	13.71″	143,000
20″	7.3	21.60″	2.959″	15.18″	175,000
[1] Working Pressure Rating = 255 psi					

Size	DR[2]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	9	4.80″	0.533″	3.69″	7,250
6″	9	6.90″	0.767″	5.31″	14,900
8″	9	9.05″	1.006″	6.96″	25,700
10″	9	11.10″	1.233″	8.53″	38,800
12″	9	13.20″	1.467″	10.15″	54,800
14″	9	15.30″	1.700″	11.76″	73,700
16″	9	17.40″	1.933″	13.38″	95,300
18″	9	19.50″	2.167″	14.99″	119,700
20″	9	21.60″	2.400″	16.61″	146,900
[2] Working Pressure Rating = 200 psi					

Size	DR[3]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	11	4.80″	0.436″	3.89″	6,000
6″	11	6.90″	0.767″	5.31″	12,500
8″	11	9.05″	0.823″	7.34″	21,500
10″	11	11.10″	1.009″	9.00″	32,400
12″	11	13.20″	1.200″	10.70″	45,900
14″	11	15.30″	1.391″	12.41″	61,600
16″	11	17.40″	1.582″	14.11″	79,800
18″	11	19.50″	1.773″	15.81″	100,000
20″	11	21.60″	1.964″	17.52″	122,000
24″	11	25.80″	2.345″	20.92″	175,000
[3] Working Pressure Rating = 160 psi					

Size	DR[4]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	13.5	4.80″	0.356″	4.06″	5,000
6″	13.5	6.90″	0.511″	5.84″	10,400

Size	DR[4]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
8″	13.5	9.05″	0.674″	7.66″	17,900
10″	13.5	11.10″	0.822″	9.39″	26,900
12″	13.5	13.20″	0.978″	11.17″	38,100
14″	13.5	15.30″	1.133″	12.94″	51,200
16″	13.5	17.40″	1.289″	14.72″	66,200
18″	13.5	19.50″	1.444″	16.50″	83,100
20″	13.5	21.60″	1.600″	18.27″	102,000
24″	13.5	25.80″	1.911″	21.82″	145,000
30″	13.5	32.00″	2.370″	27.02″	223,000
36″	13.5	38.30″	2.837″	32.62″	320,000
[4] Working Pressure Rating = 130 psi					

Size	DR[5]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
16″	17	17.40″	1.024″	15.27″	53,400
18″	17	19.50″	1.147″	17.11″	67,100
20″	17	21.60″	1.271″	18.96″	82,300
24″	17	25.80″	1.518″	22.64″	117,000
30″	17	32.00″	1.882″	28.08″	180,000
36″	17	38.30″	2.253″	33.62″	258,000
42″	17	44.50″	2.618″	39.06″	349,000
48″	17	50.80″	2.988″	44.59″	455,000
54″	17	57.10″	3.359″	50.12″	575,000
[5] Working Pressure Rating = 100 psi					

Size	DR[6]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
30″	21	32.00″	1.524″	28.83″	148,000
36″	21	38.30″	1.824″	34.48″	212,000
42″	21	44.50″	2.119″	40.06″	286,000
48″	21	50.80″	2.419″	45.73″	373,000
54″	21	57.10″	2.719″	51.40″	471,000
[6] Working Pressure Rating = 80 psi					

Size	DR[7]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
30″	26	32.00″	1.231″	29.44″	120,000
36″	26	38.30″	1.473″	35.18″	172,000
42″	26	44.50″	1.712″	40.88″	233,000
48″	26	50.80″	1.954″	46.66″	304,000
54″	26	57.10″	2.196″	52.45″	384,000
[7] Working Pressure Rating = 65 psi					

Size	DR[8]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
30″	32.5	32.00″	0.985″	29.95″	97,000
36″	32.5	38.30″	1.178″	35.77″	139,000
42″	32.5	44.50″	1.369″	41.56″	188,000
48″	32.5	50.80″	1.563″	47.44″	245,000
54″	32.5	57.10″	1.757″	53.33″	310,000
[8] Working Pressure Rating = 50 psi					

*The Maximum Pull-In Force is determined by the following formula:

$MPF = F \cdot T \cdot \pi \cdot D^2 \cdot (1/DR - 1/DR^2)$

Where, MPF = Maximum Pull-In Force, Lbs.
F = Time Under Tensile Load and Safety Factor (0.35 - dimensionless)
T = Tensile Yield Strength, psi (minimum 2,900 @ 80°F per AWWA C906)
π = Pi (3.14159)
D = Outside Diameter of Pipe, Inches
DR = Dimension Ratio

2. The maximum job site pull-in force shall not exceed the values given in the above table.

3. Fusable Pipe Joints.

   a. Fusable pipe and fittings shall be joined by the butt fusion joining method. The butt joining shall be performed by an experienced and qualified operator using materials and techniques recommended by the pipe manufacturer.

   b. Lateral connections shall be made with saddles of the appropriate sizes. Adaptors for connection to existing lateral material shall be provided.

4. Upon completion of pull-ins, Contractor shall wait 24 hours for polyethylene pipe or 4 hours for PVC pipe to allow the pipe to stabilize prior to making connection thereto or backfilling the boring and/or receiving pit.

5. Pipe fittings shall be manufactured of the same material as specified for pipe.

D. Fiberglass Reinforced Polymer Mortar Pipe for pressure sewer service, 12″ through 102″ diameter, meeting the requirements of AWWA C950 for "Fiberglass" pressure pipe, Class 250, and ASTM D2412 for Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by parallel plate loading. The pipe supplied for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 46 psi. Joints on pipe supplied on this project shall

conform to the dimensional requirements of AWWA C110 and AWWA C111 for mechanical joint and "push-on" joint cast iron and ductile iron fittings which shall be supplied on this project.

1. Certified copies of test reports of pipe of similar size and design and manufactured at the same plant as will manufacture the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

2. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

E. Tests.

1. Pipe material delivered for use on this project shall conform to the requirements of the appropriate AWWA and ASTM Specifications noted herein. All pipe shall be marked in accordance with the requirements of the cited Specifications and each load delivered to the job site shall be accompanied by the manufacturer's certification of such compliance. Said certification to be delivered to the Engineer or his representative.

210. SANITARY MANHOLES

A. Standard Manhole.

1. Sanitary manholes shall be constructed in accordance with Chapter 3.5.0 and File Nos. 12, 12A, 13, and 15 of the "Standard Specifications" and these Special Provisions.

a. Poured Manhole Base.

(1) All manhole bases (benches) shall be poured in place in accordance with Subsection 3.5.5(b) of the "Standard Specifications". Precast manhole bases or precast integral base units will be allowed in accordance with Subsection 3.5.5(c), however, no precast base units with preformed benches are allowed. All manhole benches shall be poured in place.

2. Manholes shall be precast 48 inch inside diameter with eccentric cones.

a. Adjusting Rings.

(1) A minimum of 4 inches to a maximum of 19 inches of adjusting rings shall be furnished for each manhole, unless

shown otherwise on the Plans. (Note: Type II Manholes - 3 inches minimum of rings is acceptable.)

(2) Furnish manholes to minimize the chimney height required, so that chimney seal extensions will not be required. Note that a standard 9 inch seal covers a 6-1/2 inch chimney height.

(3) Material.

(a) Adjusting rings shall be injection molded High Density Polyethylene (HDPE) adjustment rings as manufactured by Ladtech, Inc., Lino Lakes, Minnesota, or equal. Concrete adjusting rings shall not be used.

(b) Install HDPE adjusting rings per the manufacturer recommendations included in the Appendix.

b. Manhole depths shown on the Plans are approximate only, unless the cover elevation is indicated. Manhole covers shall be placed to match the existing grade unless the finished elevation is shown on the Plans.

(1) Place manhole covers 1/4 inch below the pavement grade in streets.

(2) During the first year of construction, adjust the manhole covers to 1/4 inch below the top of the lower layer of asphalt.

(3) During the second year of construction, install 1-1/2 inch cast iron adjustment rings in manhole frames to place the cover 1/4 inch below the finish pavement grade. Coat the receiving portion of the manhole frame with trowelable butyl rubber sealant prior to installing rings.

3. Manhole Frames and Covers.

a. Manhole frames and covers shall be Neenah R-1580 with Type "B" self-sealing lids, non-rocking, or equal.

B. Frame/Chimney Joints.

1. Type I.

a. All sanitary manholes located within asphaltic or concrete pavements and/or as shown on the Plans and all waterproof manholes shall be constructed with Type I frame/chimney joints. Type I joints shall consist of the following:

(1) The manhole frame shall be set on a bed of non-shrink grout, 3/4 inch minimum thickness, extending the full width of and continuously around the top of the chimney. The inner and outer faces of the mortar joint shall be trowel finished.

(a) Non-shrink grout shall be a premixed, non-metallic, cementitious, controlled expansion, high strength, versatile grout; Penngrout by IPA Systems, Inc. or equal.

(2) Adjusting rings shall be set with butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface area of the top of cone and all adjusting rings, except as specified in Paragraph (1) above. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

(3) External Chimney Seal.

Type I joints shall be provided with an external manhole chimney seal as manufactured by Cretex Specialty Products, Waukesha, Wisconsin; NPC, Inc., Milford, New Hampshire; Adaptor Inc., West Allis, Wisconsin; Wrapidseal, CCI Pipeline Systems, LLC; or equal. The external manhole seal shall be installed in accordance with the manufacturer's instructions.

(a) Furnish and install manhole seals to span (cover) the entire chimney height. Provide extensions as required.

(b) A triple layer of eight (8) mil polyethylene wrap shall be applied around the manhole from the top of the frame to a minimum depth of 84 inches. The wrap shall extend at least 18 inches below the cone section. The wrap shall be applied as a bag or a

sheet wrapped around the manhole in a continuous manner with seams bonded with waterproof tape.

1) Polyethylene wrap shall be applied after and over the external chimney seal.

2. Type II.

a. All sanitary manholes located within road shoulders and terraces and at other areas not specified for Type I joints shall be constructed with Type II frame/chimney joints. Type II joints shall consist of the following:

(1) Adjusting rings and manhole frames shall be set with butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface areas of the top of cone and all adjusting rings. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

(2) A triple layer of eight (8) mil polyethylene wrap shall be applied around the manhole from the top of the frame to a minimum depth of 84 inches. The wrap shall extend at least 18 inches below the cone section. The wrap shall be applied as a bag or a sheet wrapped around the manhole in a continuous manner with seams bonded with waterproof tape.

3. Cone/Ring Dimensions.

a. Manhole Cone Sections.

(1) The top dimensions of cone sections shall be either 24 inches inside diameter by 36 inches outside diameter or 26 inches inside diameter by 38 inches outside diameter.

(2) The outside diameter of the top of the cone section shall be as large as or larger than the base flange of the manhole casting.

b. Adjusting Rings.

(1) Adjusting ring dimensions shall match the dimensions of the top of the cone section; either 24″ x 36″ or 26″ x 38″.

(2) Adjusting rings shall have flat or even bearing surfaces providing bearing contact over the entire contact surfaces.

(3) Adjusting rings shall be as specified in Subsection 210.A.2.a(3)(a) of these Special Provisions, except the dimensions shall be as specified above.

c. Center adjusting rings on manhole cones and center manhole castings on adjusting rings so that their surfaces will be flush whenever possible.

C. Manhole Riser Joints.

1. Joints for precast manhole riser sections shall be made with rubber "O"-ring gaskets, a continuous ring of butyl rubber sealant (EZ-Stik or Kent-Seal in rope form) or equal. The butyl sealant shall be 1 inch diameter equivalent or as recommended by the manhole manufacturer.

2. Joints for precast manhole barrel sections including the joint with the bottom of the cone shall be wrapped with an external joint seal as manufactured by Mar Mac Construction Products Company; Cretex Specialty Products; CCI Pipeline Systems, LLC; or equal. The external manhole seal shall be installed in accordance with the manufacturer's instructions.

a. If external joint seal requires steel strapping it shall be a minimum 5/8″ - 316 stainless steel with stainless steel "straplock" fasteners.

D. Manhole Lifting Holes.

1. All lifting holes in precast manhole sections shall be plugged using rubber plugs supplied by the manhole supplier, non-shrink grout or other approved method. Non-shrink grout shall fill the entire void and shall be troweled at each face to provide smooth surfaces. Cement mortar shall not be used to plug lifting holes.

E. Manhole Pipe Connections.

1. Connections of pipes to manholes shall be made in accordance with Section 3.5.7 of the "Standard Specifications". All field tapped holes for connecting sewer pipe to manholes shall be made by coring.

2. All plastic pipe shall be connected to manholes by means of flexible watertight pipe to manhole seals in accordance with Subsection 3.5.7(c). Manhole seals shall be Kor-N-Seal, Link Seal or equal. All clamps, bolts, etc. of pipe to manhole seals shall be stainless steel. If Link Seal connectors are used, the bolt heads shall be placed on the inside of manholes.

F. Drop Manholes

1. All drop manholes, unless shown otherwise on the Plans, shall be constructed as "outside" drop manholes in accordance with Section 3.5.8(d) and File No. 19 or 20 of the "Standard Specifications" and the requirements of these Special Provisions.

   a. Heights of manhole drops shown on the Plans are figured from the invert of the outgoing sewer to the invert of the incoming sewer.

G. Waterproof Manholes (Where Specified).

1. Waterproof manholes shall be constructed the same as standard manholes except that they shall be furnished with waterproof frames and lids and Type I frame/chimney joints.

H. Waterproof Floodplain Manholes (Where Specified).

1. Waterproof floodplain manholes shall be constructed the same as standard manholes except that they shall be furnished with waterproof frames and lids and Type I frame/chimney joints.

   a. Furnish floodplain manholes with Neenah R-1916-F watertight frame with Type "T" gasket, bolted lid and four 1″ anchor holes. Secure the frame through the adjusting rings and into the manhole cone with 4-3/4″ stainless steel ready-rod anchor bolts with stainless steel nuts and locking washers.

   b. The Contractor shall supply Town with one (1) replacement "T" seal gasket for each waterproof manhole.

I. Sewer Stubs/Bulkheads.

1. Sewer stubs, where the length is not shown on the Plans, shall be 2 foot maximum length and shall be plugged in accordance with Section 3.2.25(a) of the "Standard Specifications".

2. Bulkheads for future sewer connections to manholes, where called for on the Plans, shall be made in accordance with File No. 13A of the "Standard Specifications". Connections for future sewer connections 27 inches in diameter and larger shall be bulkheaded with an 8 inch wall using concrete brick.

J. Manhole Air Vents.

1. The Contractor shall construct manhole air vents at the locations shown on the Plans and/or as directed by the Engineer. Manhole air vents shall be constructed in accordance with the details shown on the Plans.

K. Manhole Markers.

1. The Contractor shall place steel markers at all manholes located within new roads where the curb and gutter and pavement are to be placed in a following year. The markers shall be placed parallel to the adjacent manhole 3 feet behind the proposed curb/gutter. Markers shall extend at least 2 feet below finished grade and 4 feet above finished grade. Markers shall be painted orange.

L. Manhole Vacuum Testing.

1. Delete Section 3.7.6 of the "Standard Specifications" in its entirety and replace it with the following.

2. The Contractor shall vacuum test all sanitary sewer manholes for leakage, regardless of the sewer diameter, in accordance with the following:

   a. The chimney and casting shall be in place prior to vacuum testing manholes.

   b. All testing shall be done in the presence of the project Engineer or his representative.

3. Isolate the manhole to be tested by plugging the inlet and outlet pipes with inflatable stoppers or other suitable test plugs. The plugs shall be securely braced to prevent the plugs from being drawn into the manhole.

4. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

   a. Prior to starting the vacuum pump, determine the hydrostatic head on the lowest pipe connection to the manhole being tested.

   b. If the hydrostatic head on the lowest pipe connection to the manhole is 12 feet or less, a vacuum pressure equal to 10 inches Hg (mercury) shall be applied to the manhole utilizing the vacuum pump.

   c. When the pressure gage indicates 10 inches Hg, close the control valve, shut off the vacuum pump, and begin counting the seconds

for the indicated pressure to drop one inch Hg. If the elapsed time is longer than the minimum time indicated in the following Table I, the manhole passes the test.

d. In the event the hydrostatic head is between 12 feet and 21 feet above the lowest connection to the manhole, the test vacuum pressure shall be reduced one inch Hg for each foot of hydrostatic head in accordance with the following Table II. If the hydrostatic head is greater than 22 feet, no vacuum test shall be performed.

e. If the test fails, repair or seal the manhole using non-shrink grout or other approved materials. Retest until an acceptable test is obtained.

f. Tests may be conducted before or after backfilling.

TABLE I MINIMUM TEST TIMES IN SECONDS							
Depth Feet	Manhole Diameter in Inches						
	48	60	72	84	96	108	120
	Time in Seconds						
4	10	13	16	19	23	26	29
6	15	20	25	29	34	38	43
8	20	26	33	38	45	51	57
10	25	33	41	48	56	63	71
12	30	39	49	57	67	76	85
14	35	46	57	67	78	89	100
16	40	52	65	76	89	101	114
18	45	59	73	86	100	114	128
20	50	65	81	95	111	126	142
22	55	72	89	105	122	139	156
24	59	78	97	114	133	152	170
26	64	85	105	124	144	164	185
28	69	91	113	133	155	177	199
30	74	98	121	143	166	189	213
32	79	104	129	152	177	202	227
34	84	111	137	162	188	214	241
36	89	117	145	171	199	227	255
38	94	123	153	181	210	239	270
40	99	129	161	190	221	252	284
42	104	136	169	200	232	264	298
44	109	142	177	209	243	277	312
46	114	149	185	219	254	289	326
48	118	155	193	228	265	302	340
50	123	162	201	238	276	314	355

TABLE II ADJUSTMENTS TO VACUUM PRESSURE BASED ON HYDROSTATIC HEAD											
Hydrostatic Head (ft)*	12	13	14	15	16	17	18	19	20	21	22
Vacuum Pressure (in Hg)	10	9	8	7	6	5	4	3	2	1	**
*Hydrostatic head above critical connector.											
**At 22 feet below the groundwater table, the connector is naturally subjected to 9.5 psi.											

M. Manhole Infiltration Inspection.

1. The Contractor, accompanied by the Engineer or his Representative, shall reinspect all manholes approximately 6 months after completing work on this project to check for manhole infiltration and to observe the general condition of the manhole. All active or flowing leaks and any other necessary repairs shall be corrected prior to final acceptance of the work.

301. FORCE MAIN CONSTRUCTION

A. General Requirements.

1. Delete Section 3.2.6.(n)l of the "Standard Specifications" and replace with:

"Force mains shall be installed in accordance with Chapter 4.1.0, 4.2.0, 4.3.0 (delete Section 4.3.12), 4.4.0 (D.I.), 4.5.0 (PCPP), 4.6.0 (PVC), 4.7.0, 4.9.0 and 4.10.0 of the 'Standard Specifications' and as specified herein."

B. Bedding Material.

1. Wrapped Ductile Iron Pipe.

a. Force main bedding and cover material used with wrapped ductile iron pipe shall be bedding sand conforming to Paragraph 8.43.2(c) of the "Standard Specifications".

2. Polyvinyl Chloride (PVC) Pipe.

a. Bedding and cover material shall be crushed stone chips conforming to Paragraph 8.43.2(a) of the "Standard Specifications". Crushed pea gravel will not be allowed for use as bedding or cover material.

b. Amend Section 8.43.2(a) of the "Standard Specifications" to read in part:

"Crushed stone chips, bedding material, shall be made from crushing sound <u>limestone</u> only."

3. Trench Section.

a. The trench section shall conform with Section 4.3.3 and File No. 36 of the "Standard Specifications", as amended below:

(1) Bedding and cover material shall be placed in a minimum of three separate lifts to ensure adequate compaction of these materials, with one lift of bedding material ending at or near the springline of the pipe. The Contractor shall take care to completely work bedding material under the haunch of the pipe to provide adequate side support.

(2) Place a minimum of 12 inches of cover material over the top of the pipe.

C. Polyethylene Wrap.

1. Polyethylene wrap shall be provided on all ductile iron force main and fittings and on all ductile iron fittings used with polyvinyl chloride pipe.

2. Polyethylene wrap shall meet the requirements of AWWA Standard C-105 (ANSI A21.5) using Class C (black) polyethylene material and shall be installed as specified in Section 4.4.4 of the "Standard Specifications".

a. Fold and tape loose wrap material to minimize air entrapment which could cause the material to be punctured when backfilling.

D. Water Main Crossings.

1. Center one full length of force main on water mains wherever the force main crosses over or under a water main so that both force main joints will be as far from the water main as possible.

E. High Points in Force Main.

1. The Contractor shall install force main at the grades shown on the Plans with no high points constructed in the main except as indicated on the Plans. If a high point which could trap air can not be prevented, then an air release assembly shall be constructed at that point, if so ordered by the Engineer.

F. Joint Restraint.

1. Restraining Horizontal Fittings.

a. Concrete Blocking (Buttresses).

(1) All horizontal bends, tees, caps and plugs shall be buttressed to provide thrust blocking in accordance with Section 4.3.13 and File Nos. 44, 45 and 46 of the "Standard Specifications".

2. Restraining Vertical Bends and Offsets.

a. Changes in the grade of the force main made by vertical bends or offsets shall be restrained by strapping in accordance with File Nos. 47 and 47A of the "Standard Specifications" or as provided for below.

b. Optional Joint Restraint Systems.

(1) MEGALUG Restrained Joints.

(a) Restrain joints using MEGALUG restrained joints as manufactured by EBAA Iron Sales, Inc. of Eastland, Texas. Use Series 1100 for mechanical joint ductile iron pipe and Series 1100 HD for push-on joint ductile iron pipe.

(2) Retainer Glands.

(a) Restrain joints using retainer glands. Retainer gland set screws shall be tightened to 75 foot-pounds torque or as recommended by the manufacturer using a torque wrench. Retainer glands may be used only on 12 inch diameter pipe or smaller.

(3) PVC Restrainer Fittings.

(a) PVC restrainer fittings, as manufactured by "Uni-Flange Corporation", EBAA Iron Sales, Inc., Sigma "One Lok", Star or equal, may be used to restrain mechanical joint cast iron fittings used with PVC pipe. Restrainer fittings shall be tightened to 70 foot-pounds torque or as recommended by the manufacturer using a torque wrench. Restrainer fittings may only be used on 12 inch diameter pipe or smaller.

(4) Joint Restraint Systems.

(a) Joint restraint may be provided by the following joint restraint systems.

1) Tyler Mechanical Joint Restraint.

a) Joint restraint for mechanical joint pipe and fittings used with either ductile iron or PVC pipe may be provided using the Tyler Mechanical Joint Restraint (MJR) System on 4 inch through 12 inch diameter pipes.

2) Restrained Joint Pipe.

a) Joint restraint for push-on joint pipe may be provided by using U.S. Pipe TR FLEX restrained joint pipe, Clow Super-Lock Joint pipe, Griffin Snap-Lok restrained joint pipe, American Flex-Ring or Lok-Ring restrained joint pipe or equal.

3. Restrained Joint Pipe Sections.

a. All force main pipe and fittings, within sections shown on the Plans as "Joint Restraint" or "Restrained", shall be restrained using both joint restraint systems and buttresses as specified in Subsections F.1 (buttresses) and F.2.b (joint restraint) above.

(1) Both joint restraint and buttresses are being provided as a safety factor in locations where the soil supporting the buttress could be removed or weakened by present or future utility excavations.

b. Restrained Joints in Casings.

(1) The joints of restrained joint pipe installed in casings shall be fully extended to take up the joint slack prior to making the end connections.

G. Insulation.

1. Force mains shall be insulated where noted on the Plans and wherever the depth of cover is less than five (5) feet when so ordered by the Engineer. Insulation shall be in accordance with Chapter 4.17.0 of the "Standard Specifications" and the details on the Plans.

H. Force Main Markers.

1. The Contractor shall install markers for locating the force main at the locations shown on the Plans and as directed by the Engineer. Markers are required at all angle points in the force main.

2. Materials.

   a. Force main markers shall be an upper section of valve box. Place a valve box cap on the top of the marker reading "sewer" or "san".

3. Installation.

   a. Place the top of markers flush with the ground.

305. FORCE MAIN MATERIALS

A. Force main pipe material shall be ductile iron (DI), polyvinyl chloride (PVC), or fiberglass reinforced polyester mortar (FRPM) pipe conforming to the following:

1. Ductile iron pipe meeting the requirements of AWWA Standard C-151 (ANSI A21.51), cement mortar lined with internal and external bituminous coating and furnished with either push-on or mechanical joints with rubber gaskets. Do not furnish cable bonding or other methods of providing electrical conductivity.

   Ductile iron pipe shall be furnished for the following minimum thickness classes:

   a. Four (4), 6, 8 and 10 inch pipe shall be Class 53.

   b. Twelve (12), 14, 16, 20, and 24 inch pipe shall be Class 52.

2. Polyvinyl chloride (PVC) pipe (4 inch through 12 inch diameter) meeting the requirements of AWWA Standard C-900, Class 150, DR-18, with cast iron O.D. and integral elastomeric bell and spigot joints.

3. Polyvinyl chloride (PVC) pipe (14 inch through 24 inch diameter) meeting the requirements of AWWA Standard C-905, DR 18, Pressure Rating (PR) 235, with cast iron O.D. and integral elastomeric bell and spigot joints.

4. Fiberglass Reinforced Polymer Mortar (FRPM) pipe for pressure sewer service, 12″ through 102″ diameter, meeting the requirements of AWWA C950 for "Fiberglass" pressure pipe, Class 250, and ASTM D2412 for Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by parallel plate loading. The pipe supplied

for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 46 psi. Joints on pipe supplied on this project shall conform to the dimensional requirements of AWWA C110 and AWWA C111 for mechanical joint and "push-on" joint cast iron and ductile iron fittings which shall be supplied on this project.

a. Certified copies of test reports of pipe of similar size and design and manufactured at the same plant as will manufacture the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

b. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

B. Force main fittings shall be ductile iron or cast iron, cement mortar lined with internal and external bituminous coating and meeting the requirements of AWWA Standard C-110 (ANSI 21.10). Fittings shall be supplied with mechanical joints with rubber gaskets.

1. Ductile iron fittings meeting the requirements of AWWA Standard C-153 for "compact fittings" may be used. Compact fittings shall be U.S. Pipe "Trim Tyte" ductile iron mechanical joint fittings or equal.

2. All fittings shall be North American, Sigma or Star made only.

305.1. FORCE MAIN MATERIAL FOR DIRECTIONAL DRILLING

A. Polyvinyl chloride (PVC) force main meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (16 inch diameter) with restraining jointing systems and with built-in sealing gaskets. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be CERTA-LOCK C900/RJ or C905/RJ by Certain Teed, Terra Brute by IPEX, or approved equal.

2. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment and his methods of operation.

AWWA C900 (Jointed)

Size	DR	Pressure Class[1]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
4″	14	200 psi	.343″	4.800″	5.964″	100′	10.0%	8,000 lbs.	10,300 lbs.
6″	14	200 psi	.493″	6.900″	8.366″	150′	6.7%	9,300 lbs.	14,700 lbs.
8″	14	200 psi	.646″	9.050″	10.947″	200′	5.0%	18,900 lbs.	28,800 lbs.
10″	14	200 psi	.793″	11.100″	13.361″	250′	4.0%	24,900 lbs.	38,300 lbs.
12″	14	200 psi	.943″	13.200″	15.836″	300′	3.3%	28,300 lbs.	48,300 lbs.
4″	18	150 psi	.267″	4.800″	5.964″	100′	10.0%	6,700 lbs.	8,200 lbs.
6″	18	150 psi	.383″	6.900″	8.366″	150′	6.7%	9,000 lbs.	12,800 lbs.
8″	18	150 psi	.503″	9.050″	10.947″	200′	5.0%	18,000 lbs.	25,200 lbs.
10″	18	150 psi	.617″	11.100″	13.361″	250′	4.0%	25,600 lbs.	35,200 lbs.
12″	18	150 psi	.733″	13.200″	15.836″	300′	3.3%	26,440 lbs.	41,100 lbs.

AWWA C905

Size	DR	Working Pressure Rating[2]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
16″	18	235 psi	0.967″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.
16″	25	165 psi	0.696″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.

[1] 2-1/2:1 safety factor based on working pressure + surge allowance at 2 f.p.s.
[2] 2:1 safety factor based on working pressure only

3. The maximum job site pull-in force shall not exceed the values given in the above table.

B. Polyvinyl chloride (PVC) pipe meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (14 inch through 48 inch diameter) with thermal butt fused joints between pipe sections. Joint gaskets shall not be required. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be Fusible C900, Fusible C905, or Fusible PVC by Underground Solution, Inc., or approved equal.

2. All PVC pipe used for force main shall be colored green.

3. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment, and his methods of operation.

AWWA C900, C905 PVC Pipe D.I.P. O.D. (Fusible)						
Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	14[1]	4.80″	.34″	4.11″	100′	13,400
6″	14[1]	6.90″	.49″	5.91″	144′	27,600
8″	14[1]	9.05″	.65″	7.76″	188′	48,000
10″	14[1]	11.10″	.79″	9.51″	232′	71,600
12″	14[1]	13.20″	.94″	11.31″	275′	101,000
14″	14[2]	15.30″	1.09″	13.12″	319′	136,000
16″	14[2]	17.40″	1.24″	14.92″	363′	176,000

[1] Pressure Class = 200 PSI
[2] Working Pressure Rating = 300 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	18[3]	4.80″	.27″	4.27″	100′	10,600
6″	18[3]	6.90″	.38″	6.13″	144′	21,700
8″	18[3]	9.05″	.50″	8.05″	188′	37,600
10″	18[3]	11.10″	.62″	9.87″	232′	57,100
12″	18[3]	13.20″	.73″	11.73″	275′	80,000
14″	18[4]	15.30″	.85″	13.60″	319′	108,000
16″	18[4]	17.40″	.97″	15.46″	363′	140,000
18″	18[4]	19.50″	1.08″	17.34″	406′	175,000
20″	18[4]	21.60″	1.20″	19.20″	450′	215,000
24″	18[4]	25.86″	1.43″	22.94″	538′	306,000

[3] Pressure Class = 150 PSI
[4] Working Pressure Rating = 235 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	25[5]	4.80″	.19″	4.42″	100′	7,700
6″	25[5]	6.90″	.28″	6.35″	144′	16,300
8″	25[5]	9.05″	.36″	8.33″	188′	27,500
10″	25[5]	11.10″	.44″	10.21″	232′	41,100
12″	25[5]	13.20″	.53″	12.15″	275′	59,000
14″	25[6]	15.30″	.61″	14.08″	319′	78,800
16″	25[6]	17.40″	.70″	16.00″	363′	102,000
18″	25[6]	19.50″	.78″	17.90″	406′	128,000
20″	25[6]	21.60″	.86″	19.88″	450′	156,000
24″	25[6]	25.80″	1.03″	23.74″	538′	224,000
30″	25[6]	32.00″	1.28″	29.44″	667′	345,000
36″	25[6]	38.30″	1.53″	35.24″	798′	494,000

[5] Pressure Class = 100 PSI

[6] Working Pressure Rating = 165 PSI

Size	DR[7]	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
24″	32.5[7]	25.80″	.80″	24.20″	538′	175,000
30″	32.5[7]	32.00″	.98″	30.04″	667′	267,000
36″	32.5[7]	38.30″	1.18″	35.94″	798′	385,000
42″	32.5[7]	44.50″	1.37″	41.60″	927′	518,000

[7] Working Pressure Rating = 125 PSI

Size	DR[8]	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
30″	41[8]	32.00″	.78″	30.44″	667′	214,000
36″	41[8]	38.30″	.93″	36.44″	798′	305,000
42″	41[8]	44.50″	1.09″	42.20″	927′	415,000
48″	41[8]	50.80″	1.24″	48.20″	1,058′	539,000

[8] Working Pressure Rating = 100 PSI

*Safe Pull Force - Fusible PVC Pipe AWWA C900 and C905.

a. Minimum tensile capability of pipe = 7,000 psi (AWWA)

b. Safe Pull Stress = $\frac{7{,}000 \text{ psi}}{2.5 \text{ F.S.}}$ = 2,800 psi

c. Safe Pull Force = Cross Sectional Area of Pipe in square inches times safe pull stress rounded down.

d. Cross Sectional Area of Pipe = $\frac{\text{O.D.} + \text{I.D.}}{2} \times \pi \times T$

4. The maximum job site pull-in force shall not exceed the values given in the above tables.

C. High density polyethylene (HDPE) force main (4 inch through 54 inch diameter) shall meet the requirements of AWWA C906. Pipe material shall have a cell classification of PE 3408 (345434C) as specified in ASTM D3350.

1. Pipe material specified for this project shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating (working pressure rating) appropriate to the job site conditions, the capability of his pull-in equipment and his methods of operation.

AWWA C906; PE PIPE, MATERIAL CLASS PE 3408, D.I.P. O.D.

Size	DR[1]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	7.3	4.80″	0.658″	3.37″	8,600
6″	7.3	6.90″	0.945″	4.85″	17,900
8″	7.3	9.05″	1.240″	6.36″	30,900
10″	7.3	11.10″	1.521″	7.80″	46,400
12″	7.3	13.20″	1.808″	9.28″	65,600
14″	7.3	15.30″	2.096″	10.75″	88,200
16″	7.3	17.40″	2.384″	12.23″	114,000
18″	7.3	19.50″	2.671″	13.71″	143,000
20″	7.3	21.60″	2.959″	15.18″	175,000

[1] Working Pressure Rating = 255 psi

Size	DR[2]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	9	4.80″	0.533″	3.69″	7,250
6″	9	6.90″	0.767″	5.31″	14,900
8″	9	9.05″	1.006″	6.96″	25,700
10″	9	11.10″	1.233″	8.53″	38,800
12″	9	13.20″	1.467″	10.15″	54,800
14″	9	15.30″	1.700″	11.76″	73,700
16″	9	17.40″	1.933″	13.38″	95,300
18″	9	19.50″	2.167″	14.99″	119,700
20″	9	21.60″	2.400″	16.61″	146,900

[2] Working Pressure Rating = 200 psi

Size	DR[3]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	11	4.80″	0.436″	3.89″	6,000
6″	11	6.90″	0.767″	5.31″	12,500
8″	11	9.05″	0.823″	7.34″	21,500
10″	11	11.10″	1.009″	9.00″	32,400
12″	11	13.20″	1.200″	10.70″	45,900
14″	11	15.30″	1.391″	12.41″	61,600
16″	11	17.40″	1.582″	14.11″	79,800
18″	11	19.50″	1.773″	15.81″	100,000
20″	11	21.60″	1.964″	17.52″	122,000
24″	11	25.80″	2.345″	20.92″	175,000
[3] Working Pressure Rating = 160 psi					

Size	DR[4]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	13.5	4.80″	0.356″	4.06″	5,000
6″	13.5	6.90″	0.511″	5.84″	10,400
8″	13.5	9.05″	0.674″	7.66″	17,900
10″	13.5	11.10″	0.822″	9.39″	26,900
12″	13.5	13.20″	0.978″	11.17″	38,100
14″	13.5	15.30″	1.133″	12.94″	51,200
16″	13.5	17.40″	1.289″	14.72″	66,200
18″	13.5	19.50″	1.444″	16.50″	83,100
20″	13.5	21.60″	1.600″	18.27″	102,000
24″	13.5	25.80″	1.911″	21.82″	145,000
30″	13.5	32.00″	2.370″	27.02″	223,000
36″	13.5	38.30″	2.837″	32.62″	320,000
[4] Working Pressure Rating = 130 psi					

Size	DR[5]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
16″	17	17.40″	1.024″	15.27″	53,400
18″	17	19.50″	1.147″	17.11″	67,100
20″	17	21.60″	1.271″	18.96″	82,300
24″	17	25.80″	1.518″	22.64″	117,000
30″	17	32.00″	1.882″	28.08″	180,000
36″	17	38.30″	2.253″	33.62″	258,000
42″	17	44.50″	2.618″	39.06″	349,000
48″	17	50.80″	2.988″	44.59″	455,000
54″	17	57.10″	3.359″	50.12″	575,000
[5] Working Pressure Rating = 100 psi					

Size	DR[6]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
30″	21	32.00″	1.524″	28.83″	148,000
36″	21	38.30″	1.824″	34.48″	212,000
42″	21	44.50″	2.119″	40.06″	286,000
48″	21	50.80″	2.419″	45.73″	373,000
54″	21	57.10″	2.719″	51.40″	471,000
[6] Working Pressure Rating = 80 psi					

*The Maximum Pull-In Force is determined by the following formula:

$MPF = F \cdot T \cdot \pi \cdot D^2 \cdot (1/DR - 1/DR^2)$

Where, MPF = Maximum Pull-In Force, Lbs.
F = Time Under Tensile Load and Safety Factor (0.35 - dimensionless)
T = Tensile Yield Strength, psi (minimum 2,900 @ 80°F per AWWA C906)
π = Pi (3.14159)
D = Outside Diameter of Pipe, Inches
DR = Dimension Ratio

2. The maximum job site pull-in force shall not exceed the values given in the above table.

3. Fusable Pipe Joints.

   a. Fusable pipe and fittings shall be joined by the butt fusion joining method. The butt joining shall be performed by an experienced and qualified operator using materials and techniques recommended by the pipe manufacturer.

   b. Lateral connections shall be made with saddles of the appropriate sizes. Adaptors for connection to existing lateral material shall be provided.

4. Upon completion of pull-ins, Contractor shall wait 24 hours for polyethylene pipe or 4 hours for PVC pipe to allow the pipe to stabilize prior to making connection thereto or backfilling the boring and/or receiving pit.

5. Pipe fittings shall be manufactured of the same material as specified for pipe.

D. Fiberglass Reinforced Polymer Mortar Pipe for pressure sewer service, 12″ through 102″ diameter, meeting the requirements of AWWA C950 for "Fiberglass" pressure pipe, Class 250, and ASTM D2412 for Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by parallel plate loading. The pipe supplied for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 46 psi. Joints on pipe supplied on this project shall

conform to the dimensional requirements of AWWA C110 and AWWA C111 for mechanical joint and "push-on" joint cast iron and ductile iron fittings which shall be supplied on this project.

1. Certified copies of test reports of pipe of similar size and design and manufactured at the same plant as will manufacture the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

2. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

E. Tests.

1. Pipe material delivered for use on this project shall conform to the requirements of the appropriate AWWA and ASTM Specifications noted herein. All pipe shall be marked in accordance with the requirements of the cited Specifications and each load delivered to the job site shall be accompanied by the manufacturer's certification of such compliance. Said certification to be delivered to the Engineer or his representative.

310. VALVES AND VALVE BOXES

A. Eccentric Plug Valves.

1. Eccentric plug valves shall be furnished for buried or submerged service with mechanical joint ends, cast iron body, corrosion resistant bearings, nickel or stainless steel seat, resilient faced plug for drop-tight shutoff, 2" square operating nut opening to the left (counterclockwise) with a by-directional worm gear actuator operating against a shut-off pressure of from 0 to 75 psi and rated at a working pressure of 175 psi for 12 inch diameter and smaller and 150 psi for 14 inch diameter and larger.

a. Eccentric plug valves shall be DeZurik Series 100, Val-Matic cam-centric or equal.

B. Valve Boxes.

1. Valve boxes shall be three piece cast iron valve boxes consisting of base, screw type center (5-1/4 inch shaft diameter) and top section with cover marked "SEWER", if available, or blank (unmarked). Extension sections shall be furnished as required. Valve boxes shall be furnished for the depth of trench shown on the Plans with the cover placed at the existing grade or to the elevation shown on the Plans.

a. Valve boxes shall be North American, Sigma or Star made only. Acceptable manufacturers include: Tyler 6860 series, Bingham and Taylor 4906, Bibby - Ste. Croix, Sigma and Star.

C. Horizontal Swing Check Valves.

1. Horizontal swing check valves shall be furnished with mechanical joint ends, cast iron body, fully bronze mounted, outside lever and spring to allow backflushing of pump and discharge line, stainless steel hinge pin, "O"-ring hinge pin seal and rated for 175 psi working pressure.

a. Horizontal swing check valves shall be Mueller A-2600-6-02, Dresser Style 259-02 or equal.

315. VALVE MANHOLES

A. Valve manholes shall be constructed in accordance with the general requirements of File Nos. 12, 15 and 40 of the "Standard Specifications", with the following modifications:

1. Manholes shall be precast 48 inch inside diameter, unless shown otherwise, with eccentric cones.

a. A minimum of 3 inches to a maximum of 18 inches of adjusting rings shall be furnished for each manhole.

b. Manhole depths shown on the Plans are approximate only, unless the cover elevation is indicated. Manhole covers shall be placed to match the existing grade or at the elevation shown on the Plans.

c. Shallow manholes may be constructed with flat top slabs having openings centered in the slab.

d. Revise Chapter 8.38.0 of the "Standard Specifications", to require that concrete brick and block shall be colored "red or pink", conforming to Subsection 519.2.2 of the "State Specifications".

2. All lifting holes in precast manhole sections shall be plugged using rubber plugs supplied by the manhole supplier, non-shrink grout or other approved method. Non-shrink grout shall fill the entire void and shall be troweled at each face to provide smooth surfaces. Cement mortar shall not be used to plug lifting holes.

3. Manhole frames and covers shall be Neenah R-1580 with Type "B" lids, non-rocking, or equal. Manhole frames shall be centered on the top of the cone.

4. Construct sumps in manholes as shown in File No. 40, except do not plug if the base of the sump is above the water table.

5. Valves shall be supported by treated hardwood blocking.

6. The Contractor shall provide shop drawings for all valve manholes.

B. Manhole Joints.

1. Joints for precast manhole riser sections shall be made with rubber "O"-ring gaskets, a continuous ring of butyl rubber sealant (EZ-Stik or Kent-Seal in rope form) or equal. The butyl sealant shall be 1 inch diameter equivalent or as recommended by the manhole manufacturer.

2. Adjusting rings and manhole frames shall be set in non-shrink grout or butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface areas of the top of cone and all adjusting rings. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

   a. Non-shrink grout shall be a premixed, non-metallic, cementitious, controlled expansion, high strength, versatile grout; Penngrout by IPA Systems, Inc. or equal.

3. The interior and exterior dimensions of the top of the cone section and adjusting rings shall be equal and these surfaces shall be constructed flush with each other. Adjusting rings shall be as specified in Section 8.39.10 of the "Standard Specifications". Manhole adjusting rings shall be 26 inches I.D. by 38 inches O.D. unless otherwise approved. Center manhole casting on adjusting rings.

C. Manhole Pipe Connections.

1. Connections of force main pipes to manholes shall be made in accordance with Section 3.5.7 of the "Standard Specifications". All field tapped holes for connecting sewer pipe to manholes shall be made by coring.

2. Flexible pipe connections shall be made with flexible watertight connectors, Kor-N-Seal, Link-Seal or equal, All clamps, bolts, etc. of pipe to manhole seals shall be stainless steel. If Link-Seal connectors are used, the bolt heads shall be placed on the inside of manholes.

320. SEWAGE AIR VALVES AND AIR VALVE MANHOLES

A. Sewage Combination Air Valves.

1. Sewage combination air valves shall be A.R.I., Model No. D-020. The combination air valve shall consist of a single body, single orifice valve functioning as both an air release valve and air and vacuum valve.

   a. Sewage combination air valves (single body, single orifice) shall be constructed of stainless steel body and cover, stainless steel float, linkage and trim, and valve or reinforced nylon, EPDM movable part and stainless steel seat. Valves shall be furnished in the sizes indicated on the Plans for air and vacuum and with a 1.246 inch orifice rated for a working pressure of 3 to 250 psi for pressurized air release.

B. Backflushing Accessories.

1. Backflushing accessories consisting of a one inch inlet shutoff valve (ball or plug valve) or inlet isolation valve(s) on combination air valves, brass ball valve(s), bronze rubber seated clear water inlet valve(s) with quick disconnect coupling, quick disconnect coupling to insert in air release valve orifice outlet and 5 feet minimum of rubber hose with quick disconnect couplings on each end shall be furnished by the valve manufacturer and assembled to all sewage air valves.

C. Force Main/Air Valve Connection.

1. Sewage air valves shall be connected to the force main in accordance with the details shown on the Plans.

   a. Air valves shall be connected to the force main in a manner to keep the valve as low as possible in the manhole.

2. Force main tees shall be furnished with mechanical joints or flanged ends except flanged ends shall be furnished for the reducing flange connection and to provide restraint where shown on the Plans.

3. Shop Drawings.

   a. The Contractor shall submit shop drawings of all air valves showing valve connection piping and manhole clearances to the Engineer for his review.

D. Air Valve Manholes.

1. Air valve manholes shall be constructed in accordance with the general requirements of Section 315 of these Special Provisions for Valve Manholes, as amended below, and the Typical Details shown on the Plans.

   a. Manholes shall be precast 48 inch inside diameter, unless shown otherwise, with flat top slabs and offset openings.

   b. Manhole frames and covers shall be Neenah R-1580 with Type "B" lids, non-rocking, or equal. Manhole frames shall be centered on the top of the cone.

   c. Construct 12 inch diameter sumps in manholes as shown on the Plans.

   d. Set adjusting rings and manhole frames on trowelable grade butyl rubber sealant.

   e. All force mains, including rigid pipe and drain lines, shall be connected to manholes using approved flexible watertight pipe to manhole seals in accordance with Paragraph 3.5.7(c) of the "Standard Specifications".

2. Sealing Manhole Chimneys.

   a. The entire outside surface of the manhole chimney, including all adjusting rings and overlapping both the manhole cone or flat-top slab (a minimum of 2 inches) and the manhole frame, shall be covered with a minimum 1/4 inch thick coating of butyl rubber sealant. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

3. Manhole Lifting Holes.

   a. All lifting holes in precast manhole sections shall be plugged using rubber plugs supplied by the manhole supplier, non-shrink grout or other approved method. Non-shrink grout shall fill the entire void and shall be troweled at each face to provide smooth surfaces. Cement mortar shall not be used to plug lifting holes.

4. Warning Label.

   a. A weatherproof durable warning label, 4 inch by 6 inch size, printed in red shall be permanently attached to the inside surface of manhole slabs in line with manhole steps.

b. The labels shall read:

"Warning: Hazardous gases may be present which could cause severe injury or death. No smoking. Enter only with proper ventilation, life line attached and standby personnel present."

5. Vent Lines.

a. Construct 4 inch diameter vent lines as shown on the Plans. Vent lines shall be constructed of cast iron soil pipe, "Service Weight" grade, in accordance with Chapter 8.13.0 of the "Standard Specifications".

b. Vent lines shall be laid to drain to the manhole with the bottom of the return bend placed 30 inches above the ground elevation and end of the pipe covered with a copper insect screen.

6. Drain Lines.

a. Construct 4 inch diameter manhole drain lines as shown on the Plans.

7. Marker Posts.

a. The Contractor shall furnish and place wood posts to mark and support air valve manhole vent pipes as shown on the Plans. Marker posts shall be 6 inch nominal diameter treated lumber 7 feet long.

E. Air Valve Warranty.

1. The sewage air valve manufacturer shall provide a two (2) year warranty from the date that the work is accepted by the Owner guaranteeing that all materials and equipment are free from defects in design, materials and workmanship. The manufacturer shall, upon proper notification, repair or replace any equipment proven defective during the warranty period.

325. DRAIN VALVE AND FLOW DIVERSION ASSEMBLIES

A. Drain Valve Assembly.

1. Drain valve assemblies shall be constructed in accordance with the general requirements of Section 315 of these Special Provisions for valve manholes, as amended below, and the typical details for Drain Valve Manholes on the Plans.

a. Manholes shall be precast 48 inch inside diameter with eccentric cones or flat top slabs having offset openings.

B. Drain Valve/Flow Diversion Assembly.

1. Drain valve/flow diversion assemblies shall be constructed in accordance with the general requirement of Section 315 of these Special Provisions for valve manholes, as amended below, and the typical details for Drain Valve/Flow Diversion Manholes on the Plans.

a. Manholes shall be precast 48 inch inside diameter with eccentric cones or flat top slabs having offset openings.

b. Side outlet tees shall be furnished with flanged ends to provide restraint.

330. HYDROSTATIC TESTING

A. Delete Section 3.2.6(n)2 of the "Standard Specifications" and replace with the following:

Force mains shall be hydrostatically tested in accordance with Chapter 4.15.0 of the "Standard Specifications", as amended below:

1. The pressure test shall be run at a minimum pressure of 100 psi, measured at the point of highest elevation of the section of force main being tested.

2. The leakage test shall be run at a minimum pressure of 75 psi, measured at the point of highest elevation of the section of force main being tested. The final leakage test shall be run for 3 continuous hours.

3. The Contractor shall furnish all labor, equipment and material to complete all testing.

4. The Engineer or his Representative shall be present at all times during testing.

B. Water Purchased by Contractor.

1. Water for testing will be purchased by the Contractor. The Contractor shall notify the Owner prior to using water and shall coordinate his operations with the Owner in order not to deplete the water supply. Water usage may be restricted to periods of low demand (night time or weekend hours) if water usage is high during normal working hours.

2. Metered Water.

a. The Contractor shall meter all water used for flushing purposes. A complete record of all water used for flushing, including amounts and dates, shall be kept by the Contractor and provided to the Owner.

b. The Contractor shall use a flushing meter provided by the Owner. The meter shall be returned, in good condition, immediately after completing flushing operations. The Contractor shall be responsible for any damage to flushing meters.

C. Test Sections.

1. The Contractor has the option to test the entire new force main as one continuous test section or in segments per his discretion.

340. EQUIPMENT TESTING, START-UP AND INSTRUCTIONS

A. The Contractor shall test all equipment, including air valves and plug valves, after it is installed and prior to lift station start-up to ensure that it is functioning and in proper working order.

B. The Contractor shall have personnel available should they be needed to adjust or repair force main equipment during start-up of the lift station, by others.

C. Instructions by Manufacturer's Representative.

1. After the equipment has been installed, inspected and approved, the manufacturer's representative shall instruct the Owner's operating personnel as to the proper procedures for operating and maintaining the equipment.

350. OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Prior to substantial completion, the Contractor shall provide the Engineer with four (4) operation and maintenance manuals covering each item of equipment, including air valves and plug valves, furnished or installed under the contract.

B. Operation and maintenance manuals shall include the following information:

1. Supplier and manufacturer's name, address, telephone number, and local representative's name, address and telephone number. Sources of service and parts and a list of local repair services, supply houses and potential sources for the types of repairs and equipment parts.

2. Warranties and bonds shall be included in manual.

3. Catalog literature complete with performance data and ratings.

4. Specify equipment function, normal operating and limiting conditions.

5. Assembly, installation, alignment, adjusting and checking instructions.

6. Operating instruction for start-up, shutdown, routine and normal operation.

7. Detailed service information including schedule of recommended maintenance.

8. Troubleshooting, common operating problems, problems that might occur in unit/process. List and discuss control/prevention.

9. Detailed safety section covering the operation and maintenance of unit. Contractor shall supply a complete list of equipment service numbers, model numbers, electrical requirements, manufacturer's names, etc.

10. Complete and accurate set of as-built drawings including dimensions, schematics of hydraulics, wiring, and piping.

11. Emergency operating instructions indicating range and flexibility during emergencies.

C. The correct model number shall be designated where the literature covers more than one model.

D. For items assembled by the Contractor, the Contractor shall write and provide duplicate operation and maintenance instructions.

E. Data shall be folded to 8-1/2" x 11" size and placed into hard cover binders. Material shall be grouped according to specifications sections and filed behind individual filing tab pages on which the following is to be typed: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, and manufacturer's Order Number.

F. Manuals shall be delivered to the Engineer for approval prior to 75% of job completion. Final payment will not be certified until manuals have been received and approved.

401. STORM SEWER CONSTRUCTION

A. Bedding Sections.

1. Reinforced Concrete Pipe.

a. Reinforced concrete pipe shall be installed using Class "B" Bedding.

2. PVC Pipe (Sump Pump Lines and Laterals).

a. Polyvinyl chloride (PVC) pipe shall be installed using Class "B" Bedding.

3. Class "B" Bedding.

a. Class "B" Bedding shall conform to File No. 4 and Paragraph 3.2.6(b) (concrete pipe) or Paragraph 3.2.6(i) (PVC and HDPE) of the "Standard Specifications".

b. Delete the following sentence from Paragraph 3.2.6(b)(2):

"If crushed stone chips or other materials conforming to Section 8.43.2(a) are used as cover material, no compaction is required."

c. Amend Section 8.43.2(a) to state that crushed pea gravel is not acceptable as bedding material.

d. Cover material shall be the same material as used for bedding and shall conform to Section 8.43.2(a).

(1) Limestone Bedding and Cover Material.

(a) Amend Section 8.43.2(a) to read in part:

"Crushed stone chips, bedding and cover material, shall be made from crushing sound limestone only."

e. Placement and Compaction.

(1) Place bedding material to the springline of the pipe and compact prior to placing cover material. Compaction of bedding material at the level of the pipe springline shall include working bedding material under the haunches of the pipe using shovels or other suitable methods. The Contractor shall take care to completely work bedding

material under the haunches of the pipe to provide adequate side support.

(2) Place and compact cover material in one or more lifts after compacting bedding material.

(3) Refer to Subsection 607.B of these Special Provisions for requirements for recompacting Class "B" bedding disturbed by trench boxes.

B. Field Tile Connections.

1. All field tile encountered during construction shall be connected to the new storm sewer.

a. Tile lines crossed by the trench shall be replaced with polyvinyl chloride (PVC) sewer pipe meeting the requirements of ASTM D-3034, SDR-35, with rubber gasket joints. The PVC pipe shall extend for a minimum distance of 2 feet outside of the edge of the undisturbed trench wall. The tile to PVC pipe connection shall be made with compatible fittings, adapters or encased in concrete. The size of the new pipe shall be equal to or greater than the field tile it is connected to.

b. All damaged field tile shall be repaired and connected to the storm sewer the same day as the damage occurs so that the flow of water will not be unreasonably restricted.

C. Pipe Joint Restraint (Outfalls).

1. Secure the last two pipe sections, including end sections, at all storm sewer outfalls (discharge points) using joint ties in accordance with details on the Plans.

D. Sump Pump Laterals.

1. The Contractor shall construct sump pump laterals at the locations shown on the Plans. Sump pump laterals shall be 42 inches deep wherever possible.

a. Sump pump laterals shall be constructed adjacent to and left of the water service wherever possible.

b. Sump pump laterals shall be 4 inch PVC meeting the requirements of ASTM D3034, SDR-35, with integral bell type flexible elastomeric joints meeting ASTM D-3212.

c. Sump pump laterals shall extend to the right-of-way line and shall be constructed without vertical breaks or bends.

d. Sump pump laterals shall be connected to the mainline storm sewer by a precast tee or cored rubber boot. All cored connections shall be completed and inspected prior to installing the pipe in the trench.

e. Sump pump laterals shall be connected to sump pump mainline (PVC) with factory fabricated or injection molded in-line wyes.

f. All laterals shall be capped at the lot line. Laterals over 100 feet in length from the mainline storm sewer to the lot line shall have a clean out installed. Clean outs shall meet WisDOT requirements.

g. Place magnetic location tape over all sump pump laterals and mark the end of laterals with a wooden stake.

E. Sump Pump Mainline (Where There is No Mainline Storm Sewer).

1. The Contractor shall construct sump pump mainline lines in locations shown on the Plans.

a. Sump pump mainline lines shall be 6 inches (minimum) and shall be constructed with PVC pipe meeting the requirements of ASTM D-3034, SDR-35 with flexible elastomeric joints meeting ASTM D-3212.

b. Sump pump mainline cleanouts shall be provided at the locations shown on the Plans and in accordance with the details shown on the Plans.

c. Sump pump mainline shall be connected to catch basins by a cored rubber boot. All cored connections shall be completed and inspected prior to installing the pipe in the trench.

402. STORM SEWER INLETS/OUTLETS

A. Inlet/Outlet Grates.

1. Install steel grating on the ends of storm sewers greater than 12 inches in diameter in accordance with the details shown on the Plans and per the requirements of Chapter 8.16.0 of the "Standard Specifications".

2. Revise Section 8.16.1 as follows:

a. Delete the requirement for fastening grating to the pipe with nuts and replace with the following:

"Grating shall be prefabricated as described in Section 8.16.2."

b. Delete the requirement for painting and replace with the following:

"After fabrication, the entire grating shall be hot-dipped with a galvanized coating."

3. Inlet grates (trash racks) shall be placed over the pipe end section and outlet grates shall be placed approximately 3 inches from the end of the pipe unless specified otherwise on the Plans.

405. STORM SEWER MATERIALS

A. Storm sewer pipe material shall be reinforced concrete sewer pipe conforming to the following:

1. Reinforced concrete sewer pipe (RCP) shall meet the requirements of ASTM C-76 with mortar or rubber gasket joints conforming to ASTM C-443.

a. RCP shall be furnished for the classes of pipe shown on the Plans.

2. Reinforced concrete horizontal elliptical sewer pipe RCHEP shall meet the requirements of ASTM C-507 with mortar or rubber gasket joints conforming to ASTM C-443.

a. RCHEP shall be furnished for the classes of pipe shown on the Plans.

3. Sump Pump Mainline and Laterals.

a. Polyvinyl chloride (PVC) sewer pipe, 4 inch and 6 inch diameter, meeting the requirements of ASTM D-3034, SDR-35, with integral bell type flexible elastomeric joints meeting the requirements of ASTM D-3212. PVC material shall have a cell classification of 12454-B, 12454-C, 12364-C, or 13364-B, except that 12364-C and 13364-B shall have a minimum tensile modulus of 500,000 psi.

410. STORM SEWER MANHOLES

A. Standard Manhole.

1. Storm sewer manholes shall be constructed in accordance with Chapter 3.5.0 and File Nos. 12, 13, and 15 of the "Standard Specifications" and these Special Provisions.

   a. Poured Manhole Base.

      (1) All manhole bases (benches) shall be poured in place in accordance with Subsection 3.5.5(b) of the "Standard Specifications". Precast manhole bases or precast integral base units will be allowed, however, no precast base units with preformed benches are allowed.

   b. Manholes less than 4 feet deep do not require steps.

2. Manholes shall be precast 48, 60, or 72 inch inside diameter, as noted on the Plans, with eccentric cones. Unless indicated otherwise on the Plans, standard manholes shall be 48 inch inside diameter.

   a. Flat top slabs with offset openings may be used for shallow manholes where there is not sufficient depth to install cones or on deeper manholes with the approval of the Engineer.

   b. A minimum of 4 inches to a maximum of 19 inches of adjusting rings shall be furnished for each manhole, unless shown otherwise on the Plans.

      (1) Adjusting rings shall be injection molded High Density Polyethylene (HDPE) adjustment rings as manufactured by Ladtech, Inc., Lino Lakes, Minnesota, or equal. Concrete adjusting rings shall not be used.

   c. Manhole depths shown on the Plans are approximate only, unless the cover elevation is indicated. Manhole covers shall be placed to match the existing grade or at the elevation shown on the Plans.

      (1) Place manhole covers 1/4 inch below the pavement grade in streets.

      (2) During the first year of construction, adjust manhole covers to 1/4 inch below the top of the lower layer of asphalt.

(3) During the second year of construction, install 1-1/2 inch cast iron adjustment rings in manhole frames to place the cover 1/4 inch below the finished pavement grade. Coat the receiving portion of the manhole frame with trowelable butyl rubber sealant prior to installing rings.

3. Manhole Frames and Covers.

a. Manhole frames and covers shall be Neenah R-1580 with Type "B" lids, non-rocking, or equal.

b. Beehive grate manhole covers shall be Neenah R-2560-El or equal.

c. Manhole frames shall be centered on the top of the cone section.

B. Tee-Line Manholes.

1. Tee-line manholes shall be constructed in accordance with File No. 16 of the "Standard Specifications" and the pertinent provisions of Subsection 410.A above.

C. Junction Box Manholes.

1. Junction box manholes shall be constructed in accordance with the details included on the Plans and the pertinent provisions of Subsection 410.A above.

D. Catch Basin Manholes.

1. Catch basin manholes shall be constructed in accordance with the provisions of Subsection 410.A above except as provided for below.

a. Use flat top slabs with 24″ x 36″ opening.

b. Place a Neenah R-3067 curb inlet frame and grate on manholes.

2. Do not construct sumps in catch basin manholes.

E. Manhole Joints.

1. Joints for precast manhole riser sections shall be made with non-shrink grout, rubber "O"-ring gaskets, a continuous ring of butyl rubber sealant (EZ-Stik or Kent Seal in rope form) or equal. The butyl sealant shall be 1 inch diameter equivalent or as recommended by the manhole manufacturer.

2. Adjusting rings and manhole frames shall be set with non-shrink grout or butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface areas of the top of cone and all adjusting rings. The butyl rubber sealant shall be EZ-Stik or Kent Seal butyl base sealant in trowelable grade or equal.

3. Non-Shrink Grout.

   a. Grout shall be a premixed, non-metallic, cementitious, controlled expansion, high strength, versatile non-shrink grout; Penngrout by IPA Systems, Inc. or equal.

F. Cone/Ring Dimensions.

1. Manhole Cone Sections.

   a. The top dimensions of cone sections shall be either 24 inches inside diameter by 36 inches outside diameter or 26 inches inside diameter by 38 inches outside diameter.

2. Adjusting Rings.

   a. Adjusting ring dimensions shall match the dimensions of the top of the cone section; either 24″ x 36″ or 26″ x 38″.

   b. Adjusting rings shall have flat or even bearing surfaces providing bearing contact over the entire contact surfaces.

   c. Adjusting rings shall be as specified in Section 410.A.2.b(1) of these Special Provisions, except the dimensions shall be as specified above.

3. Center adjusting rings on manhole cones and center manhole castings on adjusting rings so that their surfaces will be flush whenever possible.

G. Sewer Stubs.

1. Sewer stubs shall be one full length of pipe or 4 foot minimum length and shall be bulkheaded in accordance with Section 3.2.25(a) of the "Standard Specifications".

H. Manhole/Pipe Connections.

1. Connections of pipes to manholes shall be made in accordance with Section 3.5.7 of the "Standard Specifications", as modified below. All

field tapped holes for connecting sewer pipe to manholes shall be made by coring.

a. Rigid Pipe. Reinforced concrete pipe shall be connected by means of brick and mortar per Subsection 3.5.7(a)1.b.

b. Flexible Pipe. Polyvinyl chloride pipe (PVC) shall be connected by an approved flexible pipe to manhole seal.

415. CATCH BASINS

A. Standard Catch Basin.

1. Catch basins shall be constructed in accordance with the standard catch basin details shown on the Plans and these Special Provisions.

a. Catch basins shall be either precast or constructed of 6 inch concrete block and shall have 12 inch sumps.

(1) Revise Chapter 8.38.0 of the "Standard Specifications" to require that concrete brick and block shall be colored "red or pink", conforming to Subsection 519.2.2 of the "State Specifications".

b. The depths of catch basins shown on the Plans are measured from the invert of the lead to the flow line of the grate and do not include the sump depth. Catch basin grates shall be placed to match the ditch or gutter grade or at the elevation indicated on the Plans.

c. Installation Sequencing.

(1) During the first year of construction, adjust the catch basins to final grade except catch basins located at low points shall be placed 2 inches low.

(2) During the second year of construction, adjust catch basins located at low points to final grade.

d. Round catch basins greater than five (5) feet in depth, measured from the inlet flow line to the bottom of the sump, shall be provided with steps in accordance with Paragraph 3.5.4(g) of the "Standard Specifications". Steps shall be OSHA approved and fabricated using 3/8 inch minimum diameter steel reinforcing rod with molded plastic covering.

e. A minimum of 3 inches to a maximum of 18 inches of adjusting rings shall be furnished for each catch basin.

B. Catch Basin Frames and Covers.

1. Catch basin frames and covers shall be Neenah R-3067 (24″ x 36″ catch basin) for vertical face curb and gutter.

C. Catch Basin/Pipe Connections.

1. Connections of rigid pipes to catch basins shall be made with brick and mortar in accordance with Subsection 3.5.7(a)1.b. of the "Standard Specifications".

2. Connections of flexible pipes to catch basins shall be made with a cored rubber boot.

420. DITCH FILLING AND GRADING

A. The Contractor shall fill in ditches where indicated on the Plans, grade the ditches to drain to storm sewer inlets in accordance with the grades shown and form new ditch sections per typical details and cross-sections.

B. Prior to grading and filling in ditches, the Contractor shall strip and stockpile all topsoil for future use in restoring disturbed construction areas. All fill areas shall be covered with a minimum of 4 inches of topsoil. If sufficient quantities of salvaged topsoil are not available for covering fill areas, the Contractor shall furnish additional topsoil.

C. Ditch drainage, in accordance with Section 1.7.10 of the "Standard Specifications", must be provided at all times.

D. Borrow excavation shall comply with Section 208 of the "State Specifications". Fill areas shall be constructed in accordance with Section 207 of the "State Specifications". Fill shall be placed in 8 inch maximum layers and compacted using specialized compaction equipment including pneumatic-tire rollers or vibratory rollers. The initial layer of fill placed over storm sewers shall be 24 inches in thickness. The Contractor shall take precautions to protect storm sewers from damage during compaction operations.

430. RIPRAP

A. Riprap shall comply with Section 606 of the "State Specifications", as modified below.

B. Materials.

1. Riprap shall comply with Subsection 606.2 except that concrete slabs may not be substituted for stone. Riprap dimensions shall be as specified in Subsection 601.2(2).

C. Placing Riprap.

1. Light Riprap.

a. Place by hand with larger stones in lower courses. Lay stones perpendicular to the slope with close, broken joints, firmly bed in the slope, and thoroughly compact. Chink spaces between stones to make the finished surface even and tight.

2. Medium, Heavy, and Extra-Heavy Riprap.

b. May be placed by mechanical means, not dumping, that produces work within reasonable tolerances of the typical section(s). Fill voids with smaller pieces.

D. Geotextile Fabric.

1. Riprap shall be placed on a layer of geotextile fabric as indicated on the Plans or as directed by the Engineer.

2. Place the fabric in accordance with Subsections 645.3.6 and 645.3.7 of the "State Specifications".

3. Material.

a. Light Riprap.

(1) The fabric shall be Geotextile Fabric, Type R (Riprap) meeting the minimum values specified in Subsection 645.2.6.

b. Medium, Heavy, and Extra Heavy Riprap.

(1) The fabric shall be Geotextile Fabric, Type HR (Heavy Riprap) meeting the minimum values specified in Subsection 645.2.7.

501. WATER MAIN CONSTRUCTION

A. Bedding and Cover Material.

1. Wrapped Ductile Iron Pipe.

a. Bedding and cover material used with ductile iron water main encased in polyethylene wrap shall be bedding sand conforming to Subsection 8.43.2(c) of the "Standard Specifications".

2. Polyvinyl Chloride (PVC) Pipe and Fiberglass Reinforced Polyester Mortar Pipe.

a. Bedding and cover material shall be crushed stone chips conforming to Paragraph 8.43.2(a) of the "Standard Specifications". Crushed pea gravel will not be allowed for use as bedding or cover material.

b. Amend Subsection 8.43.2(a) of the "Standard Specifications" to read: "Crushed stone chips, bedding material, shall be made from crushing sound limestone only."

3. Trench Section.

a. The trench section shall conform to Section 4.3.3 and File No. 36 of the "Standard Specifications", as amended below:

(1) Bedding and cover shall be placed in a minimum of three separate lifts to ensure adequate compaction of these materials, with one lift of bedding material ending at or near the springline of the pipe. The Contractor shall take care to completely work bedding material under the haunch of the pipe to provide adequate side support.

(2) Amend Section 4.3.3 and File No. 36 of the "Standard Specifications" to require a minimum of 12 inches of cover material over the top of the pipe.

B. Polyethylene Wrap.

1. Polyethylene wrap shall be provided on all ductile iron water main and cast iron or ductile iron fittings.

a. All joint restraint systems shall be enclosed within the wrap.

b. Wrap the first three feet of water service piping.

c. Wrap all cast iron or ductile iron fittings used with PVC pipe.

d. Wrap all valve boxes.

e. Wrap all hydrant barrels, but be careful not to plug weepholes.

2. Polyethylene wrap shall meet the requirements of AWWA Standard C-105 (ANSI A21.5) using Class C (black) polyethylene material with 8 mils minimum thickness and shall be installed as specified in Section 4.4.4 of the "Standard Specifications".

a. Fold and tape loose wrap material to minimize air entrapment which could cause the material to be punctured when backfilling.

C. Disinfecting Water Mains.

1. Water mains shall be cleaned and disinfected in accordance with Sections 4.3.11 and 4.3.12 and Chapter 4.16.0 of the "Standard Specifications" and AWWA Standard C651. Place calcium hypochlorite tablets in the water main as specified in Section 4.3.12.

2. See Section 555 of these Special Provisions for water main flushing and sampling requirements.

D. Sewer Crossings.

1. Center one full length of water main pipe on sewers wherever water main crosses over or under a sanitary or storm sewer so that both water main joints will be as far from the sewer as possible.

E. High Points in Water Main.

1. The Contractor shall install water main at the grades shown on the Plans with no high points constructed in the main except at hydrants and as indicated on the Plans. If a high point which could trap air can not be prevented, then an air release assembly shall be constructed at that point, if so ordered by the Engineer.

a. The Engineer reserves the right to order the Contractor to relay water main placed at the wrong grade.

F. Joint Restraint.

1. Restraining Fittings, Valves and Sleeves.

a. MEGALUG Restrained Joints.

(1) Restrain all fittings (bends, tees, caps and plugs), valves and sleeves using MEGALUG restrained joints as manufactured by EBAA Iron Sales, Inc. of Eastland, Texas, or as provided for in Paragraph b. below.

(2) Buttress all fittings, as provided for in Paragraph G.1 below, in addition to joint restraint.

b. Joint Restraint Systems.

(1) The following joint restraint systems may be used in place of MEGALUG restrained joints.

(a) Tyler Mechanical Joint Restraint.

1) Joint restraint for mechanical joint pipe and fittings used with either ductile iron or PVC pipe may be provided using the Sigma One-Lok contoured lug restraint or the Star "Stargrip" mechanical joint wedge action restraint.

(b) Restrained Joint Pipe.

1) Joint restraint for push-on joint pipe may be provided by using U.S. Pipe TR FLEX restrained joint pipe, Clow Super-Lock Joint pipe, Griffin Snap-Lok restrained joint pipe, American Flex-Ring or Lok-Ring restrained joint pipe or equal.

2. Restraining Vertical Bends and Offsets.

a. Changes in the grade of the water main made by vertical bends or offsets shall be restrained by strapping in accordance with File No. 47 of the "Standard Specifications" or as provided for in Subsection F.1 above.

3. Restrained Joint Pipe Sections.

a. All water main pipe and fittings, within sections shown on the Plans as "Joint Restraint" or "Restrained", shall be restrained as specified in Subsection F. above and fittings shall be buttressed as specified in Subsection G. below.

b. Restrained Joints in Casings.

(1) The joints of restrained joint pipe installed in casings shall be fully extended to take up the joint slack prior to making the end connections.

4. Restrain Valves on PVC Pipe in Valve Manholes.

a. All valves placed in valve manholes and installed on PVC pipe shall be restrained using PVC joint restraint systems as manufactured by EBAA Iron Sales, Inc.

5. Restrained Joint Water Services.

a. All 4 inch and larger water service piping shall be restrained from the main line tee to the shut-off valve, as specified in Subsection F.1 above, with the end of the service piping braced with thrust blocking. In lieu of providing thrust blocking, the Contractor may restrain the entire length of service piping.

6. Restrained Hydrant Leads.

a. Hydrant leads shall be restrained in accordance with Subsection 530.D of these Special Provisions.

G. Concrete Blocking (Buttresses).

1. All horizontal bends, tees, caps and plugs shall be provided with concrete buttresses, in addition to joint restraint as specified in Paragraph F.1.a(1) above, in accordance with Section 4.3.13 and File Nos. 44, 44A, 45 and 46 of the "Standard Specifications".

H. Insulation.

1. Water mains shall be insulated where noted on the Plans and wherever the depth of cover is less than five (5) feet when so ordered by the Engineer. Insulation shall be in accordance with Chapter 4.17.0 of the "Standard Specifications" and the details on the Plans.

I. Operation of Existing Valves.

1. All existing valves will be operated by or under the supervision of the Town of Somers Water Department. Contact George Stoner at (262) 859-2822.

J. Water Service Disruption.

1. The Contractor shall coordinate his work schedule with the Owner when connecting intersecting streets to the new water main in order to minimize inconvenience and disruption caused by the temporary discontinuance of water service. Water service to residences shall not be shut down for a period longer than eight (8) hours, nor after 4:30 p.m. or on weekends without approval of the Owner. Residential water service may only be shut down between the hours of 8:30 a.m. to 4:30 p.m., except that residential water services may be shut down outside of these hours with the Owner's permission. Water service to businesses shall not be shut down for a period longer than two (2) hours unless satisfactory arrangements are made with the businesses affected. The Contractor shall take whatever measures are necessary to return service at the end of each working day, including the use of temporary valves or plugs.

2. Refer to Section 105 of these Standard Special Provisions for water service disruption notification requirements.

K. Water Main Offsets.

1. Water mains shall be offset as shown on the Plans or as directed by the Engineer. Water main offsets shall be in accordance with File No. 47 of the "Standard Specifications" as modified below.

   a. Place offsets to provide a minimum of six (6) feet of cover.

      (1) Water main shall be offset down only (under the conflicting utility) to prevent high points being created in the offset.

   b. Offset castings may be used when the change in grade is 24 inches or less.

   c. Concrete buttresses shall be constructed as shown, however, optional restraining methods as specified in the section on Joint Restraint of this article may be used in lieu of strapping.

505. WATER MAIN MATERIALS

A. Water main pipe material shall be ductile iron (DI), polyvinyl chloride (PVC), or fiberglass reinforced polymer mortar (FRPM) pipe conforming to the following:

505.1. DUCTILE IRON PIPE

A. Ductile iron pipe meeting the requirements of AWWA Standard C-151 (ANSI 21.51), cement mortar lined with internal and external bituminous coating and furnished with either push-on or mechanical joints with rubber gaskets. Do not furnish cable bonding.

1. Ductile iron pipe shall be furnished for the following minimum thickness classes:

   a. Six (6) inch hydrant lead, 8 inch and 10 inch pipe shall be Class 53.

   b. Twelve (12) inch through 24 inch pipe shall be Class 52.

505.2. POLYVINYL CHLORIDE PIPE

A. Polyvinyl chloride (PVC) pipe (4 inch through 12 inch diameter) meeting the requirements of AWWA Standard C-900, Class 150, DR-18, with cast iron O.D. and integral elastomeric bell and spigot joints.

1. Hydrant leads shall be ductile iron pipe.

2. Do not furnish cable bonding or other methods of providing electrical conductivity on valves, hydrants and fittings located within sections of water main constructed with PVC pipe.

B. Polyvinyl chloride (PVC) pipe (14 inch through 36 inch diameter) meeting the requirements of AWWA Standard C-905, DR 18, Pressure Rating (PR) 235, with cast iron O.D. and integral elastomeric bell and spigot joints.

505.3. FIBERGLASS WATER TRANSMISSION MAIN

A. "Fiberglass" Reinforced Polymer Mortar Pipe for water transmission main, 12″ through 102″ diameter, meeting the requirements of AWWA C950 for "Fiberglass" pressure pipe, Class 250, and ASTM D2412 for Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by parallel plate loading. The pipe supplied for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 46 psi. Joints on pipe supplied on this project shall

conform to the dimensional requirements of AWWA C110 and AWWA C111 for mechanical joint and "push-on" joint cast iron and ductile iron fittings which shall be supplied on this project.

1. Certified copies of test reports of pipe of similar size and design and manufactured at the same plant as will manufacture the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

2. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

505.4. FITTINGS (USED WITH DUCTILE IRON, PVC, AND FIBERGLASS PIPE)

A. Fittings shall be ductile iron or cast iron, cement mortar lined with internal and external bituminous coating and meeting the requirements of AWWA Standard C-110 (ANSI 21.10). Fittings shall be supplied with mechanical joints with rubber gaskets.

1. Ductile iron mechanical joint fittings meeting the requirements of AWWA Standard C-153 for "compact fittings", 3″ through 24″ size, may be used in place of the fittings specified above.

2. All fittings shall be North American, Sigma or Star made only.

B. Bolts.

1. All water main nuts and bolts, including connections to mains, fittings, valves and hydrants, shall be Cor-Blue T-Bolts as manufactured by NSS Industries or equal.

505.7. WATER MAIN MATERIAL FOR DIRECTIONAL DRILLING

A. Polyvinyl chloride (PVC) sanitary sewer meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (16 inch diameter) with restraining jointing systems and with built-in sealing gaskets. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be CERTA-LOCK C900/RJ or C905/RJ by Certain Teed, Terra Brute by IPEX, or approved equal.

2. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment and his methods of operation.

AWWA C900 (Jointed)

Size	DR	Pressure Class[1]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
4″	14	200 psi	.343″	4.800″	5.964″	100′	10.0%	8,000 lbs.	10,300 lbs.
6″	14	200 psi	.493″	6.900″	8.366″	150′	6.7%	9,300 lbs.	14,700 lbs.
8″	14	200 psi	.646″	9.050″	10.947″	200′	5.0%	18,900 lbs.	28,800 lbs.
10″	14	200 psi	.793″	11.100″	13.361″	250′	4.0%	24,900 lbs.	38,300 lbs.
12″	14	200 psi	.943″	13.200″	15.836″	300′	3.3%	28,300 lbs.	48,300 lbs.
4″	18	150 psi	.267″	4.800″	5.964″	100′	10.0%	6,700 lbs.	8,200 lbs.
6″	18	150 psi	.383″	6.900″	8.366″	150′	6.7%	9,000 lbs.	12,800 lbs.
8″	18	150 psi	.503″	9.050″	10.947″	200′	5.0%	18,000 lbs.	25,200 lbs.
10″	18	150 psi	.617″	11.100″	13.361″	250′	4.0%	25,600 lbs.	35,200 lbs.
12″	18	150 psi	.733″	13.200″	15.836″	300′	3.3%	26,440 lbs.	41,100 lbs.

AWWA C905

Size	DR	Working Pressure Rating[2]	Pipe Wall Thickness	Pipe O.D.	Coupling O.D.	Tightest Permissible Bend		Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
						Radius	% Per 10 Ft.		
16″	18	235 psi	0.967″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.
16″	25	165 psi	0.696″	17.40″	18.624″	450′	2.2%	44,000 lbs.	68,500 lbs.

[1] 2-1/2:1 safety factor based on working pressure + surge allowance at 2 f.p.s.
[2] 2:1 safety factor based on working pressure only

3. The maximum job site pull-in force shall not exceed the values given in the above table.

B. Polyvinyl chloride (PVC) pipe meeting the requirements of AWWA C900 (4 inch through 12 inch diameter) or AWWA C905 (14 inch through 48 inch diameter) with thermal butt fused joints between pipe sections. Joint gaskets shall not be required. PVC material shall have a cell classification of 12454-B as defined in ASTM D1784.

1. Pipe shall be Fusible C900 or Fusible C905 by Underground Solution, Inc., or approved equal.

2. Pipe used for water main shall be colored blue.

3. Pipe shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating appropriate to the job site conditions, the capability of his "pull-in" equipment, and his methods of operation.

AWWA C900, C905 PVC Pipe D.I.P. O.D. (Fusible)						
Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	14[1]	4.80″	.34″	4.11″	100′	13,400
6″	14[1]	6.90″	.49″	5.91″	144′	27,600
8″	14[1]	9.05″	.65″	7.76″	188′	48,000
10″	14[1]	11.10″	.79″	9.51″	232′	71,600
12″	14[1]	13.20″	.94″	11.31″	275′	101,000
14″	14[2]	15.30″	1.09″	13.12″	319′	136,000
16″	14[2]	17.40″	1.24″	14.92″	363′	176,000

[1] Pressure Class = 200 PSI

[2] Working Pressure Rating = 300 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	18[3]	4.80″	.27″	4.27″	100′	10,600
6″	18[3]	6.90″	.38″	6.13″	144′	21,700
8″	18[3]	9.05″	.50″	8.05″	188′	37,600
10″	18[3]	11.10″	.62″	9.87″	232′	57,100
12″	18[3]	13.20″	.73″	11.73″	275′	80,000
14″	18[4]	15.30″	.85″	13.60″	319′	108,000
16″	18[4]	17.40″	.97″	15.46″	363′	140,000
18″	18[4]	19.50″	1.08″	17.34″	406′	175,000
20″	18[4]	21.60″	1.20″	19.20″	450′	215,000
24″	18[4]	25.86″	1.43″	22.94″	538′	306,000

[3] Pressure Class = 150 PSI

[4] Working Pressure Rating = 235 PSI

Size	DR	O.D.	Wall	I.D.	Bend Radius	Safe Pulling* Force (Lbs)
4″	25[5]	4.80″	.19″	4.42″	100′	7,700
6″	25[5]	6.90″	.28″	6.35″	144′	16,300
8″	25[5]	9.05″	.36″	8.33″	188′	27,500
10″	25[5]	11.10″	.44″	10.21″	232′	41,100
12″	25[5]	13.20″	.53″	12.15″	275′	59,000
14″	25[6]	15.30″	.61″	14.08″	319′	78,800
16″	25[6]	17.40″	.70″	16.00″	363′	102,000
18″	25[6]	19.50″	.78″	17.90″	406′	128,000
20″	25[6]	21.60″	.86″	19.88″	450′	156,000
24″	25[6]	25.80″	1.03″	23.74″	538′	224,000
30″	25[6]	32.00″	1.28″	29.44″	667′	345,000
36″	25[6]	38.30″	1.53″	35.24″	798′	494,000

[5] Pressure Class = 100 PSI

[6] Working Pressure Rating = 165 PSI

*Safe Pull Force - Fusible PVC Pipe AWWA C900 and C905.

a. Minimum tensile capability of pipe = 7,000 psi (AWWA)

b. Safe Pull Stress = $\frac{7{,}000 \text{ psi}}{2.5 \text{ F.S.}}$ = 2,800 psi

c. Safe Pull Force = Cross Sectional Area of Pipe in square inches times safe pull stress rounded down.

d. Cross Sectional Area of Pipe = $\frac{\text{O.D.} + \text{I.D.}}{2} \times \pi \times T$

4. The maximum job site pull-in force shall not exceed the values given in the above tables.

C. High density polyethylene (HDPE) water main (4 inch through 54 inch diameter) shall meet the requirements of AWWA C906. Pipe material shall have a cell classification of PE 3408 (345434C) as specified in ASTM D3350.

1. Pipe material specified for this project shall conform to the physical characteristics expressed in the following table. Contractor shall select the DR rating (working pressure rating) appropriate to the job site conditions, the capability of his pull-in equipment and his methods of operation.

AWWA C906; PE PIPE, MATERIAL CLASS PE 3408, D.I.P. O.D.

Size	DR[1]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	7.3	4.80″	0.658″	3.37″	8,600
6″	7.3	6.90″	0.945″	4.85″	17,900
8″	7.3	9.05″	1.240″	6.36″	30,900
10″	7.3	11.10″	1.521″	7.80″	46,400
12″	7.3	13.20″	1.808″	9.28″	65,600
14″	7.3	15.30″	2.096″	10.75″	88,200
16″	7.3	17.40″	2.384″	12.23″	114,000
18″	7.3	19.50″	2.671″	13.71″	143,000
20″	7.3	21.60″	2.959″	15.18″	175,000
[1] Working Pressure Rating = 255 psi					

Size	DR[2]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	9	4.80″	0.533″	3.69″	7,250
6″	9	6.90″	0.767″	5.31″	14,900
8″	9	9.05″	1.006″	6.96″	25,700
10″	9	11.10″	1.233″	8.53″	38,800
12″	9	13.20″	1.467″	10.15″	54,800
14″	9	15.30″	1.700″	11.76″	73,700
16″	9	17.40″	1.933″	13.38″	95,300
18″	9	19.50″	2.167″	14.99″	119,700
20″	9	21.60″	2.400″	16.61″	146,900
[2] Working Pressure Rating = 200 psi					

Size	DR[3]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	11	4.80″	0.436″	3.89″	6,000
6″	11	6.90″	0.767″	5.31″	12,500
8″	11	9.05″	0.823″	7.34″	21,500
10″	11	11.10″	1.009″	9.00″	32,400
12″	11	13.20″	1.200″	10.70″	45,900
14″	11	15.30″	1.391″	12.41″	61,600
16″	11	17.40″	1.582″	14.11″	79,800
18″	11	19.50″	1.773″	15.81″	100,000
20″	11	21.60″	1.964″	17.52″	122,000
24″	11	25.80″	2.345″	20.92″	175,000
[3] Working Pressure Rating = 160 psi					

Size	DR[4]	O.D.	Minimum Wall Thickness	Nominal I.D.	Maximum Pull-In Force (Lbs.)*
4″	13.5	4.80″	0.356″	4.06″	5,000
6″	13.5	6.90″	0.511″	5.84″	10,400
8″	13.5	9.05″	0.674″	7.66″	17,900
10″	13.5	11.10″	0.822″	9.39″	26,900
12″	13.5	13.20″	0.978″	11.17″	38,100
14″	13.5	15.30″	1.133″	12.94″	51,200
16″	13.5	17.40″	1.289″	14.72″	66,200
18″	13.5	19.50″	1.444″	16.50″	83,100
20″	13.5	21.60″	1.600″	18.27″	102,000
24″	13.5	25.80″	1.911″	21.82″	145,000
30″	13.5	32.00″	2.370″	27.02″	223,000
36″	13.5	38.30″	2.837″	32.62″	320,000
[4]Working Pressure Rating = 130 psi					

*The Maximum Pull-In Force is determined by the following formula:

$MPF = F \cdot T \cdot \pi \cdot D^2 \cdot (1/DR - 1/DR^2)$

Where, MPF = Maximum Pull-In Force, Lbs.
F = Time Under Tensile Load and Safety Factor (0.35 - dimensionless)
T = Tensile Yield Strength, psi (minimum 2,900 @ 80°F per AWWA C906)
π = Pi (3.14159)
D = Outside Diameter of Pipe, Inches
DR = Dimension Ratio

2. The maximum job site pull-in force shall not exceed the values given in the above table.

3. Fusable Pipe Joints.

   a. Fusable pipe and fittings shall be joined by the butt fusion joining method. The butt joining shall be performed by an experienced and qualified operator using materials and techniques recommended by the pipe manufacturer.

   b. Lateral connections shall be made with saddles of the appropriate sizes. Adaptors for connection to existing lateral material shall be provided.

4. Upon completion of pull-ins, Contractor shall wait 24 hours for polyethylene pipe or 4 hours for PVC pipe to allow the pipe to stabilize prior to making connection thereto or backfilling the boring and/or receiving pit.

5. Pipe fittings shall be manufactured of the same material as specified for pipe.

D. "Fiberglass" Reinforced Polymer Mortar Pipe for water transmission main, 12″ through 102″ diameter, meeting the requirements of AWWA C950 for "Fiberglass" pressure pipe, Class 250, and ASTM D2412 for Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by parallel plate loading. The pipe supplied for this project shall meet or exceed all of the requirements of ASTM D3681 for chemical resistance of "Fiberglass" pipe and fittings. The minimum pipe stiffness when tested in accordance with ASTM D2412 shall be not less than 46 psi. Joints on pipe supplied on this project shall conform to the dimensional requirements of AWWA C110 and AWWA C111 for mechanical joint and "push-on" joint cast iron and ductile iron fittings which shall be supplied on this project.

1. Certified copies of test reports of pipe of similar size and design and manufactured at the same plant as will manufacture the pipe for this Project shall be submitted to the Engineer for review and approval prior to delivery of pipe.

2. Certified copies of reports of tests performed on "Project" pipe shall accompany each shipment.

E. Tests.

1. Pipe material delivered for use on this project shall conform to the requirements of the appropriate AWWA and ASTM Specifications noted herein. All pipe shall be marked in accordance with the requirements of the cited Specifications and each load delivered to the job site shall be accompanied by the manufacturer's certification of such compliance. Said certification to be delivered to the Engineer or his representative.

510. VALVES AND VALVE BOXES

A. Resilient-Seated Gate Valves.

1. Resilient-seated gate valves shall meet the requirements of AWWA C-509 or AWWA C-515.

a. Resilient-seated gate valves shall be furnished with mechanical joints with rubber gaskets, cast iron or ductile iron body, stainless steel bonnet nuts and bolts, bronze mounted, resilient wedge, non-rising stem, "O"-ring stem seals, 2 inch square operating nut opening to the left (counterclockwise) and rated at 200 psi working pressure.

b. All 4, 6, and 8 inch valves shall be resilient-seated gate valves unless shown otherwise on the Plans.

c. Resilient-seated gate valves shall be Waterous "Series 500" (American Flow Control), Mueller, or Clow.

B. Butterfly Valves.

1. Butterfly valves shall be AWWA rubber-seated butterfly valves meeting the requirements of AWWA C-504, Class 150B.

a. Butterfly valves shall be furnished with mechanical joints with rubber gaskets, cast iron or ductile iron body for buried service, underground operator with a 2 inch square operating nut opening to the left (counterclockwise) and rated at 150 psi working pressure.

(1) Provide valves with stainless steel end cap and bolts securing the operating nut to the actuator.

(2) All 10 inch or larger butterfly valves used for private water service lines shall be rated at 200 psi working pressure.

b. All 10 inch or larger valves shall be butterfly valves.

c. Butterfly valves shall be supplied by the following manufacturers:

(1) Main Line (150 psi working pressure) – Pratt "Groundhog", Kennedy, Dresser "M&H", Clow, and Mueller "Lineseal III".

(2) Ten (10) inch or larger Water Services (200 psi working pressure) – Pratt Triton HP-250 (250 psi working pressure) 10" to 36"; Dresser M&H Style 450 (200 psi working pressure) 10" to 12"; Clow M&H (200 psi working pressure) 10" and 12" and (250 psi working pressure) 14" to 48"; and Mueller Lineseal XP (250 psi working pressure) 10" to 48".

C. Valve Boxes.

1. Valve boxes shall be three piece cast iron valve boxes consisting of base, screw type center (5-1/4 inch shaft diameter) and top section with cover marked "WATER".

a. Place valve box covers at the existing grade or to the elevation shown on the Plans or as specified in these Special Provisions. Furnish extension sections as required. Turn the top section down,

where covers are set below the finished grade, to allow for future final adjustment (raising) to finish grade.

b. Valve boxes shall be North American, Sigma or Star made only. Acceptable manufacturers include: Tyler 6860 series, Bingham and Taylor 4906, Bibby-Ste. Croix, Sigma and Star.

2. Valve Box Adaptors.

a. Valve boxes for both gate and butterfly valves shall be installed by mounting on cast iron valve box adaptors as manufactured by Adaptor, Inc., of Oak Creek, Wisconsin, or equal.

3. Valve Stem Extensions.

a. All valves installed at greater than 8 feet of depth shall be provided with valve stem extensions to bring the operating nut up to normal depth (equivalent to a valve at 8 feet of depth). The extension shall be secured to the operating nut with at least 2 set screws drilled into the nut. Provide a centering ring at the top of the extension.

4. Valve Box Depth.

a. Valve box depths shown on the Plans are approximate only, unless the cover elevation is indicated. Valve box covers shall be placed to match the existing grade (1/4 inch below pavement surface) unless the finished elevation is shown on the Plans.

b. Furnish and install valve boxes so that they may be extended (raised) to final grade without installing additional valve box sections.

5. Valve Box Adjustment.

a. During the first year of construction, adjust the valve boxes to 1/4″ below the first layer of asphalt.

b. During the second year of construction, adjust the valve boxes to 1/4″ below the final grade.

D. Tapping Valves and Sleeves.

1. Tapping valves shall be similar to the AWWA gate valves specified in Subsection 510.A. of these Special Provisions except for the end connection (usually flanged) to the tapping sleeve and oversized seat rings to permit entry of the tapping machine cutters.

2. Tapping sleeves shall be supplied by the manufacturer of the tapping valves.

E. Cutting-In Valves and Sleeves.

1. Cutting-in valves shall be similar to the AWWA gate valves specified in Subsection 510.A of these Special Provisions except that they shall be provided with special gaskets allowing assembly on various types of pipe.

2. Cutting-in sleeves shall be supplied by the manufacturer of the cutting-in valves.

F. Check Valves.

1. Check valves shall be swing check valves, mechanical or flanged joints, cast iron body, bronze mounted and furnished with outside lever and weight. Check valves shall be rated at a working pressure of 175 psi for 12 inch diameter and smaller and 150 psi for 14 inch diameter and larger.

2. Swing check valves shall be Clow, Mueller, Traverse City, Golden-Anderson or equal.

515. AIR-RELEASE ASSEMBLIES

A. Air-release assemblies shall be constructed in accordance with File No. 42 or File No. 43 (for dead end mains) of the "Standard Specifications". Copper tubing shall be 1 inch diameter for 16 inch diameter water main or smaller and 2 inch diameter for 18 inch water main and larger.

520. VALVE AND AIR-RELEASE MANHOLES

A. Valve and air-release manholes shall be constructed in accordance with the general requirements of File Nos. 12, 15, 40 and 40A of the "Standard Specifications", with the following modifications:

1. Manholes shall be precast 48 inch inside diameter, unless shown otherwise, with eccentric cones. Locate manhole opening over butterfly valve operator.

a. A minimum of 3 inches to a maximum of 18 inches of adjusting rings shall be furnished for each manhole.

b. Manhole depths shown on the Plans are approximate only, unless the cover elevation is indicated. Manhole covers shall be placed to

match the existing grade unless the finished elevation is shown on the Plans.

c. Revise Chapter 8.38.0 of the "Standard Specifications" to require that concrete brick and block, if required, shall be colored "red or pink", conforming to Subsection 519.2.2 of the "State Specifications".

2. Manhole steps shall be OSHA approved, 3/8" minimum diameter steel reinforcing rod with molded plastic covering.

3. Manhole frames and covers shall be Neenah R-1580 with Type "B" lids, non-rocking, or equal.

4. Construct sumps in manholes as shown in File No. 40, except do not plug if the base of the sump is above the water table.

5. Valves shall be supported by treated hardwood blocking.

B. Manhole Joints.

1. Joints for precast manhole riser sections shall be made with rubber "O"-ring gaskets, a continuous ring of butyl rubber sealant (EZ-Stik or Kent-Seal in rope form) or equal. The butyl sealant shall be 1 inch diameter equivalent or as recommended by the manhole manufacturer.

2. Adjusting rings and manhole frames shall be set in mortar or butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface areas of the top of cone and all adjusting rings. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

3. The interior and exterior dimensions of the top of the cone section and adjusting rings shall be equal and these surfaces shall be constructed flush with each other. Adjusting rings shall be as specified in Section 8.39.10 of the "Standard Specifications". Manhole riser rings shall be 26 inches I.D. by 38 inches O.D. unless otherwise approved. Center manhole casting on riser rings.

C. Manhole Pipe Connections.

1. Connections of water main pipes to manholes shall be made in accordance with Section 3.5.7 of the "Standard Specifications". All field tapped holes for connecting pipe to manholes shall be made by coring.

2. Flexible pipe connections shall be made with flexible watertight connectors, Kor-N-Seal, Link-Seal or equal. All clamps, bolts, etc. of pipe

to manhole seals shall be stainless steel. If Link-Seal connectors are used, the bolt heads shall be placed on the inside of manholes.

530. HYDRANTS

A. Standard Hydrant.

1. Hydrants shall be Mueller "Centurion" No. A-423 and Kennedy "Guardian", conforming to the following specifications:

a. Hydrants shall be compression type, with 5-1/4 inch bottom valve and 6 inch mechanical joint inlet connection equipped with "O"-ring packing, safety flange construction, meeting the requirements of AWWA Standard C502 and meeting specifications for 300 PSI test pressure and 150 PSI working pressure.

(1) The bottom or base flange and any other buried flanges shall be fastened using stainless steel nuts and bolts.

b. Hydrants shall have two 2-1/2 inch hose nozzles and one 4-1/2 inch National Standard pumper nozzle with National Standard fire hose coupling screw threads and nut type nozzle caps with gasket and chains. Secure the bottom or base flange and any other buried flanges, including all extension flanges, using stainless steel nuts and bolts.

c. Hydrants shall have 1-1/4 inch pentagon operating nut opening to the left (counter-clockwise).

d. Hydrants, including barrel extensions, shall be painted with Rust-Oleum Industrial Enamel 1210 "Fire Hydrant Red" with the nozzle caps and operating nut painted with Rust-Oleum Industrial Enamel 1906 "Silver Gray".

2. Air-Release Hydrants.

a. Air-release hydrants shall be installed in accordance with the details shown on the Plans.

B. Barrel Extensions.

1. Hydrants shall be furnished for the depth of bury shown on the Plans. Hydrants requiring greater than 7-1/2 feet of bury shall be furnished as standard 7-1/2 foot hydrants with extensions as required. Hydrant extensions shall be compatible with hydrant barrel and stem sections and

shall be installed at the top of the barrel section. The distance from the ground line to the centerline of the lowest nozzle shall be from 18 to 23 inches.

a. Secure extension flanges using stainless steel nuts and bolts.

C. Valves and Valve Boxes.

1. Hydrant valves and valve boxes shall conform to the requirements for gate valves and valve boxes of these Special Provisions.

D. Hydrant Leads.

1. Hydrant leads shall be six (6) inch, Class 53, ductile iron pipe.

2. Restrain hydrants with thrust blocking and by anchoring to the main. Restrain all joints with: tie rods (2-3/4" diameter) per File No. 47 of the "Standard Specifications", MEGALUG restrained joints, anchoring pipe and fittings, or restrained joint pipe per Paragraph 501.F.1.b of these Special Provisions. Provide concrete thrust blocks for both the hydrant and hydrant tee.

a. Secure the hydrant lead to the main using an anchoring tee.

3. Restrain one full length of pipe on both sides of the hydrant tee.

E. Hydrant and Auxiliary Valve Locations.

1. Place hydrants 3 feet behind the back of curb (urban roads) or 3 feet from the right-of-way line (rural roads with ditches), unless shown otherwise on the Plans.

2. Connect hydrant valves directly to the anchoring tee.

F. Temporary Hydrant Cover.

1. Temporarily cover new hydrants (except for hydrants located in new subdivisions) during construction with polyethylene bags, securely fastened in place, until after the water main has been tested and placed in service.

540. WATER SERVICES

A. Installation.

1. Water service piping shall be installed in accordance with Chapter 5.5.0 of the "Standard Specifications" and the following provisions:

   a. Do not connect services to the water main until after the main has been tested and a safe water sample obtained.

   b. Insert the corporation stop into the water main while the main is in service and under pressure.

   c. Don't backfill the water service trench until after the service has been checked for leaks and the service piping thoroughly flushed.

2. Cover.

   a. Install water service piping with 6-1/2 feet minimum cover except provide 5 feet minimum cover at ditches.

3. Tapping PVC and FRPM Water Main.

   a. PVC and FRPM water main shall be tapped using double strap service clamps. Corporation stops installed on PVC pipe shall be furnished with AWWA tapered threads conforming to AWWA C-800.

      (1) Service clamps shall have the following minimum total widths:

         (a) 3/4″ and 1″ services - 2″ minimum width.

         (b) 1-1/4″, 1-1/2″ and 2″ services - 3″ minimum width.

   b. Taps shall be located at least 2 feet from the ends of pipe sections and at least 18 inches apart measured in a horizontal direction.

   c. Tap PVC and FRPM pipe using a shell cutter with internal teeth. Do not use a standard drill and tap for direct tapping under pressure.

   d. Place teflon tape on corporation stop threads prior to installation. Corporation stops shall be torqued to a maximum of 35 ft.-lb. or as recommended by the manufacturer.

B. Curb Valve Location.

1. Curb valves shall be placed one (1) foot from the right-of-way line, unless shown otherwise on the Plans; with the residence side of the curb valve capped or plugged.

2. 4″ and Larger Services.

a. Restrain one "full" length of main on both sides of the water service tee.

b. Restrain 4″ water services with thrust blocking. Restrain all joints with tie rods (2-3/4″ diameter) per File No. 47 of the "Standard Specifications", MEGALUG restrained joints, anchoring pipe and fittings, or restrained joint pipe per paragraph 501.F.1.b of these Special Provisions. Provide concrete thrust blocks for the tee.

C. Augering Service Piping (Existing Roadways).

1. Water service piping shall be installed by augering under existing pavement and shoulder areas.

D. Water Service/Sanitary Sewer (Lateral) Separation.

1. Horizontal Separation.

a. Install water services 2-1/2 inches or larger in diameter at least 8 feet horizontally from sanitary sewer laterals.

b. Install water services 2 inches or less in diameter at least 30 inches horizontally from sanitary sewer laterals.

(1) Water services may be installed closer than 30 inches from a sewer lateral if the bottom of the water piping is at least 12 inches above the sewer.

c. No water service may be installed within 6 inches of a storm sewer.

2. Vertical Separation.

a. Water main and water service piping crossing a sanitary sewer, including laterals, and located within 10 feet of the point of crossing shall be installed:

(1) At least 12 inches above the top of the sewer, or

(2) At least 18 inches below the bottom of the sewer from the top of the water piping, or

(3) Within a waterproof sleeve, made of PVC (ASTM D3034 or ASTM D1785) or other acceptable material per Table 84.30-3 of the Plumbing Code - Department of Commerce.

E. Water Service Piping.

1. Polyethylene Tubing (New and Relaid Services).

a. Water service piping for all new and relaid services from 3/4″ through 2″ diameter shall be polyethylene (PE) tubing (copper tube size) conforming to AWWA C-901 and ASTM D2737, PE 3408, DR 9.0 (200 psi working pressure).

(1) Use 1-1/4″ diameter standard residential service.

b. Use compression type mechanical fittings for corporation stop and curb valve. Flared fittings shall not be used.

c. Join PE pipe to PE pipe using heat-fushion connections.

d. All connections of polyethylene tubing to corporation stops and curb valves shall be reinforced with liner/insert stiffeners.

F. Water Service Materials.

1. Water services shall include furnishing and installing corporation stop, service clamps if required, curb valve, valve box, and stationary rod as specified herein and as shown on the Plans.

a. Corporation stops shall be McDonald 4701BQ ball valve with AWWA/CC taper thread inlet and compression connection outlet (1-1/4″ through 2″ size).

(1) Install <u>all</u> stops with double strap service clamps. Service clamps shall have ductile iron body and stainless steel straps or shall be 100% stainless steel.

(2) Reinforce polyethylene tubing connections with liner/insert stiffeners; AY McDonald 6133T (1-1/4″ through 2″).

b. Curb valves shall be ball valves with Minneapolis Pattern thread and compression connections; A. Y. McDonald 6106Q with 4753Q McQuik assembly (3/4″ through 2″).

(1) Reinforce polyethylene tubing connections with liner/insert stiffeners.

c. Curb boxes shall be extension type with Minneapolis pattern base, McDonald 5614 with 1-1/2″ base thread for 3/4″ and 1″ sizes or McDonald 5615 with 2″ base thread for 1-1/2″ and 2″ sizes.

(1) Curb boxes shall be furnished with a 4 foot stationary rod.

d. All water service fittings shall be electrically conductive compression type.

550. HYDROSTATIC TESTS

A. General Requirements.

1. All tests shall be performed as specified in Chapter 4.15.0 of the "Standard Specifications", except that the water main shall pass three consecutive one-hour leakage tests. The Engineer or his Representative shall be present at all times during testing.

2. The Contractor shall furnish all labor, equipment and material to complete all testing.

3. Temporary Air-Release.

a. Trapped air shall be bled off (by tapping the main) when filling the main with water and/or removed by flushing through hydrants.

b. Temporary air-release may be provided by tapping 1 inch corporation stops into the high points of pipe or into the plug on dead end lines. After flushing and testing is completed, the temporary taps shall be abandoned in place.

c. The Contractor shall provide temporary flushing hydrants if required to flush dead end lines.

d. All costs for providing temporary air-release, including tapping and temporary flushing hydrants, shall be paid for by the Contractor.

B. Test Sections.

1. The Contractor has the option to test the entire new water main as one continuous test section or in segments per his discretion.

2. Connections to intersecting streets need not be tested, however, the Contractor shall sterilize and flush all connecting mains. The intersecting main(s) shall be subjected to line pressure and any visible defects repaired prior to backfilling.

C. Testing Costs.

1. The cost of all testing work (including Contractor's purchase of water) shall be included in the unit price(s) bid for water main.

2. Water Purchased by Contractor.

a. Water for testing will be purchased by the Contractor. The Contractor shall notify the Owner prior to using water and shall coordinate his operations with the Owner in order not to deplete the water supply. Water usage may be restricted to periods of low demand (night time or weekend hours) if water usage is high during normal working hours.

555. DISINFECTION

A. General Requirements.

1. The water main shall be disinfected in accordance with Section 4.3.12 and Chapter 4.16.0 of the "Standard Specifications".

a. Amend paragraph 4.16.5 of the "Standard Specifications" to read:

4.16.5 SAMPLING. The Contractor shall take all necessary samples of the water and provide any equipment necessary to take these samples at no cost to the Owner. The Contractor, accompanied by the Engineer or his representative, shall deliver the samples to an approved laboratory for testing.

B. Safe Samples.

1. At least one (1) safe sample must be obtained from <u>each</u> of the segments hydrostatically tested as listed under Subsection 550.B. (Test Sections) of these Special Provisions. Additional samples may also be required from:

a. Representative locations from each of the test sections to establish that all of the mains are free of contamination.

b. Dead end lines.

c. Connections to existing mains (see Subsection 555.C. of these Special Provisions).

2. Water main segment(s) shall not be placed in service until after safe water sample(s) have been obtained.

C. Procedures for Disinfecting Connections to Existing Mains.

The following procedures apply when existing mains are wholly or partially dewatered. Existing mains that are isolated by an existing valve require no disinfection. After the appropriate procedures have been completed, the existing main may be returned to service prior to completion of bacteriological testing to minimize disruption to service.

1. Apply liberal quantities of hypochlorite to wet trenches at or near the connection to the existing main. Use hypochlorite tablets if water is being pumped from the trench to prolong protection as hypochlorite is slowly released as the tablets dissolve.

2. Swab the interior of all pipe and fittings located between the connection to the existing main and the closest new valve (including connection pipe and fittings) with a one percent hypochlorite solution in accordance with Subsection 555.F. of these Special Provisions.

3. Flush the connection to the existing main, from both directions toward the connection if valve and locations permit, as soon as the connection has been completed and the nearest new valve installed and secured. Flush through the new main until all discolored water is eliminated.

4. Should the water main connection be severely contaminated by dirty water or other means, the existing main and connection shall be disinfected by slug chlorination in accordance with the procedure specified below:

a. Continue to isolate the section of contaminated main.

b. Shut off all service connections.

c. Place hypochlorite tablets in the connection to the new main.

d. Flush the main to remove particulates.

e. Slowly dose the contaminated main with a 300 mg/l free chlorine concentration for a period of at least 15 minutes.

f. Flush the main until the water is free of noticeable chlorine odor.

g. Open service connections and return the main to service.

5. Take bacteriological samples to provide a record for determining the effectiveness of the procedure. Samples may be required from both sides of the connection.

If unsatisfactory tests are recorded, the Owner will determine the necessary corrective action. Take daily samples until two consecutive safe samples have been recorded.

D. Rechlorination.

1. Should any test prove unsatisfactory, the water main shall be sterilized by the Contractor by such methods as he deems necessary and samples taken until acceptable results are obtained.

E. Flushing.

1. All water mains, including dead end mains and all hydrants, and all water services shall be flushed. Water services shall be flushed, with a minimum amount of water equivalent to the volume of the service pipe, until the water is visibly clean.

a. Provisions shall be made to convey water used for flushing or testing to a suitable discharge point without damage to crops or cropland and without disruption of farming operations. No flushing water may be discharged on farmlands.

b. The Contractor shall use suitable methods for disposing of flushing water to prevent surface erosion.

c. The Contractor shall provide temporary flushing hydrants as required.

2. Water Furnished By Owner.

a. Water for testing and flushing will be furnished by the Owner. The Contractor shall notify the Owner prior to commencing flushing and shall coordinate his operations with the Owner in order not to deplete the water supply. Water usage may be restricted to periods of low demand (night time or weekend hours)

if water usage is high during normal working hours. All flushing of new mains and services shall be done under the direct supervision of the Engineer or his representative.

3. Metered Water.

a. The Contractor shall meter all water used for flushing purposes. A complete record of all water used for flushing, including amounts and dates, shall be kept by the Contractor and provided to the Owner.

b. The Contractor shall use a flushing meter provided by the Owner. The meter shall be returned, in good condition, immediately after completing flushing operations. The Contractor shall be responsible for any damage to flushing meters.

F. Swabbing Water Main.

1. All piping installed outside of water main test segments shall be disinfected by swabbing with a 1% hypochlorite solution and thoroughly flushed. The entire interior surfaces of all pipes and fittings shall be thoroughly swabbed. The diameter of swabs used in pipes shall match the interior pipe diameter and provide resistance when swabbing the pipes. Pipes shall be swabbed with a pumping motion with all surfaces wiped several times. The Contractor shall use extreme care to insure the cleanliness of all water main materials used.

600. GENERAL CONSTRUCTION PROCEDURES

604. COLD WEATHER WORK

A. Asphaltic Paving.

1. Asphaltic pavement shall not be placed when the air temperature is below 35°F.

2. Paving done during the period between October 15th and May 1st shall be in accordance with Subsection 405.3.1 of the "State Specifications".

B. Mortaring Adjusting Rings.

1. Mortar for adjusting rings may only be placed when the air temperature is at least 35°F and rising or at least 40°F when falling.

2. Mortaring and concrete placement shall be in accordance with Subsection 415.5.13 of the "State Specifications.

605. ROCK EXCAVATION

A. Rock excavation shall be in accordance with Section 2.2.9. of the "Standard Specifications". The payment width for rock excavation in open-cut shall be the actual width of excavated trench, but not to exceed the outside diameter of the pipe plus 24 inches. The bottom of rock shall be measured to no lower than 4 inches below the barrel of the pipe. The vertical limits of rock may be measured by stripping earth overburden prior to blasting or removal or by other methods mutually acceptable to both the Engineer and Contractor. One such method may be to measure the depth of rock exposed on trench walls after blasting and excavation have been completed.

606. PREVENTION OF PIPE FLOTATION

A. The Contractor shall at all times prevent the possibility of pipe flotation, i.e.: the lifting of pipes by buoyancy as water rises in the trench by proper bracing or by loading to overcome buoyancy. All pipe damaged by flotation shall be removed and relaid at the Contractor's expense.

607. PORTABLE TRENCH BOX

A. The use of portable trench boxes and sliding trench shields shall conform to Section 2.3.6. of the "Standard Specifications", as modified below:

1. Trench boxes or shields used within trenches in which the pipe is installed with Class "B" or Equivalent Bedding, including flexible sewer pipes and PVC water main, shall ride on a shelf excavated in the trench to ensure that the proper bedding section is achieved and maintained.

a. 4" Through 16" I.D. Pipe. The shelf shall be located no lower than the top of the pipe, except that it shall not be placed more than 24 inches above the trench bottom unless the provisions of Paragraph 2 below are met.

b. 18" Through 30" I.D. Pipe. The shelf shall be located no lower than the springline of the pipe, except that it shall not be placed more than 24 inches above the trench bottom unless the provisions of Paragraph 2 below are met.

c. 36" Through 60" I.D. Pipe. The shelf shall be located no lower than 24 inches above the trench bottom unless the provisions of Paragraph 2 below are met.

2. Current OSHA standards allow placing trench boxes or shields on a shelf located no more than 24 inches above the bottom of the trench if the following conditions are met:

a. The trench walls consist of reasonably stable soils.

b. The trench bottom is not wet. (Note that all standing water shall be pumped or removed from the trench in order to meet this condition.)

B. Recompaction of Class B or Equivalent Bedding.

1. If a trench box or shield is supported or rides within bedding or cover material located below the top of a pipe in trenches in which the pipe is installed with Class "B" or Equivalent Bedding, including flexible sewer pipes and PVC water main, the Contractor shall recompact bedding and cover material to the top of the pipe after removing the box or shield as follows:

a. First, thoroughly compact bedding and cover material per the provisions of Paragraphs 201.A.1.a(3) (sanitary sewer), 301.B.3.a(1) (force main), 401.A.2.b (storm sewer), and 501.A.3.a(1) (water main) of these Special Provisions before moving the trench shield; then

b. lift the trench shield so that it rides on top of the cover material;

c. recompact the bedding and cover material so that there are no voids between the pipe and trench walls; and

d. pull the trench shield ahead.

2. Alternate method(s) of recompacting bedding and cover material disturbed by the trench box or shield may be used if approved by the Engineer.

608. MANUFACTURER'S REPRESENTATIVE

A. The pipe manufacturer shall have a representative available to the Contractor and Engineer for the purpose of advising them in the proper method of laying pipe and making watertight joints. It is the intent of this requirement that the representative spend only such time on the job as will accomplish the desired result of satisfactory installation practice. The presence of such representative, however, or the partial payment made for pipe as delivered, shall not relieve the Contractor of his responsibility under these Special Provisions. All pipe laying and making of all joints shall be done strictly in accordance with the manufacturer's

directions, however, the Contractor shall be responsible for the watertightness specified.

609. HANDLING PIPE AND ACCESSORIES

A. Proper equipment, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Pipe, fittings, valves and other accessories shall at all times be handled with care to avoid damage. In loading and unloading they shall be lifted by hoist or derrick or rolled on skidways in such manner as to avoid shock. Pipe unloaded by skidding shall be protected from bumping contact with other pipe or the ground. Under no circumstances shall pipe be dropped.

B. The Contractor shall carefully examine all pipes and other materials immediately before placing in the trench, and if any such pipes or materials are found to be defective they shall be rejected and removed from the work site.

610. BORING AND JACKING

A. General.

1. Boring and jacking shall be in accordance with Chapters 4.13.0 and 6.2.0 and File No. 49 of the "Standard Specifications", as amended herein.

   a. The diameter of borings shall be no greater than the outside diameter of the bell of the carrier pipe or casing plus two inches. Voids occurring between the pipe or casing and the undisturbed natural soil shall be backfilled with a pea gravel/water slurry or other approved non-cementious material.

2. Where indicated on the Plans, Contractor shall construct utility pipe by boring and jacking methods.

   a. At Contractor's option, he may install a casing pipe and insert the carrier pipe into the casing in accordance with paragraph E. below or he may install a carrier pipe conforming to the requirements of paragraph 205.A.4 of these Special Provisions which is specifically designed to be installed by boring and jacking.

3. Jacking pits shall be located at Contractors discretion taking into account permit requirements, safety and protection of public and private property unless pit locations are indicated on the Plans.

B. Subsurface Conditions.

1. It is the Contractor's responsibility to familiarize himself with subsurface conditions at the site of boring or jacking work and the Contractor shall be responsible for complete and accurate installation regardless of the subsurface conditions encountered.

C. Alignment.

1. The Contractor shall be responsible for maintaining proper line and grade of the boring or casing pipe and shall check the alignment during boring or jacking operations at intervals he feels are necessary to maintain the proper alignment. The pipe or casing shall be installed at a positive or negative grade as indicated on the Plans with no intermediate high or low points. Misalignment of the bore or casing pipe shall be corrected at the Contractor's expense.

   a. Pipe or casing shall be installed by jacking at the grade shown on the Plans. Final alignment of the pipe or casing shall be within three (3) inches of line and grade for sewers and within six (6) inches of line and grade for water main.

      (1) The grade of the pipe, including both end elevations, will be checked by the Engineer upon completion of jacking operations and prior to backfilling of jacking pits. The Contractor shall expose both ends of the pipe and shall provide any assistance required by the Engineer when checking grade. The Contractor shall provide the Engineer with at least 24 hours advance notice when requesting alignment checks.

   b. Sanitary sewer laterals installed by boring or directional drilling shall be placed at a grade of 1/4 inch per foot (2.08%) unless shown otherwise on the Plans. Vertical alignment of the completed bore shall be within 4 inches of grade and shall provide a continuous positive lateral grade.

D. Casing Pipe.

1. Casing pipe shall be ASTM A-53, Grade B, welded steel pipe with a minimum yield strength of 35,000 psi and thickness(es) of not less than:

Carrier Pipe Largest O.D.	Standard Size Casing Pipe	Casing	
		Minimum Wall Railroad	Minimum Wall Highway
10-3/4″	16″	.250″	.250″
16″	20″	.312″	.250″
20″	24″	.375″	.313″
24″	30″	.438″	.344″
30″	36″	.563″	.375″
36″	42″	.625″	.438″
42″	48″	.625″	.500″

2. Reinforced Concrete Pipe.

a. ASTM C-76. All reinforced concrete casing pipe (RCP), unless shown otherwise on the Plans or otherwise specified below, shall meet the requirements of ASTM C-76 with rubber gasket joints conforming to ASTM C-443 and shall be manufactured using "C" wall design.

(1) All ASTM C-76 reinforced concrete casing pipe shall be Class _____ or stronger.

(2) Reinforced concrete pipe used for jacking or tunneling shall have a minimum of two (2) circular rings of reinforcement extending into both tongue and groove (bell and spigot) of pipe. The concrete shall have a minimum compressive strength of 5000 psi. This compressive strength shall be reached prior to delivery of the pipe to the site.

E. Inserting Carrier Pipe.

1. Carrier pipes installed within casing pipes shall rest on skids or centering devices securely fastened to the pipe to prevent slipping or twisting as the carrier pipe is inserted into the casing pipe. If metal strapping is used, it shall be grade 316 stainless steel and shall be positioned and secured so it can not come into contact with the casing pipe. Skids shall be placed circumferentially around the carrier pipe and spaced at intervals to prevent the carrier pipe bell from contacting the casing pipe.

a. The thickness of skids shall be varied through the casing, if required, to provide a positive grade on the carrier pipe.

b. If carrier pipes twist or turn during insertion operations, the pipe shall be withdrawn and reinserted until the carrier pipe rests level on the skids as inserted.

2. Skids or centering devices shall be designed to support the full weight of the carrier pipe full of water without imparting excessive point loading to the carrier pipe wall as determined by the pipe manufacturer. Skids or centering devices shall be placed, as a minimum, three per pipe length, one at each end approximately one foot from the joint and at the mid-point of the pipe length. Additional casing spacers may be required to support the weight of the loaded pipe as stated above. Two additional spacers shall be placed approximately one foot apart and one foot inside each end of the casing pipe.

   a. Skids shall be a minimum of three feet long 4″ x 4″ nominal maple hearts or approved equal with banding grooves that will prevent the bands and pipe bells from coming in contact with the casing.

   b. Centering devices shall be RACI, Cascade, or Advance casing spacers or equal. Submit shop drawings, design data and loading calculations to Engineer for approval.

3. Contractor shall provide three copies of shop drawings and calculations indicating the design loading, circumferential spacing and longitudinal spacing. The calculations shall include a safety factor of not less than two.

4. Upon completion of the insertion of the carrier pipe within the casing, the ends of the casing shall be sealed to prevent infiltration of bedding material. Rigid end seals that may result in a shear plane are not allowed. Flexible end seals shall be wrap around type manufactured to fit the casing and carrier pipe O.D.s with an adequate overlap for sealing with mastic cement. The seal shall be minimum 1/8 inch thick neoprene rubber fastened to the casing and carrier pipes with stainless steel bands with stainless steel screw assemblies.

5. Amend Paragraph 6.2.3(b) of the "Standard Specifications" to read in part: "The annular space between the casing and carrier pipes shall <u>not</u> be filled."

611. DIRECTIONAL DRILLING

A. Work Included.

1. Furnish all labor, materials and equipment required to install water main, force main and sanitary sewer using directional drilling method of installation, all in accordance with the requirements of the Contract Documents. Work shall include but not be limited to proper installation, testing, restoration of underground utilities, environmental protection and restoration.

2. The directional drill shall be accomplished by drilling a pilot hole to design standards, and then enlarging the pilot hole no larger than that allowed in Subparagraph I.8 below to accommodate the pullback of the pipe through the enlarged hole.

3. Soil borings as required for directional drilling shall be provided by the Contractor.

B. Reference Special Provisions.

1. See Special Provision Section 205.1 for sanitary sewer pipe material to be installed by directional drilling.

2. See Special Provisions Section 305.1 for force main pipe material to be installed by directional drilling.

3. See Special Provision Section 505.7 for water main pipe material to be installed by directional drilling.

C. Quality Assurance.

1. All directional drilling operations shall be done by a qualified directional drilling Contractor with at least three (3) years experience involving work of a similar nature to the work required of this project.

2. Notify Engineer a minimum of 48 hours in advance of the date of work start.

3. All work shall be performed in the presence of the Engineer or his representative.

D. Directional Drilling Equipment Requirements.

1. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system or walk over system to accurately guide boring operations, a vacuum truck or trucks of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in good, safe condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2. Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations. Provide Engineer with a copy of the current, not more than six (6) months old, certification of the gage accuracy. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.

3. Drill Head: The drill head shall be steerable by changing it's rotation and shall provide necessary cutting surfaces and drilling fluid jets.

4. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.

5. Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, Grade D or better, with threaded box and pins. Tool joints should be hardened.

E. Guidance System.

1. A guidance system probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to 50 feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall sense and display to 0.10% of inclination with an accuracy of ±10% of the indicated inclination. Horizontal location shall be maintained within 0.5 feet of alignment.

2. Components: The Contractor shall supply all components and materials to install, operate, and maintain the guidance system.

F. Drilling Fluid (Mud) System.

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system

shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing.

2. Drilling Fluids: Drilling fluid shall be composed of clean water and bentonite clay. Water shall be provided by the Contractor. Water of a low pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or other approved modifier. No additional material may be used in drilling fluid without prior notification to Engineer. The bentonite mixture used shall have appropriate viscosities to support the drill hole during drilling and pullback.

3. Delivery System: The mud pumping system shall have an adequate capacity to deliver the drilling fluid to the drill head at a pressure suitable for the work. The delivery system shall have filters to prevent solids from being pumped into drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during operations shall be contained and conveyed to the drilling fluid recycling system or shall be removed. A berm, minimum of 12 inches high, shall be maintained around drill rigs drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and/or vacuum truck(s) of sufficient size shall be in place to convey drilling fluid from containment areas to storage and recycling facilities or disposal.

G. Other Equipment.

1. Pipe Rollers: Pipe rollers shall be used for pipe assembly during final product pullback. (Fused joint pipe only.)

H. General Requirements.

1. The Engineer shall be notified 48 hours in advance of starting work. The directional bore shall not begin until the Engineer is present at the job site. The Engineer's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as required under the Contract. It shall be the responsibility of Engineer to provide inspection personnel at such time as appropriate without causing undue hardship by reason of delay to the Contractor.

I. Directional Drilling Operation.

1. The Contractor shall provide all material, equipment, and facilities required for directional drilling. Proper alignment and elevation of the borehole shall be consistently maintained throughout the directional

drilling operation. The method used to complete the directional drill shall conform to the requirements of all applicable permits.

2. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on the Plans. If Contractor is using a magnetic guidance system, drill path shall be surveyed by Contractor for any surface geo-magnetic variations or anomalies.

3. Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by Contract Documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations.

4. Readings shall be recorded after advancement of each successive drill pipe, and the readings plotted on a scaled drawing of 1″ = 20′ horizontal and 1″ = 2′ vertical. Access to all recorded readings and plan and profile information shall be available to the Engineer, or his representative, at all times.

5. A complete list of all drilling fluid additives and mixtures to be used in the directional drilling operation shall be submitted to the Engineer, along with their respective Material Safety Data Sheets. All drilling fluids and loose cuttings shall be contained in pits or holding tanks for recycling or disposal. No fluids shall be allowed to enter any unapproved areas or natural waterways. Upon completion of the directional drill project, the drilling mud and cuttings shall be disposed of by the Contractor at an approved dump site.

6. The pilot hole shall be drilled on bore path with no deviations greater than 10% of Plan grade (6″ maximum deviation) and 0.5 feet in horizontal alignment. In the event that pilot does deviate from the bore path more than stated above, Contractor will notify Engineer and Engineer may require Contractor to pullback and re-drill from a location along bore path before the deviation.

7. Upon completion of pilot hole phase of the operation, a complete set of "as-built" records shall be submitted in duplicate to the Engineer. These records shall include copies of the plan and profile drawing, as well as directional survey reports as recorded during the drilling operation.

8. Upon approval of the pilot hole location the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be

increased to accommodate the pullback operation of the required size of water or sewer pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor's discretion with the final hole opening not greater than the following:

a. C900 and C905 PVC pipe with bell joints or couplings:

(1) O.D. of the coupling or bell plus 4 inches.

b. C900 and C905 PVC pipe and C906 HDPE pipe with fused joints:

(1) 4″ to 16″ Nominal Diameter - O.D. plus 4 inches.

(2) 18″ to 30″ Nominal Diameter - O.D. plus 6 inches.

(3) 36″ to 48″ Nominal Diameter - O.D. plus 8 inches.

9. The open borehole may be stabilized by means of bentonite drilling slurry pumped through the inside diameter of the drill rod and through openings in the reamer. The drilling slurry must be in a homogenous/flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the borehole. The volume of bentonite mud required for each pullback shall be determined by the Contractor. The bentonite slurry shall be contained at the exit or entry side of the directional bore in pits or holding tanks. The slurry may be recycled for reuse in the hole opening operation, or shall be hauled by the Contractor to an approved dumpsite for proper disposal.

10. The sewer, force main, or water pipe shall be joined together according to manufacturer's specifications. The gaskets and the ends of pipe shall be inspected and cleaned prior to each joint assembly. The ends of pipe shall be free of any chips, scratches, or scrapes before pipe is assembled. A pulling eye shall be attached to the pulling head on the lead stick of pipe, which in turn shall be attached to a swivel on the end of the drill pipe. This shall allow for a straight, smooth pull of the sewer, force main, or water pipe as it enters and passes through the borehole toward the drill rig. The pipe shall be adequately supported, to eliminate bending stresses as the pipe is pulled into the exit hole. The pullback phase of the directional drilling operation shall be carried out in a continuous manner until the pipe reaches the original entry side of the bore.

J. Record Keeping and As-Builts.

1. Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to the Engineer at completion of project.

2. The guidance system data shall be recorded every 25 feet during the actual drilling operation. The Contractor shall furnish "as-built" plan and profile drawings based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation. The guidance system data shall be certified accurate within the tolerance allowed in these Special Provisions by the Contractor.

K. "Frac-Out" Containment Procedures.

1. Should a "frac-out" occur, where by drilling fluids find and flow to a seam exposure, the drilling process shall immediately stop.

2. The area in question shall be contained using sand bags and resulting fluid shall be removed with vacuum excavation equipment supplemented with hand tools as necessary. Vacuum trailers or trucks shall be on site at all times during the drilling and pipe installation process. Resulting fluids shall be removed to a suitable disposal location.

3. The bore shall then be assessed and evaluated to formulate a satisfactory adjustment in additives at the point of obstruction before the bore can be continued.

   a. Should a "frac-out" occur, the bore hole shall be stabilized by use of "N-Seal" by Baroid or approved equal. The product shall have a proven history of successfully sealing "frac-outs" and shall be non-toxic and environmentally inert.

4. If efforts to seal the "frac-out" are unsuccessful, the bore shall be abandoned.

L. Environmentally Sensitive Areas.

1. In environmentally sensitive areas the "frac-out" containment procedures listed in K above shall be modified to include the following:

   a. DNR staff shall be contacted 24 hours prior to initiating the bore.

      (1) Heidi Hopkins (262) 884-2355

b. The Contractor shall dedicate on-site staff to follow the route of the bore for quick identification of a frac-out. This person shall have direct communication with the bore operator to cause immediate shutdown of equipment if drilling mud is observed.

c. DNR staff, see list above, shall be contacted immediately if a "frac-out" occurs.

d. The Contractor shall have the following equipment on site:

(1) Silt fence.

(2) Prefilled sand bags.

(3) Tools including shovels, buckets, and trowels.

(4) Portable pumps and hoses.

(5) Applicable MSDS for any additives used in the process.

(6) Vacuum trailers or truck.

e. All equipment shall be on-site and in adequate supply prior to starting drilling operations.

f. The Contractor shall supply sufficient staff to contain drilling mud immediately upon identification.

g. Once a frac-out has been identified, all of the following courses of action shall be examined:

(1) Reducing drilling mud pressure.

(2) Temporarily stopping advancement of the drill (rotation may continue).

(3) Modification of composition of the drilling mud.

(4) Sizing the bore hole annulus to re-open the circulation pathway.

h. In the event that the bore hole must be abandoned, the hole shall be filled with thickened drilling mud as the drill assembly is extracted. A concrete plug shall be used to cap the drilling mud.

615. WATERWAY AND WETLAND CROSSINGS

A. The Contractor shall comply with all of the conditions of stream and/or wetland crossing permits issued by the State Department of Natural Resources and the Army Corps of Engineers. A partial list of conditions of these permits is as follows:

1. None of the excavated materials shall be deposited, either temporarily or permanently, upon any part of the bed of the waterway below the high waterline and all spoil shall be placed out of the hydraulic floodway. Surplus excavated material shall not be deposited in any wetland area.

2. No dams, causeways, roadways, fills or other similar temporary or permanent devices are to be placed below the ordinary high water mark unless authorized by the DNR.

3. The removal of materials shall be done with suitable equipment, approved by the DNR, utilizing methods to minimize turbidity and deposition of silt downstream of the project area.

4. The trench shall be backfilled with clean washed gravel, free of excessive fines.

B. The Contractor may use construction methods conflicting with conditions of stream crossing permits only if approved by the State Department of Natural Resources. Contact Mr. James McNelly, Regional Water Leader, at (414) 263-8714 or the Water Management Specialists listed below for information on alternate construction methods.

1. Kenosha County:
   Heidi Hopkins (262) 884-2355

2. Expedited Permit:
   _____ (414) 263-8535

C. Wetland Crossings.

1. The Contractor shall abide by the following conditions, as well as any additional permit conditions, when crossing wetlands:

   a. Confine equipment and construction activities to the narrowest corridor possible.

   b. Schedule construction during winter months or dry summer periods.

c. The use of removable pads or mats to support equipment are preferred over placing fill material for support.

2. Groundwater Barriers.

a. Construct low permeability soil dams consisting of thoroughly compacted native soils (silt or clay soils only) in lieu of bedding and cover material for a length of three feet to prevent groundwater migration from wetland areas through the bedding stone.

b. Place barriers at a maximum spacing of 150 feet across and beyond the edges of wetlands as shown on the Plans.

3. Backfilling Excavations.

a. Backfill excavations across wetlands with native excavated material placed in layers in the reverse order that they were taken out so that the soil profile of backfilled trenches matches the soil profile of adjacent natural soils.

b. Stockpile topsoil (approximately 12 inches thick) for placing over the top of trenches so that native vegetation (from existing roots and seeds) may be reestablished.

c. Excess material shall be immediately removed from wetland areas.

4. Wetland Seeding.

a. Reseed disturbed wetland areas with the seed mixture listed below at a rate of 8.7 pounds per acre or with an alternate wetland seed mixture approved by the Engineer. Reseed with non-aggressive native species. The seed mixture shall not contain "invader" species such as Reed Canary Grass.

b. Restore wetlands immediately upon completion of trench backfilling operation.

c. Seed Mixture.

Species Common Name	Species Botanical Name	Rate (lbs/acre)
Marsh Milkweed	Asclepias incarnata	0.3
Swamp Aster	Aster firmus	0.3
New England Aster	Aster novae-angliae	0.3
Marsh Aster	Aster simplex	0.3
Bluejoint Grass	Calamagrostis cnadensis	0.3
Bottlebrush Sedge	Carex comosa	0.4

Species Common Name	Species Botanical Name	Rate (lbs/acre)
Porcupine Sedge	Carex hystericina	0.3
Lake Sedge	Carex lacustris	0.3
Common Fox Sedge	Carex stipata	1.0
Brown Fox Sedge	Carex vulpinoidea	1.0
Joe-Pye Weed	Eupatorium maculatum	0.3
Boneset	Eupatorium perfoliatum	0.3
Grass-Leaved Goldenrod	Euthamia graminifolia	0.3
Fowl Mana Grass	Glyceria striata	0.4
Sneezeweed	Helenium autumnale	0.3
Sawtooth Sunflower	Helianthus grosseserratus	0.3
Rice Cut Grass	Leersia oryzoides	0.4
Green Bulrush	Scirpus atrovirens	1.0
Woodgrass	Scirpus cyperinus	0.3
Giant Goldenrod	Solidago gigantea	0.3
Blue Vervain	Verbena hastate	0.3
	Total	**8.7 lbs/acre**

620. SANITARY SEWER LATERAL RELAY

A. Definition of Conflict.

1. Storm Sewer Conflict.

a. The Contractor shall take all precautions necessary to protect sanitary sewer laterals not conflicting with the new storm sewer from being damaged. Conflict between sanitary sewer laterals and storm sewer is defined as those laterals with less than four (4) inches of separation from the storm sewer. The Contractor shall relay laterals conflicting with the storm sewer to provide four (4) inches minimum of clearance unless directed otherwise by the Engineer.

2. Water Main Conflict.

a. The Contractor shall take all precautions necessary to protect sanitary sewer laterals not conflicting with the new water main from being damaged. Conflict between sanitary sewer laterals and water mains is defined as those laterals with less than six (6) inches of separation from the water main. The Contractor shall relay laterals conflicting with the water main to provide six (6) inches minimum of separation where laterals pass under water mains and eighteen (18) inches minimum of separation where laterals pass over water mains.

B. Construction Procedure.

1. Conflicting sanitary laterals shall be relaid from the main sewer line to a point two feet past the new water main or storm sewer. Lateral pipe material shall match the size of the existing lateral.

2. The connection to the main sewer shall be made with a new wye or tee, unless the existing connection is satisfactory, with the lateral opening placed at the springline of the main sewer and the lateral laid at a minimum 1.04% grade or as required to provide the necessary clearance.

3. Changes in vertical alignment may be made using bends.

C. Lateral Pipe Material.

1. Sanitary sewer lateral pipe material shall be polyvinyl chloride (PVC) pipe conforming to the following:

a. Polyvinyl chloride (PVC) sewer pipe meeting the requirements of ASTM D-3034, SDR-35, with integral bell type flexible elastomeric joints meeting the requirements of ASTM D-3212.

b. Connect new pipes to existing pipes having different types of material with approved watertight adaptors.

625. WATER SERVICE RELAY

A. Definition of Conflict.

1. The Contractor shall take all precautions necessary to protect water services not conflicting with the new sewer from being damaged. Conflict between water services and sewers is defined as those services with less than six (6) inches of separation from the sewer. The Contractor shall relay services conflicting with new sewers to provide six (6) inches minimum of separation where services pass over sewers and eighteen (18) inches minimum of separation where services pass under sewers.

B. Construction Procedure.

1. Water services shall be relaid as directed by the Engineer and shall be placed to provide a minimum of six (6) feet of cover.

2. Services will typically be relaid to points two feet on each side of the new sewer.

C. Water Service Pipe Material.

1. Water service piping shall be Type "K" soft annealed seamless copper water tube, matching the existing size, and conforming to ASTM Designation B-88. Fittings shall be of cast brass conforming to paragraph 8.24.3 of the "Standard Specifications".

630. WATER MAIN OFFSETS

A. Definition of Conflict.

1. The Contractor shall take all precautions necessary to protect water mains not conflicting with the new sewer from being damaged. Conflict between water mains and sewer is defined as those mains with less than six (6) inches of separation from sewers. The Contractor shall offset water mains conflicting with new sewers to provide six (6) inches minimum of separation where mains pass over sewers and eighteen (18) inches minimum of separation where mains pass under sewers.

B. Construction Procedure.

1. Water mains shall be offset as directed by the Engineer and shall be placed to provide a minimum of six (6) feet of cover.

a. Water mains shall be offset down only (under the conflicting utility) to prevent high points being created in the offset.

2. Water main offsets shall be in accordance with File No. 47 of the "Standard Specifications", as modified below.

a. Offset castings may be used when the change in grade is 24 inches or less.

b. Joint restraint may be provided by either strapping or using mechanical joint retainer glands. Retainer gland set screws shall be tightened to 75 foot-pounds torque or as recommended by the manufacturer using a torque wrench. Special restrainer fittings, as manufactured by the Uni-Flange Corporation, or equal, may be used on PVC pipe.

3. High points in mains, created by water main offsets, shall be tapped to bleed off all trapped air.

C. Water Main Materials.

1. Water main pipe material shall be ductile iron pipe meeting the requirements of AWWA Standard C-151 (ANSI 21.51), Class 53 (6″ through 10″ pipe size), Class 52 (12″ and larger pipe size), cement mortar lined with internal and external bituminous coating and mechanical joints with rubber gaskets and cable bonding for electrical conductivity, where the existing pipe has cable bonding. Fittings shall be of the same material as water main. Polyethylene wrap shall be placed on all water main where the existing pipe is wrapped.

2. Electrical conductivity shall be provided for all mechanical joint pipe and fittings, including valves and hydrants, by welding a lug to the pipe or fitting and installing a strap or cable capable of carrying 500-600 amps for an extended period of time. Field repair damaged pipe coatings with a heavy coat of Koppers 50 or 505 or equal. The use of lead tipped gaskets is prohibited.

   a. Cable bonding is not required if the existing main is not equipped with electrical conductivity.

635. TRACER WIRE

A. Tracer wire shall be installed with all underground utilities and storm sewers including laterals installed under this Contract, which are not identified by surface facilities such as manholes.

B. Material.

1. Tracer wire for use in open cut construction shall be 10 gauge multiple stranded copper wire insulated for underground installation. Tracer wire for use with horizontal directional drilling shall be 8 gauge multiple stranded copper wire insulated as specified above.

2. Tracer wire insulation shall conform to the uniform color code adopted by the American National Standard Institute. Tracer wire for:

   a. Sanitary sewer and laterals shall be green.

   b. Water mains and services shall be blue.

   c. Force mains shall be green with yellow stripe.

   d. Storm sewers and laterals shall be green with red stripe.

Note: If wire with identifying stripes as in c or d above is not readily available, the Contractor may identify coils at ends of laterals and "pig tails" in pullboxes with electrical "phase" marking tape of the same color as that called for stripes.

3. Splices.

a. Tracer wire shall be continuous between exposed connection points unless splicing is approved by the Engineer.

b. Wire splices shall be in accordance with standard electrical practices. Acceptable wire splices are brass split bolts, Dryconn Waterproof Connectors, Snap-loc Model LV 9500, or approved equal. Wire nuts are <u>not</u> acceptable.

(1) Branch connections utilizing split bolts. Splice branch tracer wire to the main tracer wire using the following procedure:

(a) Bare tracer wire on main line (do not cut).

(b) Connect branch wire to main line with brass split-bolt.

(c) Seal the connection with rubber electrical tape and overwrap with 2 layers of polyethylene adhesive tape 1-1/2″ wide and 8 mils thick.

(2) Branch connections utilizing other approved connectors, follow manufacturers' recommendations.

C. Installation.

1. In open cut construction, place the tracer wire at the springline of the main or lateral and tape to the pipe at 5 foot intervals.

2. For horizontal directional drilling type construction, tape the tracer wire to the pipe at 5 foot intervals leaving sufficient slack to accommodate the stretching of the pipe during pull-back.

D. Electrical Connections.

1. The wire shall be positively electrically connected to valve boxes and hydrants with the wire extended to the top of valve boxes and hydrants for future connection.

2. Tracer wires shall identify sanitary sewer and storm sewer laterals and water services.

   a. Sanitary sewer laterals shall have tracer wire run from main to lateral marker board at right-of-way, up the lateral marker board, then back down and terminating at the right-of-way line with a 5 foot coil of wire and all the while maintaining a continuous loop.

   b. Storm sewer laterals shall have tracer wire run from main to lateral marker board at right-of-way, up the lateral marker board, then back down and terminating at the right-of-way line with a 5 foot coil of wire and all the while maintaining a continuous loop.

   c. Water services shall have tracer wire run from main to curb box at right-of-way, up the curb box, then back down and terminating at the right-of-way line with a 5 foot coil of wire and all the while maintaining a continuous loop.

3. Tracer wires identifying force mains shall be accessed in an upper section of a valve box with cover marked sewer at approximately 500 foot intervals, at all angle points, and at other convenient locations as shown on the Plans.

E. Testing.

1. The Contractor shall test all tracer wire for electrical continuity prior to acceptance of the main or service lateral to which it is accessory.

640. SUPPORT OF UNDERGROUND STRUCTURES

A. General.

1. Delete Subsection 2.6.5 of the "Standard Specifications" and replace with the following requirements.

2. The Contractor shall support utilities crossing trenches. Utilities requiring support include: sanitary sewers and laterals, storm sewers including catch basin leads and sump pump leads, water mains including services greater than 2 inch size, field tile lines, gas lines and telephone conduits. Generally, only utilities greater than 2 inches in size require support.

B. Means of Support.

1. The Contractor shall use Option One to support utilities unless the Engineer approves the use of Option Two.

2. Option One (Typical):

a. Backfill below the utility with compacted granular or slurry backfill conforming to Section 700 of these Special Provisions. Place granular or slurry backfill to one foot minimum beyond the edge of the crossing utility and place at a maximum 1:1 slope.

b. Place bedding and cover material in accordance with pertinent sections of the "Standard Specifications".

3. Option Two (With Engineer's Approval):

a. Support the utility using reinforced concrete beams conforming with File No. 2 of the "Standard Specifications".

b. Place bedding and cover material in accordance with pertinent sections of the "Standard Specifications".

4. Backfill trenches above utilities with the backfill material specified on the Plans.

650. EROSION CONTROL

A. General.

1. The Contractor shall take all measures necessary to minimize erosion, water pollution and siltation caused by construction of this project. Erosion control measures shall be in accordance with Chapter 2.8.0 of the "Standard Specifications", Subsection 107.20 and Section 628 of the "State Specifications", the details shown on the Plans.

The Contractor shall use the standards prepared by the Wisconsin Department of Natural Resources as a reference and guide for erosion control practices. The standards are maintained and located on the Wisconsin Department of Natural Resources website at:

www.dnr.wi.gov/runoff/stormwater/techstds.htm

The Contractor shall comply with the provisions of local erosion control plans and/or ordinances.

2. Erosion Control Plan.

a. Prior to beginning work, the Contractor may be required to submit an erosion and sediment control plan, detailing specific measures

that will be employed in the various stages of construction for approval by the Engineer.

3. Implementation.

a. The Contractor shall not begin work until after initial erosion and sediment control devices are in place and approved by the Engineer.

B. Erosion Control Measures.

1. Erosion control measures shall include, but not be limited to the following:

a. Divert upstream runoff from flowing through the construction site.

b. Protect downstream or adjacent waterways and wetlands with silt fence.

c. Delay stripping topsoil until required for construction.

d. Place erosion control bales or stone check dams in ditches and other drainageways to collect sediment and to slow the velocity of runoff.

e. Construct sedimentation basins.

f. Protect storm sewer inlets and the upstream end of culverts with erosion control bales or stone check dams.

g. Prompt removal of excavated material.

h. Proper storage of backfill and bedding materials including placing silt fence or erosion control bales on the downslope sides of spoil piles.

i. Construction of gravel access roads to construction sites to prevent sediment from being tracked onto roadways.

j. Prompt (same-day) cleanup of material tracked onto adjacent streets.

k. Timely restoration of damaged surface areas.

l. Temporary seeding.

m. Install silt fence on both sides of the construction corridor through wetland areas as well as at all edges of wetland areas.

2. Temporary Erosion Control Measures.

a. The Contractor shall construct temporary erosion control measures, where erosion is likely to be a problem, prior to beginning work on those section(s) of the project. Temporary erosion control measures shall be maintained until after permanent erosion control, such as seeding or sodding, has been established.

b. In the event that permanent erosion control measures are <u>not</u> fully implemented in the current construction season, the Contractor shall be responsible for maintaining all necessary temporary erosion control measures until after permanent measures have been completed in the following year.

C. Construction Pit Dewatering.

1. The Contractor may be required to treat effluent from construction pit dewatering prior to the direct discharge to surface waters or wetlands. Treatment methods include seepage basins, settling basins and mechanical means. Refer to Subsection 102.A of these Special Provisions for instructions for obtaining discharge permits.

D. Construction Within Drainageways.

1. Construction work within ditches or drainage swales shall not be allowed to disrupt the existing drainage pattern for a distance greater than 500 feet at one time unless otherwise approved by the Engineer. The Contractor shall be responsible for providing temporary drainage around the work area when existing drainage patterns are interfered with.

a. Protect the upstream end of culverts with erosion bales or sand bags.

2. Ditches shall be reshaped to their existing cross-section immediately after construction work on that section of the project has been substantially completed. The Contractor shall take all measures necessary to prevent erosion of drainageways.

3. Temporary and permanent erosion control measures, including erosion bales, stone check dams, silt fence, riprap and lawn restoration including erosion mat, shall be performed in a timely manner and in accordance with the requirements of these Special Provisions.

E. Installation, Inspection, Maintenance and Restoration of Erosion Control Devices.

1. General.

a. This subsection applies to all erosion control devices used on this project.

2. Installation.

a. Install or place erosion control devices either (as appropriate):

(1) Prior to beginning construction activities;

(2) Immediately after grading of ditches or slopes is completed;

(3) Immediately after completing lawn restoration; and/or

(4) When so directed by the Engineer.

3. Inspection.

a. Inspect erosion control devices:

(1) Within 24 hours after each 0.5 inch or greater rainfall;

(2) At least daily during prolonged rainfall; and

(3) At least once every seven days.

4. Maintenance.

a. Maintain erosion control devices for the duration of the project and until after slopes and ditches have been stabilized and turf developed to the extent that future erosion is unlikely, at which time the Contractor shall remove the temporary erosion control device(s).

b. Remove sediment deposits when the build-up exceeds approximately one-half the volume capacity of the erosion control device.

5. Restoration.

a. Restore areas immediately after removing erosion control devices by reshaping or regrading and placing topsoil, fertilizer, seed and

mulch. Place erosion mat, if required to control erosion or if so directed by the Engineer.

F. Erosion Bales.

1. The Contractor shall place erosion bales of straw, hay or other suitable baled material to form checks or dikes as required to control erosion, including at locations shown on the Plans and/or as directed by the Engineer. Placement and maintenance of erosion bales shall be in accordance with Subsections 628.3.3 and 628.3.14 (temporary ditch checks) of the "State Specifications" and details on the Plans.

2. Temporary Ditch Checks.

   a. Place a double row of erosion bales as shown on the details.

G. Silt Fence.

1. The Contractor shall place silt fence as required to control erosion, including at the locations shown on the Plans and/or as directed by the Engineer. Silt fence shall be placed and maintained in accordance with Subsection 628.3.4 of the "State Specifications" and details on the Plans.

   a. Furnish fabric with a top support cord.

   b. Install tie backs in areas of heavy flow or where directed by the Engineer.

2. Ditches/Drainageways.

   a. Do not use silt fence in ditches or drainageways.

H. Wetland Protection.

1. The Contractor shall install a sediment filtration device within wetlands, where shown on the Plans and as directed by the Engineer. The device is used in place of silt fence, allowing greater water passage than silt fence while trapping soil particles.

2. Material.

   a. The sediment filtration device (biodegradable) shall be "Sediment STOP" manufactured by North American Green of Evansville, Indiana, or equal.

3. Installation.

a. Install the device per manufacturer's recommendations.

I. Erosion Mat.

1. General.

a. The Contractor shall place erosion mat over all restored ditches (bottoms and side slopes), slopes greater than 10%, areas shown on the Plans or specified below and/or as directed by the Engineer. The Contractor may also place erosion mat to improve grass seed germination and growth.

2. Material.

a. Erosion mat materials shall be as specified herein and/or in the Wisconsin Department of Transportation's Product Acceptability Lists (PAL).

(1) Low Flow (Ditches - Typical).

(a) Erosion mat shall be WisDOT Class I, Type B, double netted mat.

(2) High Flow (Specified on Plans).

(a) Erosion mat shall be WisDOT Class II, Type B, long lasting organic mat.

(3) Urban - Short Term (Residential Lawns).

(a) Erosion mat shall be WisDOT Class I, Urban, Type A, short term except the mat shall be double netted. Use biodegradable anchoring devices only per PAL.

c. Installation.

(1) Install erosion mats in accordance with Subsection 628.3.2 of the "State Specifications", the details on the Plans and the manufacturer's recommendations. The Contractor shall provide the Engineer with one (1) full set of manufacturer's literature and installation instructions for each product prior to installing erosion mat.

J. Stone Check Dam.

1. The Contractor shall construct stone check dams in ditches or drainageways at the locations shown on the Plans and/or as directed by the Engineer. Construct stone check dams in accordance with the details on the Plans.

K. Inlet Protection.

1. The Contractor shall protect all existing and new catch basins and storm sewer inlets, both within the construction limits and downstream of the project as noted on the Plans and as directed by the Engineer, from erosion using inlet protection in accordance with Subsection 628.3.13 of the "State Specifications" and details on the Plans.

L. Stone Tracking Pad.

1. The Contractor shall install stone tracking pads, to reduce the amount of sediment tracked onto roads, at the locations shown on the Plans, at other access points, and as directed by the Engineer.

2. Construction.

a. Construct pads using a minimum of 12 inches of 3" to 6" clean aggregate with minimum dimensions of 12 foot in width (matching the width of the egress point) by 50 feet in length. Construct pads on a WisDOT Type R geotextile fabric in wet ground conditions. Extend and/or widen pads if required to prevent tracking.

b. Repair and clean pads as required.

c. Remove tracking pad after construction has been completed and restore the area.

3. Tire Washing.

a. If all sediment is not removed by the tracking pad, then tires shall be pressure washed prior to exiting the site.

b. Contractor shall be required to power wash equipment to remove all plant material and soil from the equipment to be used in and adjacent to prairie and wetland areas and where rivers or streams are to be crossed.

M. Turbidity Barrier.

1. The Contractor shall install turbidity barriers at the location shown on the Plans and as directed by the Engineer in accordance with Subsection 628.3.10 of the "State Specifications" and details on the Plans.

2. Sediment Removal.

a. Remove sediment trapped by the turbidity barrier as directed by the Engineer. Sediment will only be removed if there is a significant build-up in the watercourse. Do not remove sediments or the turbidity barrier the same day that construction operations take place to allow for sediments to settle.

N. Silt Screen.

1. The Contractor shall install silt screen at the locations shown on the Plans and as directed by the Engineer in accordance with details on the Plans.

2. Sediment Removal.

a. Remove sediment trapped by the silt screen as directed by the Engineer. Sediment will only be removed if there is a significant build-up in the watercourse. Do not remove sediment or the silt screen the same day that construction operations take place to allow time for sediment to settle.

O. Soil Stabilizer

1. General.

a. The Contractor shall apply soil stabilizer over all disturbed areas where final lawn restoration has not been completed (i.e., topsoil, seed, mulch, and matting) and erosion is occurring, if so directed by the Engineer.

a. The Contractor shall apply soil stabilizer over areas shown on the Plans and/or as directed by the Engineer.

2. Material.

a. The soil stabilizer shall be on WisDOT's Product Acceptability Lists (PAL) and shall be a Type B anionic polyacrylamide. Approved products are listed below.

Product Name	Manufacturer
Natural Earth PolyStable Plus	Earth & Road
CF 2000 Polymer	Construction Fabrics and Materials (CFM)

3. Application.

   a. Apply soil stabilizer in accordance with Subsection 628.3.12 of the "State Specifications" and the Department of Natural Resources (DNR) Conservation Practices Standards 1050.

   b. Test soil types to insure proper material selection.

   c. Apply per manufacturer's recommendations. Provide the Engineer with a copy of the manufacturer's product literature and suggested application method(s).

   d. Do not apply to channel bottoms.

P. Immediate Lawn Restoration.

1. The Contractor shall restore lawn areas as shown on the Plans, immediately after completing work on these sections of the project.

2. Lawn restoration shall comply with Subsection 820.A of these Special Provisions.

Q. Sodding.

1. The Contractor shall place sod at the locations shown on the Plans. Sod shall be placed immediately after completing work on these sections of the project.

2. Sodding shall comply with Subsection 820.B of these Special Provisions.

R. Sod Ditch Checks.

1. The Contractor shall construct sod ditch checks at locations shown on the Plans and in accordance with the details shown on the Plans.

2. Sodding shall comply with Subsection 820.B of these Special Provisions.

S. Masonry Ditch Checks.

1. The Contractor shall construct masonry ditch checks at locations shown on the Plans in accordance with Section 605 of the "State Specifications", the details shown on the Plans.

T. Temporary Erosion Barriers.

1. The Contractor shall construct temporary earthen dikes to prevent surface runoff from flowing over areas as shown on the Plans. The earthen dikes shall be removed after slopes and ditches have been stabilized and turf developed to the extent that future erosion is unlikely. The dike area shall be reshaped and restored by seeding in accordance with Subsection 820.A. of these Special Provisions.

U. Temporary Sedimentation Basins.

1. The Contractor shall construct temporary sedimentation basin(s) at location(s) shown on the Plans. The basins shall be filled in and banks removed after slopes and ditches have been stabilized and turf developed to the extent that future erosion is unlikely. The basin area shall be reshaped and restored by seeding in accordance with Subsection 820.A. of these Special Provisions.

V. Temporary Seeding.

1. The Contractor shall restore all grass and terrace areas within sections shown on the Plans as "Temporary Seeding" with a temporary seeding composed of 100% oats (annual rye grass - optional) at a seeding rate of 2 pounds per 1,000 square feet. Temporary seeding shall include placing topsoil in accordance with Subsection 820.A. of these Special Provisions. The temporary seeding shall be placed within 14 days after work on the project has been substantially completed. Permanent lawn replacement shall be placed as early as possible in the spring of the following year, but no later than May 15th.

655. EROSION CONTROL PLAN

A. Erosion Control Measures.

All erosion control measures shall be in accordance with Section 650 of these Special Provisions and the provisions of the Wisconsin Department of Natural Resources website for the erosion control technical standards at www.dnr.wi.gov/runoff/stormwater/techstds.htm

B. Construction Activity.

1. Description.

Major construction activities on this project include:

a. clearing and grubbing
b. site grading
c. detention pond(s)
d. ditching
e. road construction
f. sanitary sewer
g. water main
h. storm sewer

2. Construction Sequence.

Construction activities will generally consist of the following work sequence:

a. install temporary erosion control

b. clearing and grubbing

c. construct detention ponds for temporary use as sediment traps

d. construct ditches to divert or direct runoff

e. site grading and rough cut roads

Opt.—Strip topsoil from road right-of-ways prior to utility construction.

f. install sanitary sewer, water main, and storm sewer

g. finish grade roadways and complete site grading

h. place salvaged topsoil, fertilize, seed, and mulch, and install permanent erosion control measures

C. Erosion Control Sequence.

No construction may proceed until after the appropriate erosion control devices have been installed and approved by the Engineer. Erosion control measures or devices shall be installed in the following sequence, unless otherwise approved by the Engineer.

1. Preconstruction Erosion Control Measures.

   a. Install silt fence around the project perimeter.

   b. Construct sediment traps.

   c. Construct detention ponds if used for sediment control.

   d. Protect existing culverts and storm inlets with erosion bales or silt fence.

   e. Construct stone construction site access roads.

2. Erosion Control Measures Installed During Construction.

   a. Place erosion bales in rough graded drainageways and roadside ditches.

   b. Protect stockpiles with silt fence.

   c. Immediate restoration of critical areas such as stream banks.

   d. Maintenance of erosion control devices.

3. Permanent Erosion Control Measures

   a. Seed and mulch immediately after placing topsoil.

   b. Place sod in highly erodible areas.

   c. Install erosion control fabric.

   d. Place erosion bales on steep slopes in ditches.

4. Post Construction Activities.

   a. Remove all temporary erosion control devices after permanent erosion control has been established and the site is stabilized.

   b. Restore areas from which erosion control devices have been removed by seeding, mulching, and erosion mat or sodding as directed by the Engineer.

700. BACKFILLING UTILITY TRENCHES

A. Excavated Material Backfill (Trenches Outside of Existing or Proposed Paved or Graveled Areas).

1. Excavated material, in accordance with Section 8.43.5 of the "Standard Specifications", may be used to backfill trenches located outside of existing or proposed paved or graveled areas or as shown on the Plans, except as provided for in Paragraph B below.

a. If excavated material is unsuitable for backfilling, trenches shall be backfilled with granular material when so ordered by the Engineer.

2. Sewer Laterals and Water Services.

a. Sewer lateral and/or water service trenches through lawn or terrace areas may be backfilled with excavated material outside of one half-to-one slopes extending downward and outward from the edges of pavement and gravel areas or from the back of curb and gutter.

3. Backfill in Waterways.

a. Materials used to backfill trenches within waterways shall be washed gravel backfill free of excessive fines. Materials conforming to Tables 32 and 33 (bedding materials) of Section 8.43.2 of the "Standard Specifications" shall be generally considered acceptable under this classification.

B. Granular Backfill (Trenches Within Existing or Proposed Paved or Graveled Areas).

1. Granular backfill, in accordance with Table 37 of Section 8.43.4 of the "Standard Specifications", shall be used to backfill trenches located within existing or proposed paved or graveled areas or as shown on the Plans, except as provided for below.

a. If excavated material is suitable for use as granular backfill, trenches shall be backfilled with suitable excavated granular material when so ordered by the Engineer.

2. Sewer Laterals and Water Services.

a. Sewer lateral and/or water service trenches through roads, gravel areas, shoulders, parking areas, and driveways shall be backfilled with granular backfill within one half-to-one slopes extending

downward and outward from the edges of pavement and gravel areas or from the back of curb and gutter.

3. Backfill in Waterways.

   a. Materials used to backfill trenches within waterways shall be washed gravel backfill free of excessive fines. Materials conforming to Tables 32 and 33 (bedding materials) of Section 8.43.2 of the "Standard Specifications" shall be generally considered acceptable under this classification.

C. Slurry Backfill.

1. "Slurry" aggregate material shall be used to backfill trenches as shown on the Plans.

   a. The slurry backfill material must be prepared in the quantities noted below. The material shall be placed in a clean cement mixer truck and thoroughly mixed.

      1,350 lbs. Sand
      775 lbs. #1 Stone (1 inch)
      1,150 lbs. #2 Stone (2 inch)
      25 gals. (+0 to -0.5 gal.) Water per cubic yard

   b. No additional water will be allowed. The above weights are damp weights.

   c. Just prior to placing the slurry, the mixer shall be run at mixing speed for one full minute to insure an even mixture.

   d. Compaction of slurry backfill is not required, however, the Engineer may order mechanical vibration in areas difficult to backfill.

2. Kenosha County Highways.

   a. Trenches located under the traveled roadway of Kenosha County highways shall be backfilled with "slurry" material between points located one foot beyond the edge of shoulders or the back of curb and gutter.

   b. Trenches located adjacent to and outside of the roadway, but within or above 1:1 slopes passing through and sloping down and out from points located one foot beyond the edge of shoulders or

back of curbs, shall be backfilled with either "slurry" material or granular backfill.

3. State Highways.

a. Trenches located under the traveled roadway of State Highways shall be backfilled with "slurry" material between points located 5 feet beyond the edge of shoulders or the back of curb and gutter.

b. Trenches located adjacent to and outside of the roadway limits indicated in Paragraph a. above shall be backfilled with granular backfill under the ditch foreslope and ditch bottom.

D. Consolidation.

1. Amend Section 2.6.14 of the "Standard Specifications" to read in part:

"All granular and excavated material backfill shall be consolidated through mechanical compaction by means of a backhoe boom-mounted compactor. Either a vibratory compactor or compaction wheel is acceptable if it can meet the densities specified below. The backhoe used for compaction shall be equal in reach to the backhoe used for excavating the trench; i.e., capable of reaching the bottom of the trench with no additional shelf excavation. Backfill shall be compacted in eighteen (18) inch maximum lifts, before compaction, unless noted otherwise below, except that the first lift shall be two (2) feet in depth. The Contractor shall take all precautions necessary to protect utilities from being damaged during backfilling and compaction operations."

a. Granular backfill shall be compacted to a minimum of 95% Standard Proctor Density.

b. Excavated material backfill shall be compacted to a density equal to 100% of the density of the undisturbed material in adjacent trench walls.

c. Topsoil shall not be compacted.

d. State Highways.

(1) Backfill placed within state highway right-of-ways shall be compacted in 12″ maximum lifts, except that the first lift shall be two (2) feet in depth.

2. If there is a question as to whether or not the specified density has been achieved, a soil testing firm selected by the Engineer will be brought in to

determine the backfill density. The cost of this testing will be paid for by the Owner if the test results are satisfactory, however, if the backfill is found to be inadequately compacted, the Contractor shall pay all testing costs.

3. If the Contractor desires to use alternate compaction equipment or backfill depths greater than those specified, documentation must be submitted to the Engineer substantiating the adequacy of the proposed compaction method. Alternate compaction methods shall not be used unless approved by the Engineer. The Engineer may require density testing by an approved soil testing firm to field verify backfill densities. All compaction testing costs for field verifying alternate compaction methods shall be paid for by the Contractor.

E. Surplus Excavated Material.

1. Surplus excavated material shall not be stockpiled on site, but shall be disposed of by the Contractor, at his own option and cost, at off site locations provided by him.

2. The Contractor shall be responsible for obtaining the use of all "off site" disposal sites and all necessary permits, unless the site is designated by the Owner. Disposal sites designated by the Owner shall be kept neat, leveled, and graded to drain. Material lost from trucks in transit shall be cleaned up immediately. Material not properly cleaned up will be removed by the Owner and the cost thereof charged to the Contractor.

3. Surplus excavated materials shall not be deposited within floodplains, marshes or other wetland areas.

800. SURFACE REPLACEMENT AND SITE RESTORATION

A. General Replacement.

1. The provisions of Sections 2.6.11 and 2.7.2 of the "Standard Specifications" are modified as follows:

a. The Contractor shall replace or restore, unless specified otherwise, any sidewalk, driveway, curb, gutter, shoulder, pavement, culvert, lawn, ditch, fence, sign, mailbox or other property damaged by him at his own cost. Minimum requirements for restoration and replacement shall be in accordance with the applicable sections of these Special Provisions or as directed by the Engineer.

(1) The Contractor is specifically directed to replace all mailboxes and street signs removed or damaged by his operations.

b. Damaged concrete pavements and driveways, sidewalks and curb and gutter shall be removed and replaced to existing joints unless otherwise allowed by the Engineer.

c. Restoration of pavements damaged by normal truck hauling operations; i.e., hauling within approved weight and speed limits and exercising reasonable care while starting, stopping or turning vehicles, will not be the responsibility of the Contractor. This provision does not apply to pavement damaged by truck wheels during loading or unloading operations.

2. Mailbox Relocation.

a. The Contractor shall relocate all mailboxes, including those not damaged or disturbed by his operations, to meet U.S. Postal Service Requirements.

3. Correction of Minor Replacement Problems.

a. Any minor construction related replacement or restoration problems, brought to the Contractor's attention, shall be corrected within 24 hours or this work may be done by the Owner's personnel with the cost charged to the Contractor.

b. Minor problems might include: driveway access restrictions caused by rutting, settling or other maintenance problems, damaged or removed mailboxes, blockage of surface drainage and erosion problems.

B. Culverts.

1. Amend Section 2.1.2 of the "Standard Specifications" to include the following:

"The Contractor shall remove and protect culverts conflicting with the utility work and shall replace the culverts to their original line and grade upon completion of utility installation in the immediate area."

2. Kenosha County Highways.

a. The Engineer will shoot culvert inverts within County Highway right-of-ways, both prior to their removal and after their replacement, to insure that they are relaid to the existing grade.

b. If existing culverts within County Highway right-of-ways are damaged, to the extent that new culverts are required, they shall be replaced with new CSCP of equal size but no less than 15″ diameter for driveways and 18″ diameter for cross-culverts. Damaged apron endwalls shall also be replaced.

c. Any unserviceable culvert; i.e., rusted or previously damaged through no fault of the Contractor, removed during construction shall be replaced with a new culvert.

C. Survey Monuments.

1. Contractor's attention is directed to Section 2.1.4 of the "Standard Specifications" requiring the Contractor to protect survey monuments, excluding those monuments within or adjacent to trench excavations or road grading limits, from being damaged. The Contractor shall notify the Engineer at least 48 hours prior to removing or disturbing any survey monuments within his construction limits, to allow the Engineer to tie in the location of these monuments prior to their removal.

a. The Engineer will replace all damaged monuments previously tied in as stated above.

b. All damaged survey monuments shall be replaced by a Registered Land Surveyor at the Contractor's expense if the monument is:

(1) Located within the construction limits, but not tied in by the Engineer due to the Contractor's failure to notify the Engineer as stated above; or

(2) Damaged due to careless operations outside of the excavation limits.

2. Section Corner Monuments.

a. The Contractor shall notify the County Surveyor, Kurt Bauer, at (262) 547-6721 Ext. 260, three (3) days prior to removing any section corner monuments.

b. The Contractor shall remove and salvage all section corner monuments and/or ties within trench excavations. The County Surveyor will tie in these monuments prior to their removal and will be responsible for their replacement. The Contractor shall confirm that monuments have been tied in prior to removal. All such monuments not tied in shall be replaced by the County Surveyor at the Contractor's expense.

D. Pavement Protection.

1. The Contractor shall take all precautions necessary to protect road pavements, including shoulders, from being damaged. Sheathing and bracing or the use of a portable trench box, if required, shall be in accordance with Chapter 2.3.0 of the "Standard Specifications".

2. Backfill or excavated material spilled or tracked onto pavements or shoulders shall be removed at the completion of each working day or as directed by the Engineer. Any such materials interfering with traffic shall immediately be swept off with power brooming equipment.

E. Pavement Replacement.

1. See Sections 810, 1304, and 1407 of these Special Provisions.

F. Lawn Replacement.

1. See Section 820 and 1630 of these Special Provisions.

G. Field Restoration.

1. All trenches crossing fields (croplands) shall be restored as follows:

a. Strip all topsoil from over trenches, stockpile within easement areas and replace over trenches after backfill materials have been compacted.

H. Field Tile.

1. Field tile lines crossed and damaged by trenches shall be replaced with polyvinyl chloride (PVC) sewer pipe meeting the requirements of ASTM D-3034, SDR-35, with rubber gasket joints. The PVC pipe shall extend for a minimum distance of 2 feet outside of the edge of the trench wall. The tile to PVC pipe connection shall be made with compatible fittings, adapters or encased in concrete. The size of the new pipe shall be equal to or greater than the tile line being replaced.

a. Damaged field tile shall be repaired the same day as the damage occurs so that the flow of water will not be unreasonably restricted.

b. Damaged tile shall be connected to new storm sewers wherever possible.

I. Waterway Restoration.

1. Lawn areas adjacent to waterways (creeks or drainage ditches), including stream banks, shall be restored immediately upon completion of trench backfilling and compaction operations.

2. Lawn restoration shall include topsoil, fertilizer, seed, mulch and erosion control fabric as specified in these Special Provisions.

3. Restoration of banks shall include placing an erosion control fabric over all seeded areas. The fabric shall be Erosion Control Fabric as manufactured by Geotextile Systems, Inc., Pewaukee, Wisconsin, or equal. The fabric shall be installed in accordance with the manufacturer's specifications.

4. Care shall be taken during construction to minimize erosion into waterways. Temporary erosion control measures including bales or silt fences shall be used to prevent sediment-laden runoff from entering waterways.

J. Trench Surface Maintenance.

1. The Contractor's attention is directed to Section 2.6.16 of the "Standard Specifications", requiring the Contractor to maintain trench surfaces for the duration of the Contract and for one (1) year after acceptance.

810. PAVEMENT REPLACEMENT (EXISTING PAVEMENTS - EXCLUDING NEW SUBDIVISION ROADS)

A. Saw-Cutting Pavements.

1. All concrete and asphalt pavements, shoulders and driveways shall be saw-cut to a minimum depth of three (3) inches prior to being shattered and removed. Where concrete pavements are covered with an asphalt overlay, both the asphalt and concrete shall be saw-cut. Pavements shall be saw-cut in neat straight lines perpendicular or parallel to the road centerline to produce a clean joint for pavement restoration. If the saw-cut edge is damaged during construction, the Contractor shall saw-cut the pavement again immediately prior to paving.

a. All concrete and asphalt pavements within state highway right-of-ways shall be saw-cut full depth prior to being shattered and removed.

2. Concrete Pavement.

a. If the saw-cut edge of a trench through a concrete pavement outside of state highway right-of-ways is closer than 4 feet to an existing joint or pavement edge, the pavement shall be removed and replaced to such joint or pavement edge.

b. State Highways.

(1) A minimum width of 10 feet of concrete pavement shall be removed and replaced on state highways.

(2) If the saw-cut edge of a trench through a concrete pavement within a state highway right-of-way is closer than 10 feet to an existing joint or pavement edge, the pavement shall be removed and replaced to such joint or pavement edge.

B. Temporary Surfacing.

1. All trenches in asphaltic shoulders, driveways and pavements shall be temporarily surfaced with base aggregate dense 1-1/4-inch equal in thickness to the total thickness of gravel base course and asphaltic pavement.

2. All trenches in concrete driveways and pavements shall be temporarily surfaced with base aggregate dense 1-1/4-inch equal in thickness to the total thickness of gravel base course and concrete pavement.

3. The temporary gravel surface shall be in place at the end of the working day and shall be maintained until the asphaltic surface or concrete pavement is placed.

4. Cold Patch.

a. State and County Roads.

(1) The Contractor shall temporarily restore damaged pavements on state and county highways with a minimum of 4 inches of approved well compacted asphaltic cold patch or temporary asphaltic hot mix within seven (7) days after backfilling trenches. The Contractor has the option of

placing the permanent pavement replacement in place of the temporary pavement within the same time period.

(2) The Contractor shall be responsible for maintaining temporary pavement replacement.

(3) The temporary patch shall be replaced with the permanent pavement at the completion of all trenching work and/or when weather conditions permit.

b. Town Roads.

(1) If the Contractor cannot complete permanent asphaltic pavement replacement work prior to asphaltic plants shutting down for the winter season, he shall temporarily restore damaged road pavements with a minimum of 2 inches of approved well compacted asphaltic cold patch or temporary asphaltic hot mix.

(2) The temporary patch shall be placed as soon as practical after completing utility work. The temporary patch shall be removed and the permanent pavement replacement work shall be completed as soon as weather conditions permit, but no later than the following June 1st.

(3) The Contractor shall be responsible for maintaining temporary pavement replacement.

C. Damaged shoulder, pavement, driveway, and parking areas shall be replaced "in kind"; except that where the existing pavement thickness is less than the following minimum pavement thickness(es), the minimum pavement section (specified below) shall be placed:

1. Gravel Roads and Road Shoulders.

a. A minimum of 10 inches of base aggregate dense shall be placed over gravel roads.

b. A minimum of 8 inches of base aggregate dense shall be placed over gravel road shoulders.

2. Asphaltic Pavements.

a. Existing asphaltic pavements shall be replaced with a minimum of 10 inches of base aggregate dense and 5 inches of asphaltic concrete pavement.

(1) The pavement shall consist of a minimum 1-1/2 inch thick upper layer and a minimum 3-1/2 inch thick lower layer using 12.5 mm (1/2 inch) nominal size aggregate.

3. New Subdivision Roads.

a. New subdivision roads may be graded to subgrade, by others, prior to utility construction.

b. The Utility Contractor shall restore the subgrade to its existing condition upon completion of utility construction.

4. Concrete Pavements.

a. Existing concrete pavements shall be replaced with a minimum of 7 inches of non-reinforced concrete pavement and 6 inches of base aggregate dense 1-1/4-inches.

b. Refer to Paragraph 810.A.2.b of these Special Provisions for minimum widths of pavement removal on state highways.

5. Concrete Base and Asphaltic Overlay.

a. Restoration of pavements consisting of a concrete base and asphaltic surface or overlay may be "in-kind" or with full depth asphaltic concrete pavement.

(1) Pavement replacement "in kind" shall be installed with a 3-day high-early-strength concrete and asphaltic overlay unless an 8-hour special-high-early-strength concrete is specified in the Special Conditions.

(2) Full depth asphaltic concrete pavement shall be installed with 4 equal lifts with a maximum of 2 lifts installed per day.

6. Road Pavements (Kenosha County Highways).

a. Existing asphaltic pavements within Kenosha County Highway right-of-ways shall be replaced with a minimum of 12 inches of base aggregate dense and 5 inches of asphaltic concrete pavement.

7. Driveways and Parking Areas.

a. Gravel Surface.

(1) Existing gravel driveways and parking areas shall be replaced with a minimum of 8 inches of base aggregate dense.

(2) Base course material shall match the existing material; example, place limestone material over existing limestone drives.

b. Asphaltic Pavement.

(1) Existing asphaltic driveways and parking areas shall be replaced with the following minimum thicknesses:

(a) Residential - 6″ base and 3″ pavement (1-1/2″ upper layer and 1-1/2″ lower layer using 9.5 mm aggregate gradation).

(b) Commercial - 8″ base and 4″ pavement (1-3/4″ upper layer and 2-1/4″ lower layer using 12.5 mm aggregate gradation).

(c) Industrial - 12″ base and 4″ pavement (1-3/4″ upper layer and 2-1/4″ lower layer using 12.5 mm aggregate gradation).

c. Concrete Pavement.

(1) Existing concrete drives shall be replaced with a minimum of 6 inches (7 inches minimum over business or industrial drives) of concrete pavement and 6 inches of base aggregate dense 1-1/4 inch. Concrete drives shall be reinforced if the existing drive has reinforcing.

D. Base Aggregate Dense.

1. Base aggregate dense shall comply with Section 305 of the "State Specifications", as modified below.

a. The top layer of base (4 inches minimum thickness) shall be base aggregate dense 1-1/4-inch and the lower layer(s) shall be either base aggregate dense 3-inch (6 inches minimum thickness) or base aggregate dense 1-1/4-inch (4 inches minimum thickness). Note:

If the total base thickness is less than 10 inches, then only base aggregate dense 1-1/4-inch may be used.

(1) The base shall be constructed in two or more layers in accordance with Section 305.3 of the "State Specifications".

(2) Base material placed over Kenosha County roads shall be base aggregate dense 1-1/4-inch.

b. Base material placed over driveways shall be base aggregate dense 1-1/4-inch.

c. The top 3 inches of base material placed over road shoulder areas shall be base aggregate dense 3/4-inch and the remainder shall be either base aggregate dense 3/4-inch or base aggregate dense 1-1/4-inch.

2. Base material, including shoulders and drives, shall be compacted using rolling or vibratory type equipment unless otherwise approved by the Engineer.

3. Base aggregate dense shall be crushed limestone.

E. Asphaltic Concrete Pavement.

1. Asphaltic concrete pavement shall comply with Section 815 or 1450 of these Special Provisions. The pavement mix shall be Type E-3 for State or County Highways and Type E-0.3 for other roadways and either Type E-0.3 or Asphaltic Surface for driveways and parking areas.

F. Concrete Pavement.

1. Concrete pavement shall comply with Section 415 of the "State Specifications", as modified below:

a. All concrete shall be Grade C, air-entrained, 7-bag mix with a 28-day compressive strength of 4000 psi, as specified in Subsection 501.3.2 of the "State Specifications", and shall be ready-mixed.

b. High Early Strength Mixes (if Specified in Special Conditions).

(1) All concrete shall be Air-Entrained High-Early-Strength Concrete, Grade C, 7-bag mix, with a 28-day compressive strength of 4000 psi, as specified in Subsection 501.3.2 of the "State Specifications", and shall be ready-mixed.

OR

(2) All concrete shall be special-high-early-strength concrete (3000 psi within 8 hours), as specified in Subsection 416.2.6 of the "State Specifications", and shall be ready-mixed.

c. All concrete shall receive a brush finish.

d. Concrete shall be cured by the Impervious Coating Method in accordance with Subsection 415.3.12.2.

e. The pavement shall be opened to traffic in accordance with Subsection 415.3.17.

f. High Early Strength Mixes (if Specified in Special Conditions).

(1) The pavement shall be opened to traffic within 3 to 4 days after pouring in accordance with Subsection 415.3.17.

(2) The pavement shall be opened to traffic the same day as poured, if possible, but not sooner than 8 hours after placing.

2. Pavement Ties.

a. All joints between existing and new pavements shall be constructed using tie bars conforming to Subsection 505.2.6 of the "State Specifications".

(1) Anchor transverse joints with 1-1/4″ x 18″ dowel bars at 15″ maximum spacing as shown on the detail.

(2) Anchor longitudinal joints with No. 4 x 24″ ties bars at 30″ C-C spacing.

3. Test Specimens.

a. The Contractor shall take two (2) representative concrete samples for 7 day and 28 day compression testing from each day's concrete mix.

b. The Contractor shall field cure, care for, and ship the test cylinders to the testing laboratory. Test results shall be forwarded to the Engineer. All testing costs shall be paid for by the Contractor.

G. Pavement Restoration Timetable.

1. Asphaltic pavement shall be placed in accordance with the requirements of Subsection 450.3 and concrete pavement shall be placed in accordance with the requirements of Subsection 415.3.16 of the "State Specifications".

2. Weather permitting, pavement replacement shall be completed within 30 calendar days after completing utility construction work or within the time allowed in Section 110 of these Special Provisions.

3. Pavement replacement work in areas constructed during winter months shall be completed by the following June 1st. All pavement replacement in areas constructed after June 1st shall be completed in accordance with Paragraphs 1 and 2, above.

820. LAWN REPLACEMENT (EXISTING DEVELOPED AREAS - EXCLUDING NEW SUBDIVISIONS)

A. All damaged or destroyed grass and terrace areas shall be restored with four (4) inches minimum of topsoil and shall be fertilized, seeded and mulched as specified below and as directed by the Engineer.

1. Topsoil.

a. Topsoil shall be imported material, furnished by the Contractor, consisting of materials as specified in Subsection 625.2 of the "State Specifications".

b. Salvaged topsoil may be used to restore lawns only if the material is screened and approved by the Engineer.

c. Topsoil and salvaged topsoil shall be pulverized (completely broken down to remove all clods and lumps). The material shall be free of rocks, twigs and other foreign material, 100% shall pass a one-inch sieve and at least 90% shall pass the No. 10 sieve (0.08 inch).

d. Topsoil and salvaged topsoil shall be placed in accordance with Paragraph 625.3.3 of the "State Specifications".

2. Fertilizer.

a. Topsoil shall be fertilized with fertilizer complying with Section 629 of the "State Specifications". Apply Type A fertilizer at 7 pounds per 1,000 square feet.

3. Seeding.

a. Lawn Type Turf.

(1) All lawn areas restored with topsoil, unless shown otherwise on the Plans, shall be seeded with grass seed meeting the requirements of Subsection 630.2.1.5.1.1.1 (Seed Mixture No. 40) of the "State Specifications", except that seed shall be distributed at a rate of four (4) pounds per 1,000 square feet.

b. Rural Type Turf.

(1) All rural grass areas, except those areas where a lawn type turf is required and unless shown otherwise on the Plans, shall be seeded with grass seed meeting the requirements of Subsection 630.2.1.5.1.1.1 (Seed Mixture No. 10) of the "State Specifications", except that seed shall be distributed at a rate of four (4) pounds per 1,000 square feet.

4. Mulching.

a. All seeded areas shall be mulched in accordance with the requirements of Section 627 of the "State Specifications".

b. The Contractor may place mulch using Method A, B, or C of Subsection 627.3.2.

B. Sodding.

1. The Contractor shall place sod over all damaged grass, lawn and terrace areas as shown on the Plans, or as directed by the Town.

2. Sodding shall comply with Section 631 of the "State Specifications", as amended below:

a. Materials.

(1) Sod shall consist of permanent grasses, indigenous to the general locality where it is to be used and practically free from weeds or undesirable grasses.

(2) The Contractor shall submit a certificate to the Engineer before installation detailing the sod grass composition and place of origin.

(3) Sod shall be cut in uniform strips approximately 18″ x 72″, be 3/4″ thick or more and have grass 2″ tall.

b. Areas to be sodded shall be covered with 4 inches minimum of topsoil and fertilized in accordance with Subsections 820.A.1 and 820.A.2 of these Special Provisions.

c. All sodded areas shall be kept thoroughly moist by watering or sprinkling, when rainfall is deficient, for a minimum period of ten days or until final project completion.

C. Erosion Control Mat.

1. See Section 650 of these Special Provisions.

D. Lawn Restoration Timetable.

1. Weather permitting, lawn replacement shall be completed within 30 calendar days after all other work has been completed or within the time allowed in Section 110 of these Special Provisions. Seeding may be done at any time during the growing season when soil conditions are suitable.

2. All lawn replacement work in areas constructed during winter months shall be completed by May 15th of that year. All lawn replacement work in areas constructed after May 15th shall be completed in accordance with Paragraph 1 above.

900. TRAFFIC MAINTENANCE

A. Through Traffic Access (Collector or Arterial Streets).

1. The Contractor shall maintain a minimum of one lane of traffic on major collector or arterial streets (as defined by the Town of Somers) at all times. Roads shall be maintained in a safe condition throughout the duration of the project. The Contractor shall take all precautions necessary to safely

warn the public of the probable increased danger to travel due to construction of the Work.

a. All streets shall be open to two-way traffic after working hours and all day on weekends and holidays.

b. The Contractor shall at all times conduct his work in a manner to minimize obstruction to local traffic.

B. Local Traffic Access (Local Streets).

1. The Contractor may close minor local streets (as defined by the Town of Somers) to through traffic, allowing local traffic only, during working hours. The Contractor shall at all times conduct his work in a manner to minimize obstruction to local traffic. Roads shall be maintained in a safe condition throughout the duration of the project. The Contractor shall take all precautions necessary to safely warn the public of the probable increased danger to travel due to construction of the work.

a. All streets shall be open to [local – through (two-way)] traffic after working hours and all day on weekends and holidays.

b. The Contractor shall notify police and fire departments prior to closing any street to through traffic.

c. The Contractor shall provide access for garbage collection and mail delivery on those streets closed to through traffic by his construction activities for the duration of the project.

C. Driveway Access.

1. If driveway access is to be blocked, then it shall be the Contractor's responsibility to notify all affected property owners prior to closing that section of the street to traffic.

2. The Contractor shall construct temporary ramps at all driveways to provide access during road construction.

3. The Contractor shall provide full-time access to residences of handicapped persons, nursing and retirement homes, hospitals and other facilities as directed by the Engineer, unless other satisfactory arrangements are approved.

4. Access to Businesses and Industries.

   a. The Contractor shall provide full-time access to businesses and industries unless other satisfactory arrangements are approved. Access may be provided by constructing temporary drives and/or by placing steel plates over new concrete gutters.

D. Mail Delivery.

1. The Contractor is responsible for insuring that mail can be delivered to properties affected by his work operations in a reasonable and timely manner.

2. If the Contractor's operations unduly restrict or prohibit mail delivery, he shall take measures to provide alternate method(s) for mail pick-up. Alternate methods may include:

   a. Temporarily relocating mailboxes removed by his operations.

   b. Providing alternate/multiple delivery and collection boxes at a central location.

3. Alternate mail delivery methods shall be coordinated with both the post office and all affected properties.

E. Detouring Traffic (If Specified in Special Conditions).

1. The Contractor may detour traffic from streets as specified in the Special Conditions. Traffic shall be detoured along the routes specified in the Special Conditions.

2. Traffic may be detoured only during those periods of the working day that are deemed necessary by the Contractor, Engineer and Owner for prosecution of the work unless stated otherwise in the Special Conditions. Streets shall be open to two-way traffic during non-working hours, weekends, holidays and during periods of work not included above. Work shall be scheduled to keep streets open to two-way traffic to the maximum extent possible.

3. The Contractor shall be responsible for furnishing, installing and maintaining all barricades and signs required for detouring traffic. The detour route and signing shall be coordinated with and approved by the Town of Somers.

4. The Contractor shall provide local traffic access on streets closed to through traffic by detours. See Subsection 900.B above.

F. Snow Removal.

1. The Contractor shall coordinate his activities with the appropriate agency responsible for snow removal during periods of inclement weather.

G. Signing, Barricades and Flagmen.

1. Whenever the Contractor's activities obstruct through traffic, there shall be sufficient flagmen on duty to guide the traffic, and the Contractor shall furnish and install all temporary signing and barricades required to safely direct the traveling public around the obstructed area.

2. Suitable barriers shall be erected and maintained at each end of an obstructed section of roadway and at all affected roadway intersections.

3. Traffic control shall be done in accordance with the latest version of Part 6, Temporary Traffic Control of the FHWA "Manual on Uniform Traffic Control Devices", the Traffic Control Plan (if shown on the Plans) and Section 643 of the "State Specifications".

4. Whenever traffic on state or county highways is obstructed, the Contractor shall provide a minimum of two (2) flagmen to direct traffic at each separate work location.

1000. CONSTRUCTION IN STATE, COUNTY AND TOWN HIGHWAYS

A. Highway Permits.

1. Construction within the right-of-ways of State, County and Town Highways shall be governed by the applicable permits and the appropriate sections of the Specifications. Said permit(s) for this construction have been obtained for the Contractor by the Owner and are available for review at the locations indicated in the "Official Notice to Bidders" for review of Plans.

2. The Contractor shall familiarize himself with all requirements of said permits and general requirements of these agencies.

a. A State of Wisconsin highway permit is required for work within State highway right-of-way.

(1) The WisDOT shall be notified at least 24 hours prior to the installation of erosion control and storm water management measures within State highway right-of-ways. It is the Contractor's responsibility to insure that the WisDOT has

been notified prior to commencing work on State highways. Contact Mr. Andy Maxwell, Southeast Region Permits Coordinator, at (262) 521-5344.

(2) The WisDOT shall also be notified after the project has been completed and lawn areas stabilized.

(3) Open-Cut Work Restrictions.

(a) Open-cuts in travel lanes within state highway right-of-ways will not be allowed between December 1st and April 15th, nor during times when asphaltic hot mix is not available.

B. Kenosha County Highway Permit.

1. A partial list of conditions of the Kenosha County Highway Department is as follows:

a. Trenches within or adjacent to traveled roadways, left open during non-working hours, shall be protected with snow fence along the entire trench edge abutting the roadway and shall be marked with at least 2 flashing barricades at each end and at intermediate points not to exceed a 25 foot spacing.

b. No equipment or construction materials may be stored overnight or on weekends, holidays or other non-working days within County right-of-ways except that backhoes and front-end loaders may be parked near the end(s) of open trenches provided that the machine is at least 4 feet from the edge of the pavement and provided that a minimum of 2 flashing barricades are placed adjacent to machines used for this purpose.

c. No steel tracked equipment, such as backhoes and bulldozers, may be driven on or over the paved surface of County roads. (outside of the construction limits.)

d. A separate Kenosha County Highway Permit (in addition to the permit already acquired for this project) is required for temporary field entrances used by the Contractor for access to spoil material disposal areas located along County highways. The Contractor shall obtain any permits necessary for temporary access.

e. Prior to beginning any work on County highway right-of-ways, the Contractor shall contact the Kenosha County Highway Department (phone [262] 857-1870) to give the name and phone number of at

least two of his employees who may be contacted in case of an emergency during non-working hours.

f. Construction materials and/or backfill spilled or tracked on pavement or shoulder areas and interfering with traffic are to be immediately swept off by power broom. All roadways shall be clean at the end of working days.

g. No excavated materials may be stored temporarily or permanently within County Highway right-of-ways.

h. The Contractor shall accompany the Engineer, Owner and representative of the Kenosha County Highway Department on a touring or "windshield" inspection of County highways prior to commencement of construction. The Engineer will prepare a report on the condition of County roads observed during the tour. Upon completion of highway restoration work, a final tour will be conducted to determine the adequacy of highway restoration; including pavement, shoulder, ditch and terrace areas. Any restoration work found to be unacceptable shall be repaired by the Contractor at his cost within a reasonable amount of time.

1201. CLEARING AND GRUBBING

A. Clearing and grubbing shall comply with Sections 201 and 202 of the "State Specifications", as amended herein.

B. Measurement and Payment.

1. All trees to be removed are shown on the Plans and/or will be field marked by the Engineer.

a. The diameter of trees scheduled for removal shall be 1/3 of the circumference measured 4-1/2 feet above the existing ground level.

b. Amend Subsection 201.4.5 of the "State Specifications" to read in part:

"Only those trees and stumps having a diameter of six (6) inches or greater will be measured for payment."

C. Tree Trimming.

1. The Contractor shall carefully trim limbs or branches overhanging the road, of trees to be preserved, as directed by the Engineer. Such trimming

shall be performed in accordance with generally accepted horticultural practices.

a. Treat cut surfaces and abrasions on oak trees between April 1st and September 30th with tree paint in accordance with Subsection 201.3(4).

D. Tree Protection.

1. Trees and shrubs to be preserved shall be protected from scarring or other injury during grading operations. Excavation operations around trees to be preserved shall minimize the disturbance to the existing ground as much as possible within the dripline of preserved trees, but shall not disturb the original ground around these trees within a distance equal to twice the diameter of the tree, one foot minimum. Exposed roots resulting from excavation shall be cleanly cut and covered with humus-bearing soil. The Contractor shall compensate the Owner for damage to protected trees caused by the Contractor's operations.

E. Disposal of Debris.

1. Stumps, roots, brush, waste logs and limbs, timber tops and debris resulting from clearing and grubbing shall be disposed of by the Contractor. Burning or burial within the street right-of-way and/or project site is prohibited.

2. Disposal of diseased material shall be in accordance with all local, state and federal regulations. Dispose of elm wood and stumps in accordance with Subsection 201.3(17).

1201.1. TREE ROOT REMOVAL

A. This work shall consist of removing tree roots from within the limits of excavation, including 6 to 12 inches behind proposed curb and gutter and from 6 to 12 inches beyond the edges of the proposed sidewalk. Remove tree roots to a depth of not less than 6 inches below the concrete base or finished ground grade.

B. Construction Method.

1. Cut roots utilizing mechanical root cutting equipment or by a hand method. Roots shall be cleanly cut in a vertical direction with as little damage to remaining roots as possible. Do not cut roots using backhoes or endloaders.

2. Cover exposed roots with burlap, straw or humus-bearing soil and keep moist until backfilling is completed.

1203. REMOVING OLD CULVERTS

A. Removing small pipe culverts shall consist of removing, salvaging when required, storing and disposing of existing culverts as shown on the Plans and/or as directed by the Engineer. This work shall be done in accordance with Section 203 of the "State Specifications".

1. Unsalvageable culverts shall be disposed of by the Contractor at his own site.

B. All salvaged materials shall be delivered to a site designated by the Town. Materials shall be placed (stored) as directed by the Town.

1. The Town will determine if culverts are salvageable.

1204. REMOVING MISCELLANEOUS STRUCTURES

1204.1. REMOVING PAVEMENT

A. Removing asphaltic and concrete pavements shall consist of removing asphaltic and concrete pavement, including asphaltic and concrete drives, as shown on the Plans and as directed by the Engineer. This work shall be done in accordance with Section 204 of the "State Specifications".

B. Saw-Cutting Pavements.

1. All concrete and asphalt pavements (including butt joints), shoulders and driveways shall be saw-cut to a minimum depth of three (3) inches prior to being shattered and removed. Where concrete pavements are covered with an asphalt overlay, both the asphalt and concrete shall be saw-cut. Pavements shall be saw-cut in neat straight lines, at right angles to the street or drive, to produce a clean joint for pavement restoration. If the saw-cut edge is damaged during construction, the Contractor shall saw-cut the pavement again immediately prior to paving.

a. All concrete and asphalt pavements within state highway right-of-ways shall be saw-cut full depth prior to being shattered and removed.

C. Any electrical wiring contained in concrete removal shall be cut to an adequate length to provide splicing of wire for new concrete pavement and coordinated with the Owner's electrician.

1204.2. MILLING PAVEMENT

A. "Asphaltic Pavement Milling" shall consist of removing asphaltic pavement by milling at the location(s) and to the thickness(es) shown on the Plans and as directed by the Engineer and disposing of the milled material in accordance with Subsection 1204.5 of these Special Provisions.

B. The milling equipment and construction methods shall conform to the requirements of Subsection 490.3 of the "State Specifications", except as it relates to the stockpiling location of material.

1204.3. REMOVING CONCRETE STRUCTURES

A. Removal of concrete curb and gutter, sidewalk and steps shall include removing and disposing of all concrete sections shown on the Plans and as directed by the Engineer.

B. Concrete removal work shall comply with Section 204 of the "State Specifications".

C. Concrete structures shall be removed to existing joints or as marked in the field. If saw-cutting is necessary, it shall be done in accordance with Section 1204.1 of these Special Provisions.

1204.4. DISPOSAL OF PAVEMENT AND CONCRETE STRUCTURES

A. All removed pavement material and miscellaneous structures, including curb and gutter and sidewalk shall be disposed of by the Contractor in places provided by him outside of the right-of-way and/or project site.

B. All other miscellaneous structures and materials shall be disposed of in accordance with Subsections 203.3.4 and 204.3.2 of the "State Specifications".

1205. ROADWAY AND DRAINAGE EXCAVATION

1205.1. COMMON EXCAVATION

A. Common excavation shall include all roadway, site grading and drainage excavation necessary to complete this project, including topsoil removal as specified herein and as shown on the Plans.

1. The undercutting of areas to provide for four (4) inches of topsoil shall be considered incidental to common excavation.

2. The Contractor shall remove all topsoil from within the areas for grading. The volume of the topsoil removal below subgrade elevation shall be considered incidental to common excavation.

B. All excavation and grading work shall comply with the provisions of Sections 205 (Roadway and Drainage Excavation), 207 (Embankment), 211 (Preparing the Foundation), and 213 (Finishing Roadway) of the "State Specifications".

C. Drainage During Construction.

1. Drainage shall be provided during construction in accordance with Subsection 205.3.3 of the "State Specifications".

D. Dust Control.

1. The Contractor shall minimize the dispersion of dust from the subgrade during grading operations, including maintenance operations until acceptance of the work, by the application of water or other approved dust control materials.

E. Topsoil Stockpile.

1. The Contractor shall stockpile an adequate amount of satisfactory topsoil for spreading over excavated lawn and terrace areas.

2. Refer to Section 1625 of these Special Provisions for additional topsoil requirements.

F. Quantities of Grading Work.

1. Quantities.

a. The Contractor shall determine earthwork quantity(s) from cross-sections, grading plans, or other data provided.

1205.2. EXCAVATION BELOW SUBGRADE (EBS)

A. Deposits of frost-heave material, unstable silty soils, water-bearing soil, topsoil or other undesirable foundation materials shall be removed from the area within the roadway slopes to such depths as directed by the Engineer. This work shall be done in accordance with Subsection 205.3.4 of the "State Specifications".

1. Remove unsuitable materials to a minimum depth of 12 inches below subgrade or as directed by the Engineer.

B. Granular Backfill for Excavation Below Subgrade.

1. Granular backfill for excavation below subgrade shall comply with Section 209 of the "State Specifications".

a. Pit run gravel will generally be acceptable as granular backfill.

b. Excavations below subgrade shall be filled with satisfactory materials, excavated from other sections of the project, if such materials are available.

C. Stone Backfill to Stabilize Subgrade

1. Stone backfill to stabilize subgrade shall comply with the following gradation requirements:

2 Inch Size (ASTM C-33 - Size No. 3)

Sieve Sizes	Percentage Passing by Weight
2-1/2 Inches	100
2 Inches	90 - 100
1-1/2 Inches	35 - 70
1 Inch	0 - 15
1/2 Inch	0 - 5

2. The Contractor may substitute base aggregate dense 3" for stone backfill.

1205.3. DITCHING AND SHAPING

A. Ditching and shaping shall consist of excavating and reshaping the earth adjacent to the roadway shoulder to allow surface water runoff to be directed away from the roadway.

B. All work shall be performed in accordance with Sections 1205 and 1625 of these Special Provisions.

C. The work shall include stripping and stockpiling of salvaged topsoil, excavating earth as necessary, disposal of excess material, and hauling and placing salvaged topsoil.

D. The disturbed area shall be restored in accordance with Section 1630 of these Special Provisions.

1205.4. SITE GRADING

A. Site grading work shall be done in accordance with Sections 1205.1 (Common Excavation), 1205.2 (Excavation Below Subgrade), 1205.5 (Disposal of

Materials), 1207 (Embankments), 1208 (Borrow), 1625 (Topsoil and Salvaged Topsoil), and 1630 (Lawn Restoration) of these Special Provisions.

B. Maximum Grading Slope (4:1).

1. All site grading operations including topsoil stripping and/or stockpiling, utility construction, street construction, cutting, filling, or other miscellaneous earth moving operations that result in cut or fill slopes, shall leave those slopes in a smoothly graded surface with slopes not to exceed 4:1 to allow weed cutting by ordinary tractor mounted cutting equipment. Any exceptions to this standard must be explicitly approved by the Town before slopes are made.

C. Site grading work shall include all work shown on the Plans and specified in the Special Conditions.

1205.5. DISPOSAL OF MATERIALS

A. Surplus Excavated Material.

1. Surplus spoil material, from either utility or grading operations, shall not be stockpiled on site; but shall be disposed of by the Contractor at off site locations provided by him.

2. The material shall be disposed of in a manner that will create a neat and trim appearance, and in a manner to neither create a nuisance nor cause pollution nor siltation of watercourses, streams, lakes and reservoirs. Disposal areas shall be leveled by the Contractor, graded to drain, and the surface restored.

1207. CONSTRUCTION OF EMBANKMENTS

A. The construction of embankments, including fills and subgrades, shall be in accordance with Section 207 of the "State Specifications".

B. Materials.

1. Embankments and other fill areas shall be constructed with approved materials, obtained from roadway and drainage excavation, conforming to Subsection 207.2. Salvaged topsoil, sod, logs, brush, and other perishable material shall not be used in embankments inside the 1:1 slopes.

C. Standard Compaction.

1. Fill areas and the finished earth subgrade in cut sections and below fill sections shall be compacted in accordance with Subsection 207.3.6.2 for

Standard Compaction. Fill shall be placed and compacted in layers generally not exceeding eight (8) inches in thickness before compaction.

2. Standard compaction shall consist of compacting each layer of the embankment or earth subgrade to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment.

3. Compaction shall be performed by specialized compaction equipment unless the Engineer determines that routing of hauling and leveling equipment over the area to be compacted is satisfactory and sufficient.

4. Specialized compaction equipment shall include tamping rollers, pneumatic-tire rollers, vibratory rollers or other approved compaction equipment.

D. Proofrolling.

1. Prior to placing granular subbase or base course material, the Contractor shall test the subgrade strength by proofrolling. Proofrolling shall involve running loaded trucks or scrapers over the entire roadway (pavement plus shoulders) width. Weak or soft spots in the subgrade shall be removed and backfilled with granular backfill material conforming with Subsection 1205.2.B of these Special Provisions.

1208. BORROW EXCAVATION

A. Borrow excavation shall comply with the provisions of Section 208 of the "State Specifications", except an earthwork summary is not part of the Plans.

1. The Contractor shall be responsible for furnishing, hauling and placing borrow excavation, including securing the necessary borrow pits.

2. Borrow excavation shall meet the material requirements of Subsection 208.2.1 and shall be approved by the Engineer.

1210. SOIL STABILIZATION FABRIC

A. This work shall consist of furnishing and placing a soil stabilization fabric over soft or unstable subgrades as directed by the Engineer.

B. Installation.

1. The fabric shall be placed in accordance with Subsection 645.3.2 of the "State Specifications" and the following requirements.

2. Clearing and grubbing operations shall be completed prior to placement of the fabric. Remove all sharp objects, tree stumps and large stones that could puncture the fabric.

3. Place the fabric by rolling onto the soft subgrade, extending over firm soil for a minimum distance of 5 feet. Overlap fabric rolls from 1.5 to 3 feet as required by local soil conditions.

4. Place the first layer of aggregate by backdumping from trucks and spread with a tracked bulldozer. Do not drive vehicles directly on the fabric. The first lift of subbase material shall be 8 inches minimum compacted thickness or as directed by the Engineer. Compact the subbase using vibratory rollers or other approved compaction equipment.

C. Subbase Material.

1. Subbase course material shall comply with Subsection 1205.2.C of these Special Provisions.

D. Fabric Material.

1. The fabric shall be Geotextile Fabric, Type SAS meeting the requirements of Subsection 645.2.2 of the "State Specifications".

2. Acceptable fabric materials include all products listed on the Wisconsin Department of Transportation Approved Products Lists.

1211. PREPARING THE FOUNDATION

A. Preparing the foundation shall be done in accordance with the following provisions and Section 211 of the "State Specifications".

B. Earth Subgrade (With Rough Grading by Others).

1. Preparation of earth subgrade shall include all work required to finish grade the road subgrade including preparation of the subgrade for curb and gutter, sidewalk, and driveways.

2. Existing pavements and base courses will be removed by the Contractor to approximate subgrade elevation. The Contractor shall be responsible for bringing the subgrade to grade in accordance with Subsection 211.3.2. This work includes the disposal of all surplus excavated materials.

C. Foundation for Asphaltic Surfacing (Existing Unpaved Roads).

1. Foundation for asphaltic surfacing shall include all work required to prepare the base course, including shoulders, for paving.

2. The Contractor shall scarify all existing road surfaces. Upon completion of the scarifying operations the Engineer will stake the roads for line and grade.

3. The Contractor shall fine grade and compact the road, adding base course material as required, to the finished base course grade.

1305. BASE AGGREGATE DENSE

A. Base aggregate dense shall be constructed in accordance with Section 305 of the "State Specifications", and the typical section(s) shown on the Plans. The Contractor shall furnish and place base material as required to construct the base to grade.

1. Moisture Content.

a. Base material shall have a maximum moisture content of seven (7) percent before being weighed. Moisture content in excess of 7 percent will be deducted from the measured weight. Moisture content will be expressed as a percent of dry weight.

B. Gradation.

1. Base aggregate dense shall conform to the following gradations, as specified in Subsection 305.2.2:

a. Lowest layer (5″) - 1-1/4-inch.

b. Top layer (5″) - 3/4-inch (Traffic Bond).

2. Aggregate shall be crushed limestone only.

C. Standard Compaction.

1. Base aggregate dense shall be compacted in accordance with Subsection 207.3.6.2 of the "State Specifications" for standard compaction, as modified below.

a. Base aggregate dense shall be placed and compacted in two (2) or more layers in accordance with Section 305.3 of the "State

Specifications". Compacted layers shall be 6 inches or less, unless the Engineer approves thicker layers.

b. Moisture shall be added by tank wagon as required for maximum compaction.

c. Standard compaction shall consist of compacting each layer of the base course to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment.

d. Compaction shall be performed by specialized compaction equipment including tamping rollers, pneumatic-tire rollers, vibratory rollers or other approved compaction equipment.

D. Proofrolling.

1. Prior to placing asphaltic or concrete pavement, the Contractor shall test the base strength by proofrolling. Proofrolling shall involve running loaded trucks or scrapers over the entire roadway (pavement plus shoulders) width. Weak or soft spots in the base shall be removed, replaced with clean base aggregate dense, compacted in 6 inch maximum lifts and retested.

E. Dust Control.

1. The Contractor shall minimize the dispersion of dust from the base, including shoulders, during construction and maintenance operations until after placement of the surface course.

2. Dust control shall be accomplished by the application of water or other approved dust control material as required by the Engineer.

1305.1. EXISTING GRAVEL DRIVEWAYS (ROAD CONSTRUCTION PROJECTS)

A. Gravel driveways, including the gravel base under asphaltic drives, shall be constructed in accordance with Section 1305 of these Special Provisions.

1. Existing gravel drives shall be replaced "in-kind", except place a minimum of 9 inches of base aggregate dense 1-1/4-inch in two equal layers.

1350. GRANULAR SUBBASE

A. Granular subbase shall be constructed in accordance with Section 350 of the "State Specifications" and the typical section(s) shown on the Plans. The

Contractor shall furnish and place subbase course material as required to construct the subbase course to grade.

B. Material.

1. Granular subbase material shall comply with the requirements of Subsections 350.2 and 209.2 of the "State Specifications" except that 100% of the material used shall pass a three-inch sieve and at least 25% by weight shall pass a No. 4 sieve. Material passing the No. 4 sieve shall comply with Subsection 209.2.2.

2. Aggregate shall be crushed limestone only.

C. Standard Compaction.

1. Granular subbase shall be compacted in accordance with Subsection 207.3.6.2 of the "State Specifications" for standard compaction, as modified below.

a. The subbase shall be placed and compacted in two (2) equal layers.

b. Moisture shall be added by tank wagon as required for maximum compaction.

c. Standard compaction shall consist of compacting each layer of the subbase to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment.

d. Compaction shall be performed by specialized compaction equipment including tamping rollers, pneumatic-tire rollers, vibratory rollers or other approved compaction equipment.

D. Proofrolling.

1. Prior to placing base course material, the Contractor shall test the subbase strength by proofrolling. Proofrolling shall involve running loaded trucks or scrapers over the entire roadway (pavement plus shoulders) width. Weak or soft spots in the subbase course shall be removed, replaced with clean subbase course material, compacted in 6 inch maximum lifts and retested.

E. Dust Control.

1. The Contractor shall minimize the dispersion of dust from the subbase course, including subgrade, during construction and maintenance operations until after placement of the base course.

2. Dust control shall be accomplished by the application of water or other approved dust control material as required by the Engineer.

1390. BASE PATCHING

A. Base patching shall comply with Section 390 of the "State Specifications", as modified below.

1. This work shall include the removal of either concrete pavement and/or asphaltic concrete pavement and construction of a base course of either portland cement concrete or asphaltic concrete pavement.

2. The existing damaged pavement shall be saw-cut and removed as shown on the Plans or as directed by the Engineer.

3. The underlying base and unsuitable subbase material shall be removed and replaced with dense graded base in accordance with Section 1305 of these Special Provisions.

4. The asphaltic base course shall be constructed of an asphaltic mixture conforming to Section 1450 of these Special Provisions for lower course.

a. The asphaltic base course shall match the thickness of the existing pavement and shall be placed in 3 inch maximum lifts.

1450. ASPHALTIC CONCRETE PAVEMENT

A. Asphaltic concrete pavement shall comply with Sections 450, 455, and 460 of the "State Specifications" as modified below. The pavement mix shall be Type E-0.3 - E-10 for roadways as specified in the bid item and may be either Type E-0.3 or Type Asphaltic Surface for driveways and parking areas. The pavement mix shall be comprised of virgin and/or recycled aggregate and asphaltic materials unless otherwise specified.

1. Aggregate.

a. Aggregate in the pavement mix shall conform to Subsection 460.2.2 of the State Specifications, including the gradation requirements of Subsection 460.2.2.3, and the gradations listed below.

	Nominal Size	Minimum Layer Thickness
Lower Layer	3/4″ (19.0 mm)	2.25″
Upper Layer	1/2″ (12.5 mm)	1.75″
Asphaltic Surface	3/8″ (9.5 mm)	1.50″

2. Asphalt Cement.

   a. Asphalt cement shall conform to Subsection 455.2.4 of the "State Specifications" and shall consist of a performance grade in accordance with Procedure 14-10-5 of the "Facilities Development Manual".

3. Pavement Mix.

   a. Prior to beginning construction, the Contractor shall provide the Engineer with copies of current state approvals for the pit, mixing plant and design mixes for materials proposed to be used on this project.

   b. Asphaltic mixture shall be produced and incorporated in the work on the basis of a job-mix formula. The Contractor shall be responsible for the asphaltic job-mix design report, conforming to Subsection 460.2.7, and shall submit a signed copy of the report to the Engineer for review at least two weeks prior to plant start up for paving production.

   c. Pavement Mix.

      (1) Pavement mixture shall be in accordance with Subsection 460.1 and 460.2 of the "State Specifications" and shall be the types noted above or as specified below:

         (a) E-0.3: Residential streets and parking lots.

         (b) E-1: Industrial, commercial, and collector streets, CTH's, and low volume STH's.

         (c) E-3: Major arterial streets, high volume CTH's, and medium volume STH's.

         (d) Asphaltic Surface: Driveways and small parking lots (Option - Use Type E-0.3).

d. Delete Subsection 460.2.8 from the "State Specifications". Quality management program does not apply to this project.

B. Pavement Compaction.

1. All pavements shall be built in accordance with the Maximum Density Method per Subsection 460.3.3 of the "State Specifications". The maximum specific gravity value shall be indicated on the asphaltic job-mix design report.

2. Pavements shall be compacted to a density not less than that shown in the table below:

Minimum Required Density:

LOCATION	LAYER	PERCENT OF TARGET MAXIMUM DENSITY		
		MIXTURE TYPE		
		E-0.3, E-1, and E-3	E-10, E-30, and E-30x	SMA
TRAFFIC LANES [1]	LOWER	91.5 [2]	92.0 [2]	94.0
	UPPER	91.5	92.0	94.0
SHOULDERS AND APPURTENANCES	LOWER	89.5	89.5	91.0 [3]
	UPPER	90.5	90.5	91.0 [3]

[1] Includes parking lanes as determined by the Engineer.

[2] Minimum reduced by 2 percent for < 3 million ESALs and one percent for > 3 million ESALs, when the first lift of lower layer constructed on base aggregate dense or recycled base courses.

[3] Minimum density will be 94.0 when the shoulders are paved integrally with the mainline pavement.

3. Delete Subsection 460.5.2.3 from the "State Specifications". Pavement density incentives do not apply to this project.

4. The Contractor shall verify degree of compaction and submit a report to the Engineer as to date paved, date tested, location, and degree of compaction.

C. Recycled Asphaltic Concrete Pavement.

1. The Contractor shall not use recycled asphaltic concrete pavement for any layers.

D. Butt Joints.

1. The Contractor shall construct butt joints wherever the new pavement overlay butts up to existing pavements; including at intersecting streets, project ends and as shown on the Plans.

2. Butt joints may be constructed by removing a section of pavement or by milling or grinding down 1-1/2 inches of pavement. Saw-cuts shall be in neat straight lines at right angles to the street in accordance with Section 1204.1 of these Special Provisions.

E. Pavement Passes and Thickness.

1. Asphaltic concrete pavement shall be placed in passes as shown on the Plans. Lower layer and upper layer passes shall be staggered to prevent joints from extending through the entire asphaltic pavement.

   a. Five inch thick asphaltic pavement shall consist of a 3-1/4 inch lower layer and a 1-3/4 inch upper layer.

2. The longitudinal joint(s) in the upper layer shall be located at the centerline of the pavement and/or at edges of traffic lanes.

F. Tack Coat.

1. A tack coat shall be applied to each lower layer prior to placing the succeeding layer. Apply the tack coat the same day that the next layer is placed.

   a. Tack coat material shall be an asphalt emulsion, conforming to Subsection 455.2.5 of the "State Specifications", diluted with an equal amount of water and applied at a rate of 0.025 gallons per square yard or at a rate required to effectively bond the overlying material.

G. Temperature of Asphalt Placed.

1. All asphalt (both upper and lower layers) shall be placed at a temperature of 250°F or higher.

H. Cold Weather Work.

1. Asphaltic pavement shall not be placed when the air temperature in the shade is less than 35°F unless approved by the Engineer.

2. Paving done during the period between October 15th and May 1st shall be placed in accordance with Subsection 450.3.2 of the "State Specifications".

I. Construction Equipment.

1. The paver shall have sufficient power and traction to operate on grades. Screed extensions with static extensions shall not exceed 12 inches. Automatic control systems shall be used unless otherwise determined by the Engineer.

2. Vibratory rollers shall conform to Subsection 450.3.1.5.

J. Construction Methods.

1. Prior to placing asphaltic base or surface courses, all required corrections of filling potholes, sags, and depressions shall be made.

2. All edges of existing abutting asphaltic pavements shall be saw-cut immediately prior to paving to form a straight firm joint, unless otherwise waived by the Owner.

3. All rolling shall be performed during daylight hours or as approved by the Engineer.

K. Proofrolling.

1. Prior to placing the asphaltic pavement lower layer, the Contractor shall test the base strength by proofrolling. Proofrolling shall involve running loaded trucks or scrapers over the entire roadway (pavement plus shoulders) width. Weak or soft spots in the base or subbase course shall be removed, replaced with clean base or subbase course material, compacted in 6 inch maximum lifts and retested.

1450.1. ASPHALTIC DRIVEWAYS

A. Asphaltic driveways shall be constructed in accordance with Sections 1305 (Base) and 1450 (Pavement) of these Special Provisions. The pavement mix shall be Asphaltic Surface conforming to Subsection 465. Residential drives shall consist entirely of upper layer design mixtures and commercial and industrial drives shall consist of both lower layer and upper layer design mixtures.

1. Existing asphaltic drives shall be replaced "in-kind" except that the following minimum thicknesses shall be placed:

a. Residential - 6″ base and 3″ pavement (1-1/2″ upper layer and 1-1/2″ lower layer using 9.5 mm [3/8 inch] aggregate gradation).

b. Commercial - 8″ base and 4″ pavement (1-3/4″ upper layer and 2-1/4″ lower layer using 12.5 mm [1/2 inch] aggregate gradation).

c. Industrial - 12″ base and 4″ pavement (1-3/4″ upper layer and 2-1/4″ lower layer using 12.5 mm [1/2 inch] aggregate gradation).

1455. TACK COAT

A. The Contractor shall apply a tack coat to the existing pavement prior to placing the asphaltic overlay. Tack coat shall comply with Section 455 of the "State Specifications".

1. Material.

a. Tack coat material shall be an asphalt emulsion, diluted with an equal amount of water in accordance with Section 455.2.5 of the "State Specifications".

2. Application Rate.

a. The tack coat shall be spread at a rate of 0.025 to 0.05 gallons per square yard or as directed by the Engineer. The quantity shall be figured assuming an application rate of 0.05 gallons per square yard.

B. Surface Preparation.

1. The Contractor shall sweep the pavement area with a power broom to remove dust, dirt, clay or other objectionable material prior to placing the tack coat.

C. Crack Sealing.

1. The Contractor shall seal all cracks 1/8″ or wider with asphaltic cement or rubberized crack filler prior to placing the tack coat.

2. The Contractor shall sweep or blow out loose dirt, clay and other objectionable materials from cracks prior to filling them.

D. Protecting Structures.

1. Surfaces of all structures shall be protected from being spattered or marred by tack coating operations.

1501. CONCRETE MASONRY

A. Grade of Concrete

1. All concrete shall be Grade A, air-entrained, as specified in Subsection 501.3.2 of the "State Specifications".

a. All concrete shall be "ready-mixed".

B. Surface Finish.

1. All concrete shall receive a brush finish.

C. Curing.

1. Concrete pavement, curb and gutter and sidewalk shall be cured in accordance with the requirements of Subsection 415.3.12 of the "State Specifications", except that all concrete shall be cured by the Impervious Coating Method as specified in Subsection 415.3.12.2.

D. Test Specimens.

1. The Contractor shall take two representative concrete samples in accordance with ASTM C-31 for 7 day and 28 day compression testing in accordance with ASTM C-39 from approximately every 25 cubic yards of concrete placed or as directed by the Engineer. This work shall conform to Subsection 501.3.10 of the "State Specifications".

2. Test cylinders shall be six inches in diameter by 12 inches in height.

3. The Contractor shall field cure, care for and ship the test cylinders to the testing laboratory.

a. Copies of test results shall be provided to the Engineer.

1520. CULVERT PIPE

A. The Contractor shall provide culvert pipe and apron endwalls where the material used is a Contractor option; providing and removing temporary culvert pipe; and cleaning existing culvert pipes in accordance with Section 520 of the "State Specifications".

B. Method of Measurement.

1. Culverts pipe will be measured by the linear foot acceptably completed, determined by multiplying the number of units in the pipe culvert by their commercial laying length. Pipes with skewed or beveled ends will be measured by multiplying the number of regular units by their commercial laying length and adding the length of each skewed or beveled end section measured on the centerline of the structure along the flow line of the section.

2. Apron endwalls will be measured by each individual unit acceptably completed.

1521. CORRUGATED STEEL CULVERT PIPE

A. The installation of culverts shall comply with Section 521 of the "State Specifications".

1. Culverts shall be placed in trenches excavated through existing ground or through compacted embankments.

2. The trench shall be wide enough to permit thorough compaction of backfill material. The bottom of the trench shall be shaped by means of a template so that at least 10% of the outside diameter of the pipe will be in contact with the bottom of the trench. Backfill the trench with selected excavated material placed in six (6) inch maximum lifts and mechanically compacted to a minimum of 90% Standard Proctor Density. Backfill material shall be brought up simultaneously on both sides of the pipe.

B. Materials.

1. Corrugated steel pipe shall be furnished for the following minimum gages/thicknesses.

6″ CSCP	18 gage (0.052 in.)
8″ thru 24″ CSCP	16 gage (0.064 in.)
30″ & 36″ CSCP	14 gage (0.079 in.)

C. Steel Apron Endwalls.

1. Steel apron endwalls, complying with Sections 520 and 521 of the "State Specifications" shall be installed at the ends of all culverts.

1601. CONCRETE CURB AND GUTTER

A. Standard Section.

Concrete curb and gutter shall conform to the 30 inch Type "D" section of the Wisconsin Department of Transportation and shall be constructed in accordance with Section 601 of the "State Specifications" and the typical section(s) shown on the Plans.

1. Concrete masonry shall conform to Section 1501 of these Special Provisions.

B. Base Aggregate Dense.

1. Construct curb and gutter on a layer of compacted base aggregate dense base course, placed to a thickness matching the subgrade elevation of the curb and gutter to the subgrade elevation of the adjacent pavement.

2. Material.

a. The base material shall conform to Section 305 of the "State Specifications" and shall be base aggregate dense 1-1/4 inch and/or 3 inch.

C. Contraction Joints.

1. Spacing.

a. Adjacent to Asphalt Pavement.

(1) Contraction joints in curb and gutter adjoining asphaltic pavement shall be spaced at intervals of 10 feet or as directed by the Engineer.

2. If the Contractor elects to saw-cut the joints, the joints shall be saw-cut the same day when normal or rapid concrete setting conditions prevail. If conditions exist that retard the setting of the concrete, the saw-cutting of the joints shall be delayed until the concrete has set sufficiently to preclude raveling during the sawing. If shrinkage cracks develop prior to saw-cutting, the cracked sections of concrete shall be removed to such an

extent that the normal joint spacing will still exist. Contraction joints constructed by saw-cutting shall be a minimum of 2 inches in depth.

D. Expansion Joints.

1. Expansion joints shall be placed as outlined in Subsection 601.3.6 of the "State Specifications". Joint filler shall be 3/4" expansion fiber material.

2. Place expansion joints at the locations shown on the Plans and as detailed below:

a. Curb and Gutter Located Adjacent to Asphalt Pavement.

(1) At the PC and PT of horizontal curves.

(2) Three feet from each side of drainage structures.

(3) At 300 foot maximum spacing on both tangents and curves.

E. Opening to Traffic.

1. Traffic shall not be allowed on curb and gutter for a period of at least 7 days after placing or until the concrete has attained a compressive strength of at least 3,000 pounds per square inch in accordance with Subsection 415.3.17 of the "State Specifications".

F. Tapered Curb Ends

1. A tapered curb section shall be constructed at the ends of the curb and gutter where shown on the Plans. The tapered sections shall be 3 feet long and end with a 2 inch high curb. A contraction joint shall be placed at the end of the tapered section.

G. Driveway Openings.

1. Driveway openings installed after the initial installation of the concrete curb/gutter shall have the existing curb/gutter removed by removing to the nearest 10 foot joint spacing or by removing the curb head using approved sawing equipment for the intended removal.

1602. CONCRETE SIDEWALK, STEPS AND DRIVEWAYS

A. Standard Sections.

1. The construction of concrete sidewalks, steps and driveways shall comply with Section 602 of the "State Specifications" and the details shown on the Plans.

2. Concrete masonry shall conform to Section 1501 of these Special Provisions.

3. Sidewalks.

   a. Standard sidewalks shall be 4 inches minimum thickness except at driveways where the sidewalk shall match the thickness of the adjacent concrete drive with a minimum thickness of 6 inches provided and shall have a minimum 2 inch thick base aggregate dense (3/4" size). At driveways the base aggregate dense shall be 6 inches thick.

4. Driveways.

   a. Concrete driveways shall be reinforced with 1.5 pounds per cubic yard of polypropylene fiber mesh and shall be constructed to the following minimum thicknesses.

      (1) Residential - 6 inches thick.

      (2) Commercial and Industrial - 7 inches thick.

B. Base Course.

1. Concrete sidewalk, steps and driveways shall be constructed on a compacted gravel base. The gravel base shall be base aggregate dense conforming to base aggregate dense 3/4-inch (sidewalk and steps) and base aggregate dense 1-1/4-inch (driveways) of Subsection 305.2.2 of the "State Specifications". The base shall be constructed to the following minimum thicknesses.

   a. Concrete sidewalk and steps (excluding 6 inch sidewalk at drives) - 2 inches thick.

   b. Concrete driveways (including 6 inch sidewalk at drives) - 6 inches thick.

C. Joints.

1. Joints shall be placed and constructed in accordance with Subsection 602.3.2.5 of the "State Specifications" and these Special Provisions.

2. Expansion Joints: Place one-half (1/2) inch expansion joints as directed below:

   a. Through sidewalks at uniform intervals of not more than 96 feet.

   b. At joints with intersecting sidewalks.

   c. Between sidewalk and/or driveway and back of curb and gutter. Construct the sidewalk or driveway grade 1/4 inch higher than the back of curb elevation where they meet.

   d. At the intersection of 4 inch sidewalk with (6 inch) drives.

   e. Place one inch expansion joints between sidewalk and buildings or other rigid structures.

3. Contraction Joints.

   a. Sidewalks.

      (1) Place contraction joints at a 5 foot typical spacing or as directed by the Engineer. Contraction joint spacings shall typically match adjacent sidewalk sections.

   b. Driveways.

      (1) Place contraction joints parallel to the curb line at a 6 foot maximum spacing.

      (2) Place contraction joints at right angles to the curb line at an 8 foot maximum spacing.

      (3) Center joints to create symmetrical sections.

   c. Industrial Driveways (Heavy Duty).

      (1) Place contraction joints parallel to the curb line at a 12 foot maximum spacing.

      (2) Place contraction joints at right angles to the curb line at a 15 foot maximum spacing.

(3) Center joints to create symmetrical sections.

D. Handicap Ramps.

1. Handicap curb ramps shall be constructed at locations shown on the Plans in accordance with details on the Plans. The Contractor must use a detectable warning field with truncated domes. See details in Appendix.

E. Opening to Traffic.

1. Pedestrian traffic shall not be allowed for a period of at least 3 days after placing concrete and vehicular traffic shall be excluded for a period of at least 7 days after placing or until the concrete has attained a compressive strength of at least 2,500 pounds per square inch.

1611.1. MANHOLE AND VALVE BOX ADJUSTMENTS

A. Manhole Adjustments (Existing Manholes).

1. The Contractor shall adjust existing precast manhole castings to grade by adding or removing concrete adjusting rings. After removing the manhole casting and rings, the Contractor shall clean the casting and manhole mating surfaces to remove all loose mortar and other substances. The Contractor shall take precautions to prevent gravel and other materials from entering the manhole. All materials falling into the manhole shall be removed by the Contractor. Manhole adjustments are shown on the Plans.

a. Concrete adjusting rings shall be furnished by the Contractor and shall match the dimensions of existing rings and/or manhole castings. Concrete rings shall be reinforced with one line of steel centered within the ring.

b. Adjusting rings and manhole frames shall be set with butyl rubber sealant troweled into a 1/4 inch thick layer over the entire surface areas of the top of cone and all adjusting rings. The butyl rubber sealant shall be EZ-Stik or Kent Seal butyl base sealant in trowelable grade or equal.

(1) Manhole frames and rings on storm sewers may be set with either butyl sealant or a bed of mortar.

c. The exposed exterior surface of sanitary manholes adjusted to grade shall be sealed with a minimum 1/4 inch thick coating of butyl rubber sealant.

2. The Contractor shall adjust existing castings on concrete block manholes to grade by adding or removing concrete adjusting rings, concrete brick, or concrete block as the case may be. After removing the manhole casting and adjusting devices, the Contractor shall clean the casting and manhole mating surfaces to remove all loose mortar and other substances. Should it be necessary to reach final grade, the Contractor shall remove the top four (4) inches of the top course of concrete block. This work shall result in a flat, smooth bearing surface to support the manhole casting.

   a. The Contractor shall take precautions to prevent gravel and other materials from entering the manhole. All materials falling into the manhole shall be removed by the Contractor. Manhole adjustments are shown on the Plans.

   b. Additional details of manhole adjustment shall be in accordance with 1.a, 1.b, and 1.c above.

3. New Subdivision Roads.

   a. Manhole castings on new Town roads shall be adjusted so that the manhole covers are set to 1/2″ below the top of the first layer of asphalt during the first year of construction. The Contactor shall install 2 inch adjustment rings in manhole frames during the second year of construction.

B. Manhole Adjustment/Reconstruction.

1. Precast Concrete Manholes: Manholes that cannot be brought to final grade by adding or removing adjusting rings shall be adjusted to grade in accordance with the following procedure:

   a. Remove casting, rings, cone section, and riser section(s) as required.

   b. Place new riser section(s) and/or cone section, 3″ to 18″ of concrete adjusting rings and reset casting to grade in accordance with Subsection 1611.1.A above. Salvaged materials in satisfactory condition may be reused if approved by the Engineer. A flat-top slab may be substituted for the cone section.

2. Concrete Block Manholes: Manholes that cannot be brought to final grade by the methods described in Section 1611.1.A.2 above shall be adjusted to grade in accordance with the following procedure:

   a. Remove casting, rings, bricks, and the concrete block cone section down to the top of the barrel section and remove all mortar. The

Contractor shall take precautions to prevent gravel, mortar, and other material from entering the manhole. All material falling into the manhole shall be removed by the Contractor.

b. Using solid concrete barrel block and mortar conforming to the requirements of Chapter 3.5.0 of the "Standard Specifications", extend the manhole barrel up to an elevation between 17 inches and 32 inches below finished grade. Install new manhole steps in alignment with existing steps and at existing intervals. Place concrete cover with opening, adjusting rings, and manhole casting in accordance with paragraphs 3, 3.a, 3.b, 3.c, and 3.d below.

3. All manhole adjustments shall be constructed in accordance with Chapter 3.5.0 and File Nos. 11, 12, and 15 of the "Standard Specifications" and these Special Provisions.

a. Manhole steps shall be OSHA approved and fabricated using 3/8" minimum diameter steel reinforcing rod with molded plastic covering.

b. Joints for precast manhole riser sections shall be made with rubber "O"-ring gaskets, a continuous ring of butyl rubber sealant (EZ-Stik or Kent-Seal in rope form) or equal except that joints for storm sewer manholes may also be made with mortar. The butyl sealant shall be 1 inch diameter equivalent or as recommended by the manhole manufacturer.

c. The entire outside surface of sanitary manhole chimneys, including all adjusting rings and overlapping both the manhole cone or flat-top slab (a minimum of 4 inches) and the manhole frame, shall be covered with a minimum 1/4 inch thick coating of butyl rubber sealant. The butyl rubber sealant shall be EZ-Stik or Kent-Seal butyl base sealant in trowelable grade or equal.

d. Revise Chapter 8.38.0 of the "Standard Specifications" to require that concrete brick and block shall be colored "red or pink", conforming to Subsection 519.2.2 of the "State Specifications".

C. Valve Box Adjustments.

1. The Contractor shall adjust valve boxes to grade by screwing or sliding the valve box top section to the required elevation.

D. Finished Grade.

1. Concrete Pavement.

a. The top of valve boxes and manhole castings shall be set to match the finished concrete grade.

2. Asphalt Pavement.

a. The top of valve boxes and manhole castings shall be set 1/4 inch below the finished asphaltic grade.

E. Protection of Projecting Structures.

1. The Contractor shall protect manholes and valve boxes projecting above the subbase or base material (prior to placement of base course and pavement) with barriers and flashing lights or (after the base course has been constructed) by temporarily placing base course material around the projecting structure.

F. Misaligned Structures.

1. The Contractor shall take precautions to protect all manhole frames and valve boxes from being damaged or moved out of alignment. The Contractor shall adjust all misaligned manhole frames and valve boxes, disturbed by his operations.

G. Valve and Valve Box Inspection.

1. Grading/Base Course Construction.

a. The road contractor, accompanied by the Engineer or his representative, shall inspect all valves and valve boxes, including hydrant valves, upon completion of grading work and base course construction. This inspection shall include removing all dirt and gravel from valve boxes and operating valves to insure that the valve nut is accessible and that the valve is operational.

2. Paving.

a. The paving contractor, accompanied by the Engineer or his representative, shall inspect and adjust to 1/4" below the pavement grade, all valves and valve boxes, including hydrant valves, prior to commencing paving operations. This inspection shall include removing all dirt and gravel from valve boxes and insuring that valve nuts are accessible.

1611.2. CATCH BASIN ADJUSTMENTS

A. Existing catch basins shall be adjusted, as required, to the required elevation by removing the castings and adjusting the top of the structure by removing or adding concrete, brick masonry or concrete brick or block masonry and resetting the casting on a bed of mortar.

1617. DELIVERY TICKETS

A. Delivery tickets shall be furnished by the Contractor for materials per weight or volume: i.e., base aggregate dense, asphaltic concrete pavement, tack coat, borrow excavation and topsoil. Scales are to be furnished by the Contractor and shall have been tested within the preceding 6 months to insure accuracy by an authorized testing firm. A copy of the test report shall be provided to the Engineer.

1625. TOPSOIL AND SALVAGED TOPSOIL

A. Topsoil and salvaged topsoil shall comply with Section 625 of the "State Specifications".

1. Topsoil and salvaged topsoil shall consist of materials as specified in Subsection 625.2.

B. Topsoil Stripping and Topsoil Stockpile.

1. Road Construction.

a. Strip all topsoil from beneath the traveled roadway to two (2) feet minimum beyond the back of curb and from all cut areas.

2. Subdivisions and Site Development.

a. Strip all topsoil from within the grading limits of the entire site, except as shown otherwise on the Plans or as specified below, as directed by the Engineer.

(1) Strip all topsoil from within street right-of-ways prior to beginning utility construction.

3. Stockpile an adequate amount of satisfactory topsoil for spreading over excavated lawn and terrace areas.

C. Placing Salvaged Topsoil.

1. Road Construction.

a. Place four (4) inches minimum of satisfactory salvaged topsoil or topsoil over all excavated terrace areas and blend with existing lawns.

(1) Topsoil shall be placed in accordance with Paragraph 625.3.3.

2. Subdivisions and Site Development.

a. Satisfactory salvaged topsoil or topsoil shall be placed and spread over the entire site grading area, including roadway terraces, to a uniform depth (4 inches minimum) as required to dispose of all salvaged topsoil.

(1) Topsoil shall be placed in accordance with Paragraph 625.3.3.

3. Excess salvaged topsoil shall be disposed of in accordance with Section 1205.5 of these Special Provisions.

4. Place unsatisfactory salvaged topsoil (containing stones or clay soils) over fill areas and cover with 4 inches minimum of suitable salvaged topsoil.

1630. LAWN RESTORATION

A. Lawn restoration shall include furnishing and placing fertilizer, seed, and mulch.

1. Furnishing, hauling, and placing topsoil, if an inadequate amount of salvaged topsoil has been stockpiled, shall be included in common excavation.

B. Fertilizer.

1. Fertilizer shall comply with Section 629 of the "State Specifications". Apply Type A fertilizer at 7 pounds per 1,000 square feet.

C. Seeding.

1. Seeding shall comply with Section 630 of the "State Specifications".

2. Lawn Type Turf.

a. Grass seed shall meet the requirements of Subsection 630.2.1.5.1.1.1 (Seed Mixture No. 40), except that seed shall be distributed at a rate of four (4) pounds per 1,000 square feet.

3. Rural Type Turf.

a. Grass seed placed in rural areas where lawn type turf is not required shall meet the requirements of Subsection 630.2.1.5.1.1.1 (Seed Mixture No. 10) of the "State Specifications", except that seed shall be distributed at a rate of three (3) pounds per 1,000 square feet.

4. The Contractor shall furnish all empty seed bags to the Owner.

D. Mulching.

1. Mulching shall comply with Section 627 of the "State Specifications". All seeded areas shall be mulched.

a. The Contractor may use either Method A, B or C of Subsection 627.3 when placing mulch.

E. Lawn Restoration Timetable.

1. Seeding may be done at any time during the growing season when soil conditions are suitable.

2. Weather permitting, lawn restoration shall be completed within 10 calendar days after topsoil has been placed.

3. All lawn restoration work shall be completed by October 1st of the same year or by May 15th of the following spring.

1631. SODDING

A. Sodding shall comply with Section 631 of the "State Specifications", as amended below.

B. Materials.

1. Sod shall consist of permanent grasses, indigenous to the general locality where it is to be used and practically free from weeds or undesirable grasses.

2. The Contractor shall submit a certificate to the Engineer before installation detailing the sod grass composition and place of origin.

3. Sod shall be cut in uniform strips approximately 18″ x 72″, be 3/4″ thick or more and have grass 2″ tall.

C. Areas to be sodded shall be covered with 4 inches minimum of topsoil or salvaged topsoil and fertilized in accordance with Section 1630 of these Special Provisions.

D. Sodded areas shall be constructed in accordance with Subsection 631.3 of the "State Specifications".

E. All sodded areas shall be kept thoroughly moist by watering or sprinkling, when rainfall is deficient, for a minimum period of ten days or until final project completion.

1632. FURNISHING AND PLANTING PLANT MATERIALS

A. General.

1. Furnishing and planting plant materials shall be in conformance with Section 632 of the "State Specifications".

B. Materials.

1. Plants.

a. Unless otherwise provided for or approved by the Engineer, all plant materials shall conform to the requirements of Subsection 632.2 of the "State Specifications and to the requirements specified herein. Plants shall include all trees, shrubs and vines as shown on the Plans and/or as specified herein.

C. Equipment.

1. The Contractor shall provide all equipment, labor and incidentals necessary to furnish, haul and place plant materials shown on the Plans.

2. The Contractor shall furnish watering equipment per Subsection 632.15 of the "State Specifications". Water will be available from the Owner at no cost to the Contractor.

D. Construction Methods.

1. Plants.

a. Plant construction methods shall conform to Subsection 632.3 of the "State Specifications".

b. Place wood mulch over all plants per the requirements of Subsection 632.3.9 of the "State Specifications".

E. Plant Establishment and Replacement.

1. The plant establishment period shall be a one year period. The establishment requirements shall conform to Subsection 632.3.18.1.3 of the "State Specifications".

2. Plant care and maintenance shall be per Subsection 632.3.19 of the "State Specifications".

3. Acceptance and replacement of plant material shall be per Subsection 632.3.20 of the "State Specifications".

1637. SIGNING

1637.1. END OF ROADWAY MARKER

A. End of roadway markers shall be Type II Signs conforming to Section 637 of the "State Specifications" and the details on the Plans.

B. Markers shall consist of nine 3-inch diameter red retroflectors mounted symmetrically on an 18-inch diamond shaped solid red retroflective panel. The marker shall be at least 4 feet above the edge of pavement.

1637.2. SIGNS

A. Signs shall consist of furnishing and installing signs and supports in accordance with Section 637 of the "State Specifications" and as shown on the Plans. Installation shall consist of attaching all signs to new or existing supports at the required locations as shown on the Plans and as directed by the Engineer. All hardware required for sign installation shall be supplied by the Contractor and conform to Section 637 of the "State Specifications", and shall be approved by the Owner prior to installation.

1. Sign base material may be either sheet aluminum or wood.

B. Mounting.

1. All signs shall be mounted on wood posts supports or other approved supports by the Owner conforming to Section 634 and as shown on the Plans.

C. Hardware.

1. All hardware for all sign installation shall be mounted to the support in a manner to prevent rotation of the sign. Backbraces shall be mounted to the sign to provide adequate support at the top and bottom of the sign to prevent bending. All hardware for signs shall be mounted to the sign by use of rivets, bolts, etc. as approved by the Owner and the Engineer.

1638. REMOVING SIGNS

A. This work shall consist of removing existing signs and hardware from poles as shown on the Plans or directed by the Engineer. Work also includes removal of sign posts as noted on the Plans and filling of post hole with concrete to restore area. Sign removal shall be in accordance with the requirements of Subsections 638.3.4, 638.3.5, and 638.3.6 of the "State Specifications". All proposed signing for each intersection approach shall be in place and functional prior to any sign removal along the pertaining route. All removed signs shall be salvaged and delivered to a location as directed by the Owner.

B. The existing sign layout sheets indicate the existing signing at the time of this proposal, and may not represent the actual conditions at time of construction.

1638.1. REMOVE AND RELOCATE SIGNS

A. This work shall consist of removing and relocating existing signs, hardware, and posts as shown on the Plans or as directed by the Engineer. Sign removal shall be in accordance with the requirements of Section 1638 of these Special Provisions.

B. All removed signs, hardware, and posts shall be relocated to a location as directed by the Engineer. Relocation shall include installation of sign, hardware, and posts at a new location. The sign is to be installed to the height as shown in the details on the Plans. Any damage caused to the signs, hardware, or posts shall be repaired or replaced at the Contractor's expense.

1646. PAVEMENT MARKING

A. Pavement marking shall be in accordance with Section 646 of the "State Specifications" and the details shown on the Plans.

B. Material.

1. Pavement marking material shall be epoxy conforming to Subsection 646.2.4.

2. Glass beads shall be applied with the paint.

1646.1. REMOVING PAVEMENT MARKINGS

A. Removing pavement markings shall be in accordance with Section 646.3.4 of the "State Specifications" and the details shown on the Plans.

1647. PAVEMENT MARKING, PARKING STALL

A. Pavement marking for parking stalls shall be in accordance with Section 647 of the "State Specifications", as amended herein.

B. Material.

1. Pavement marking material shall be white paint conforming to Subsection 646.2.2 of the "State Specifications". Paint shall be applied in 4 inch wide stripes.

2. Glass beads are not required.

APPENDIX

APPENDIX TABLE OF CONTENTS

2000. DESIGN GUIDELINES - NEW RESIDENTIAL SUBDIVISIONS

A. Street Width.

1. Typical residential minor street is 36 feet face-to-face of curb.

2. Typical residential collector street is 48 feet face-to-face of curb.

B. Curb and Gutter.

1. Use Town standard 30 inch vertical face type curb and gutter section.

C. Sidewalks.

1. Construct sidewalks in new subdivisions on one side of the street only (if required).

D. Residential Pavement Section.

1. 10″ base aggregate dense (2 lifts).

2. 5″ asphaltic concrete pavement, Type E-0.3 (3-1/2″ binder - 1-1/2″ surface).

E. Utility Locations.

1. Place sanitary sewer on street centerline.

2. Place water mains 8 feet north and east of centerline.

3. Place storm sewers 8 feet south and west of centerline.

4. Water Valves.

a. Place valves at intersecting right-of-way lines at street intersections and 5 feet off hydrants at midblock.

5. Hydrants.

a. Place 3 feet back of curb with auxiliary valve connected directly to the anchoring tee.

b. Locate hydrants in cul-de-sacs on a lot line (not at the far end or back of the cul-de-sac) to provide room for snow storage at the back of the cul-de-sac.

6. Sanitary Sewer Laterals, Sump Pump Laterals, and Water Services:

a. End sanitary sewer and sump pump laterals at the right-of-way line.

b. End water services at the curb box one foot inside the right-of-way line.

F. Storm Sewer Sizing.

1. Design storm sewers to handle the 10 year recurrence interval storm.

G. Detention/Retention Ponds.

1. Detention/retention ponds shall be sized to store runoff from a 100-year storm under developed conditions while discharging at a rate equal to the runoff from a 10-year storm under pre-developed conditions. In addition, the outlet shall be restricted to retain runoff from low flows using a weir or other similar device.

H. New Subdivision Construction Schedule.

1. First Year of Construction.

a. Place the base aggregate dense, install curb/gutter and sidewalk (if required) and place the first layer of asphalt (by November 1st) the year that utility and road improvements are constructed.

b. Adjust manhole covers and valve boxes to 1/4″ below the top of the first layer of asphalt.

c. Adjust catch basins to final grade except catch basins located at low point shall be placed 2 inches low.

3. Second Year of Construction.

a. Place the final layer of asphalt (by October 15th).

b. Install 1-1/2 inch adjustment rings in manholes and adjust valve boxes to 1/4″ below final grade.

c. Adjust catch basins located at low points to final grade.

I. Utility Trench Backfill.

1. Granular Backfill.

a. Use granular backfill within existing or proposed paved or graveled areas.

b. If approved, excavated granular materials (including sand) may be used as granular backfill.

2. Excavated Material Backfill.

a. Utility trenches, may be backfilled with excavated material backfill outside of existing or proposed paved or graveled areas.

J. Maximum Grading Slope.

1. The maximum slope of all excavations, including ditches and temporary earth stockpiles, shall be 4:1.

K. Gravel Surfaces Prohibited.

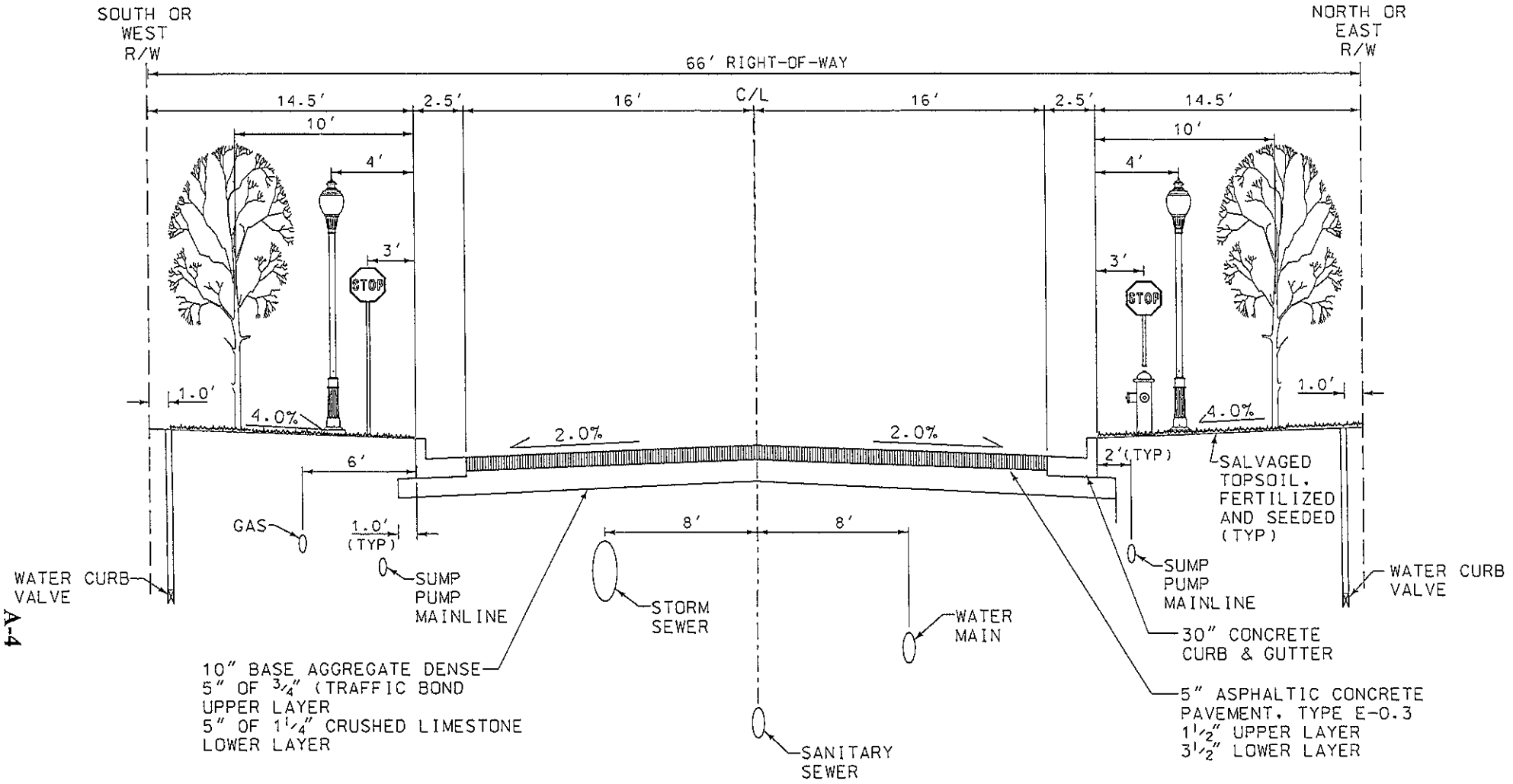
1. All new or reconstructed roads, driveways, parking areas, etc., shall have either an asphaltic or concrete surface.

L. Snow Storage Easement.

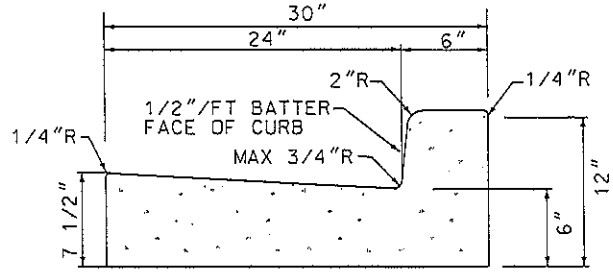
1. Provide snow storage easement(s) on cul-de-sacs.

M. Sewage Lift Station.

1. Use wet well-dry well type only.



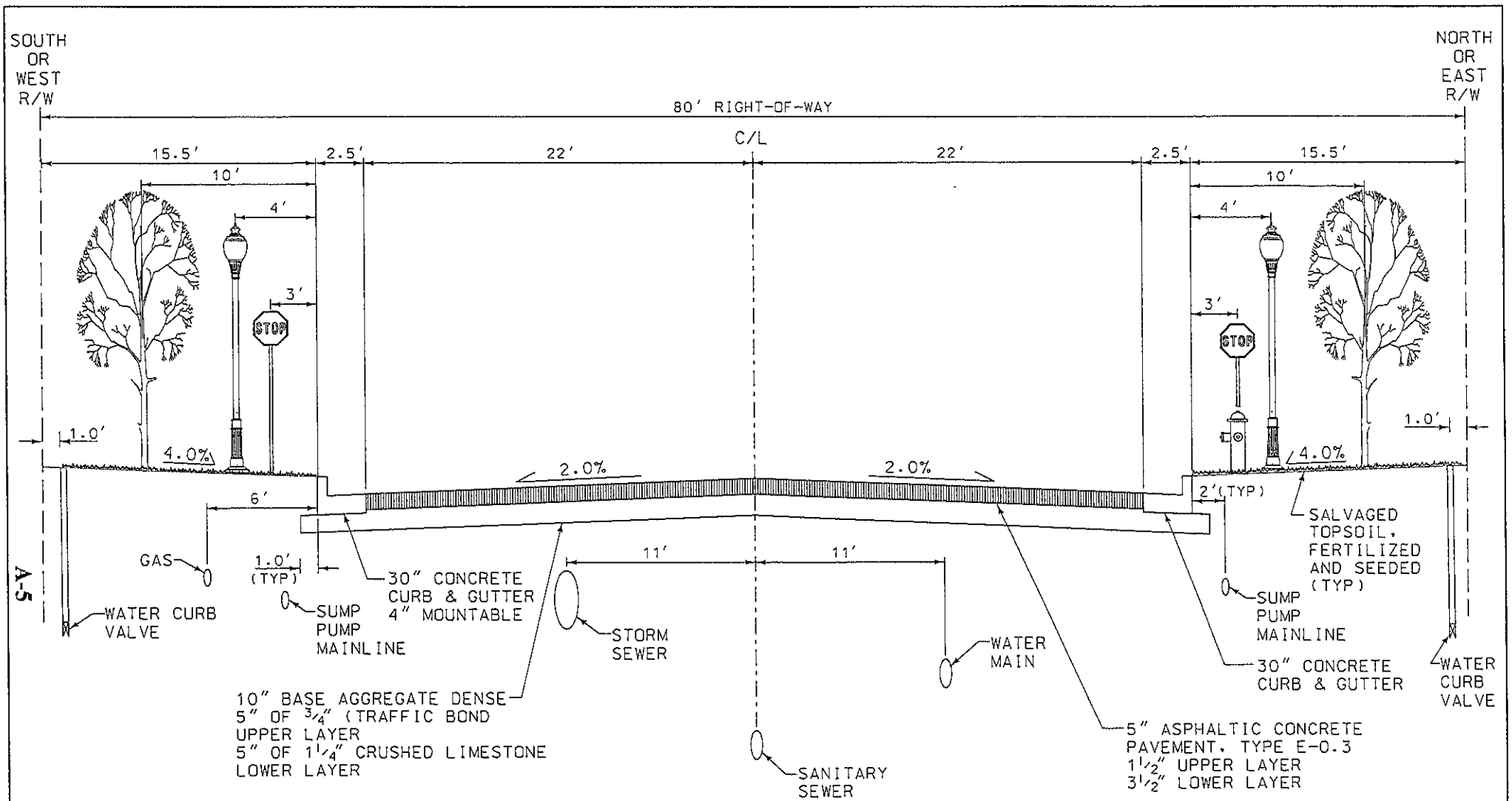
A-4



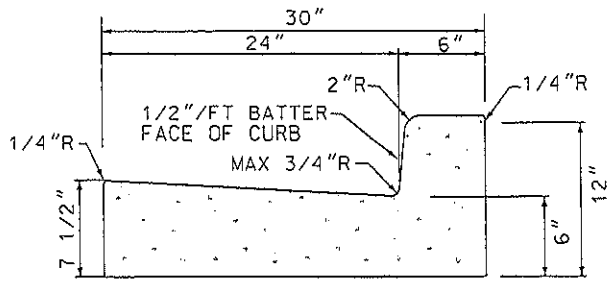
30" CONCRETE CURB & GUTTER, TYPE D

NOTE:
UNDERGROUND ELECTRIC, TELEPHONE AND CABLE ARE TO BE LOCATED ALONG THE BACK PROPERTY LINES.

FIGURE 15
TOWN OF SOMERS
MINOR STREET
TYPICAL ROAD SECTION

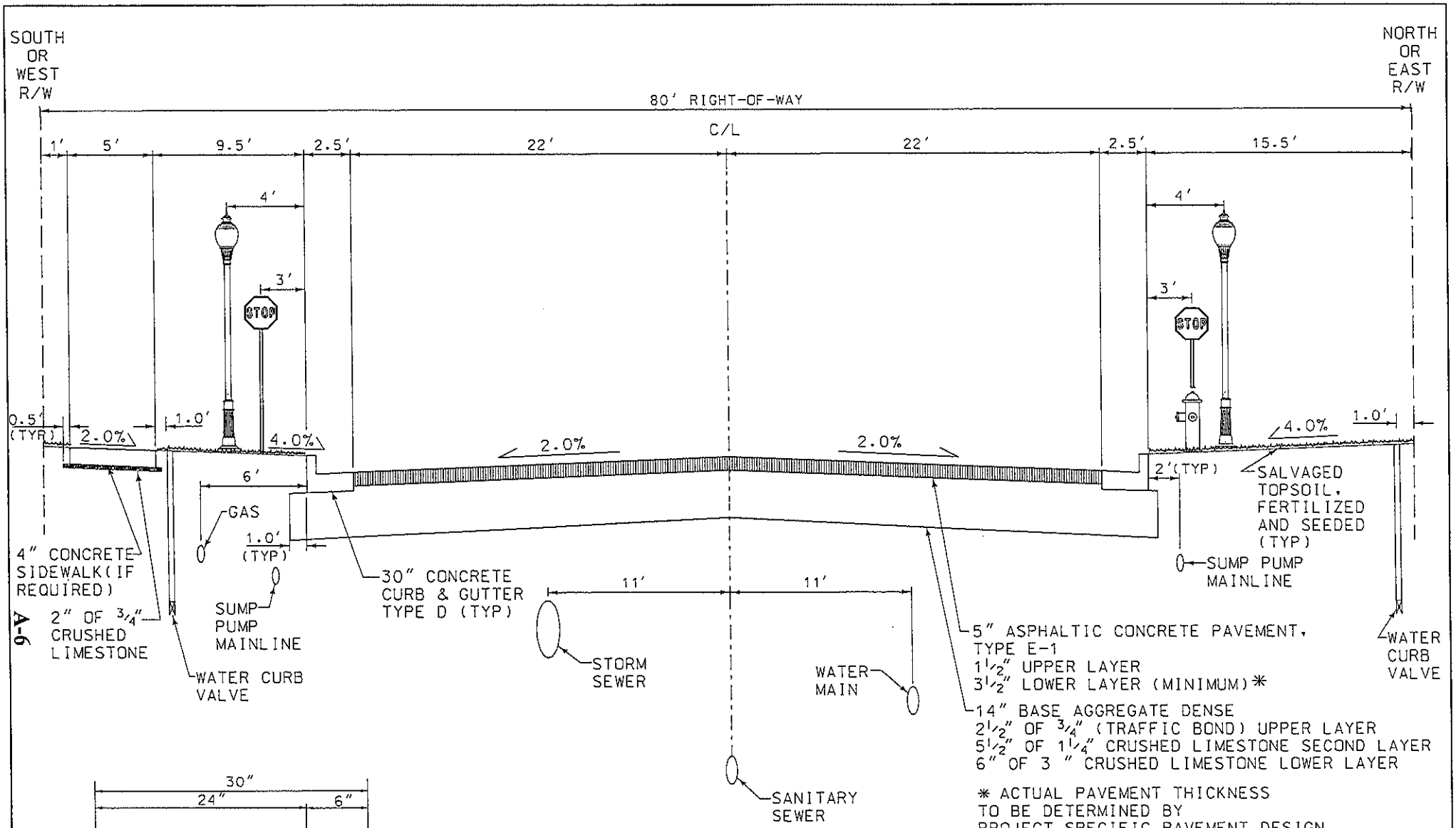


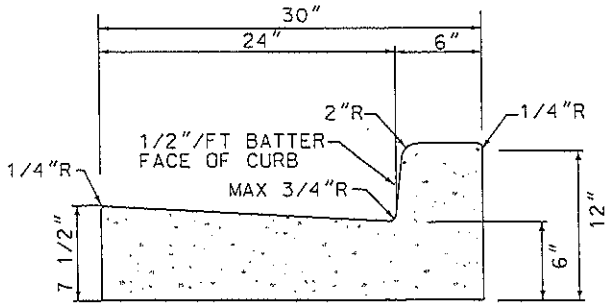
NOTE:
UNDERGROUND ELECTRIC, TELEPHONE AND CABLE ARE TO BE LOCATED ALONG THE BACK PROPERTY LINES.



30" CONCRETE CURB & GUTTER, TYPE D

FIGURE 16
TOWN OF SOMERS
RESIDENTIAL COLLECTOR
TYPICAL ROAD SECTION

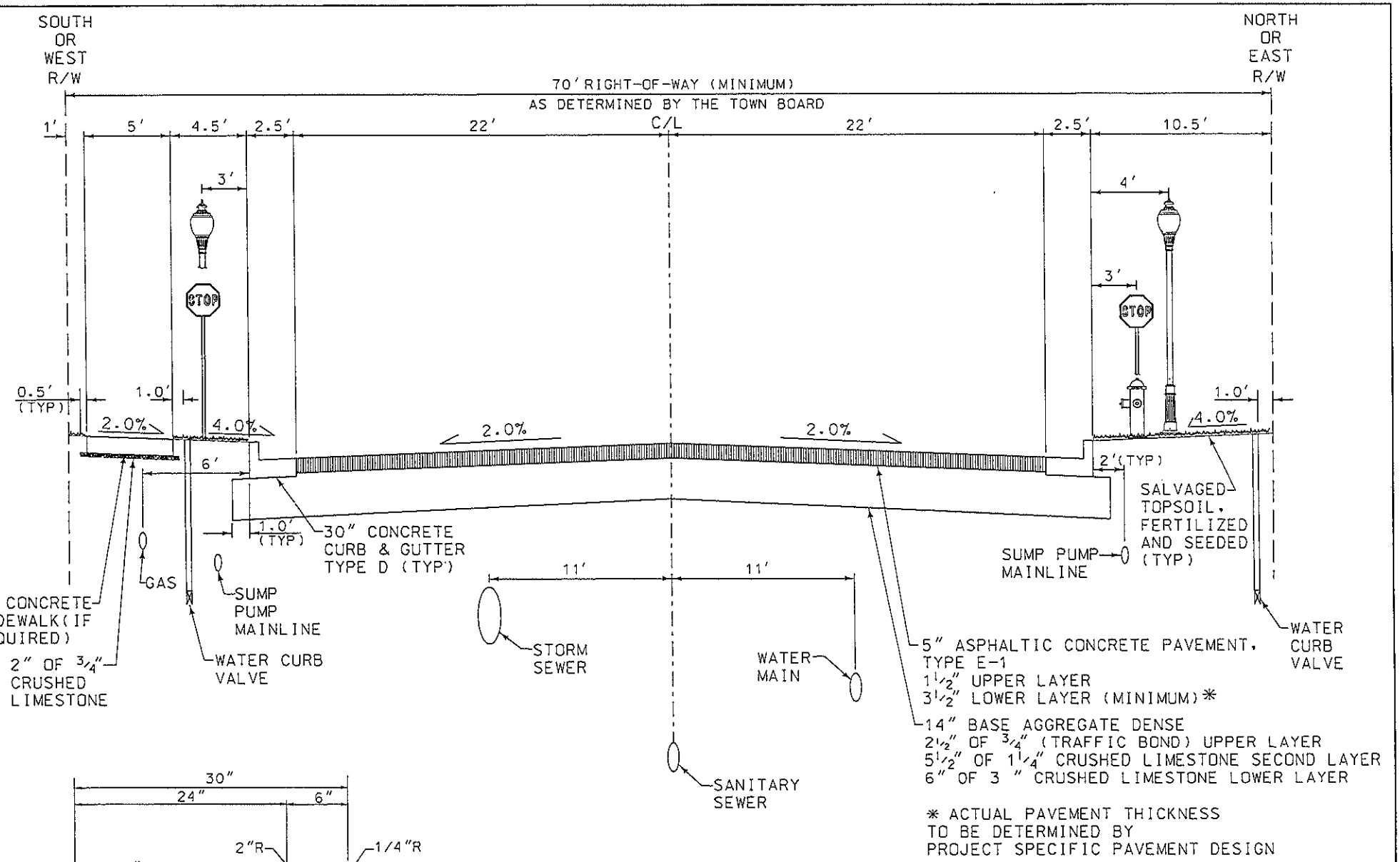


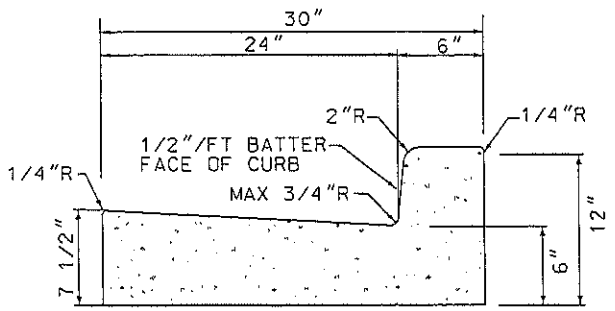


30" CONCRETE CURB & GUTTER, TYPE D

NOTE:
UNDERGROUND ELECTRIC, TELEPHONE AND CABLE ARE TO BE LOCATED ALONG THE BACK PROPERTY LINES.

FIGURE 17
TOWN OF SOMERS
COMMERCIAL COLLECTOR
TYPICAL ROAD SECTION





30" CONCRETE CURB & GUTTER, TYPE D

NOTE:
UNDERGROUND ELECTRIC, TELEPHONE AND CABLE ARE TO BE LOCATED ALONG THE BACK PROPERTY LINES.

FIGURE 18
TOWN OF SOMERS
INDUSTRIAL ROAD
TYPICAL ROAD SECTION

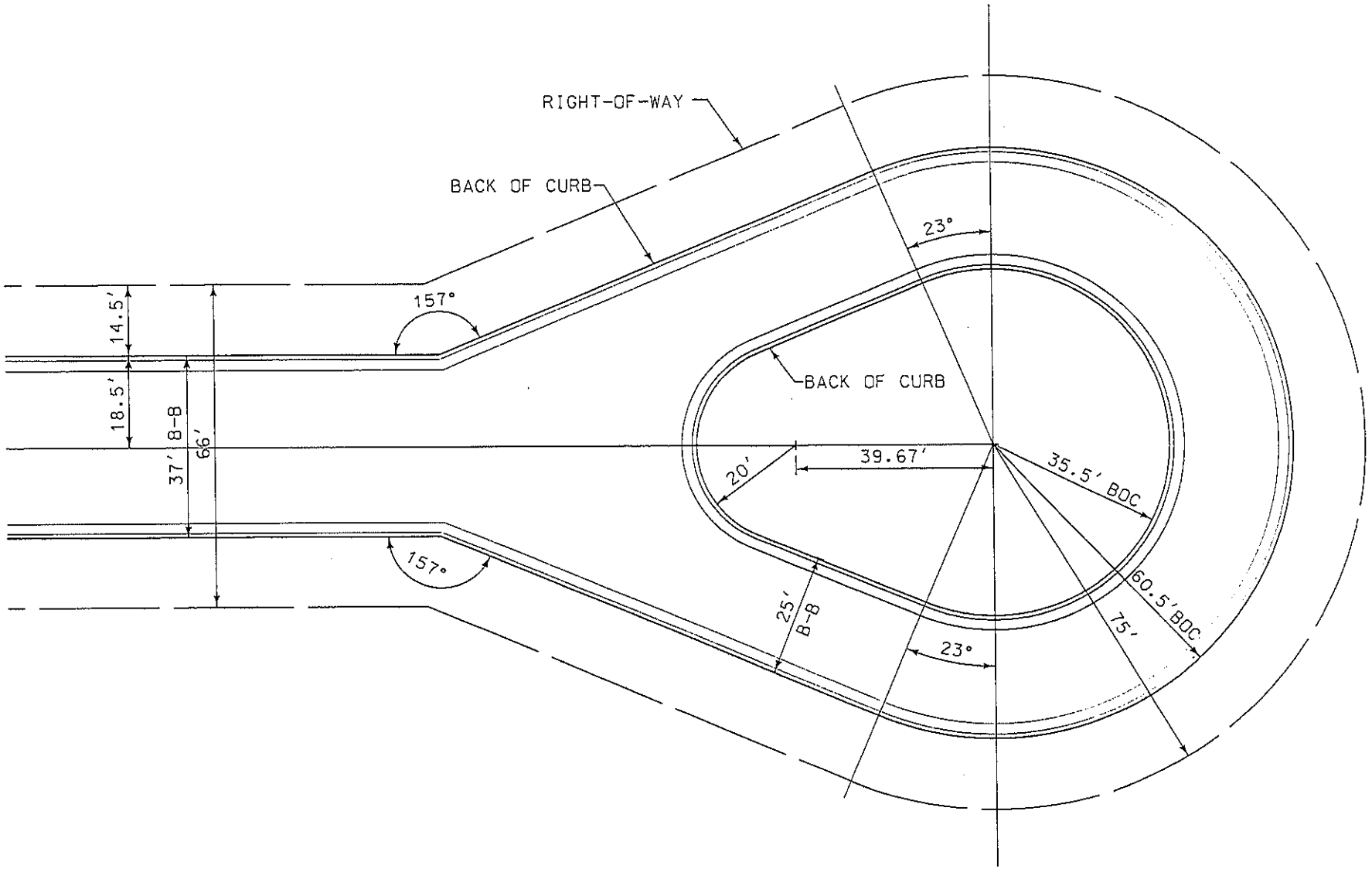
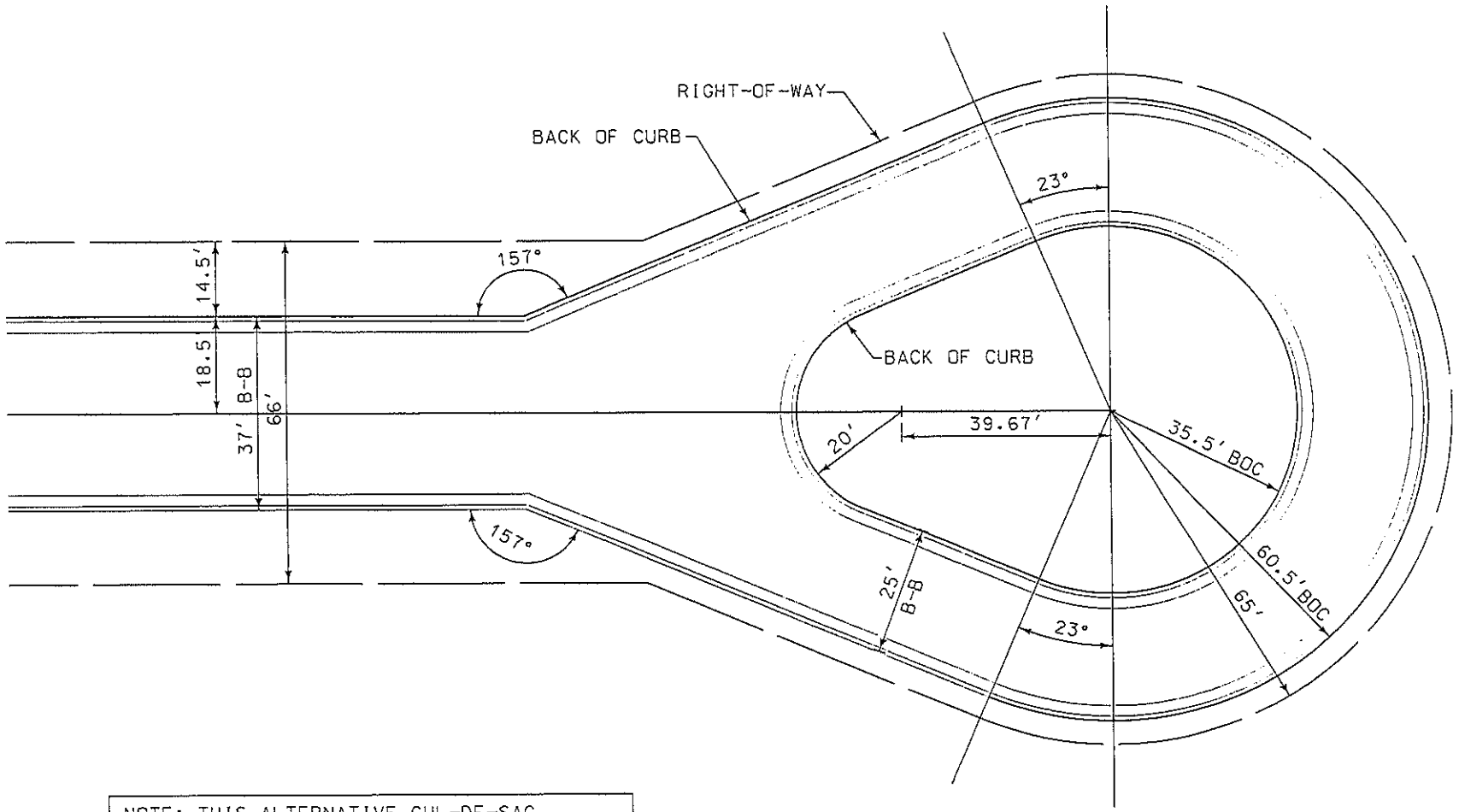
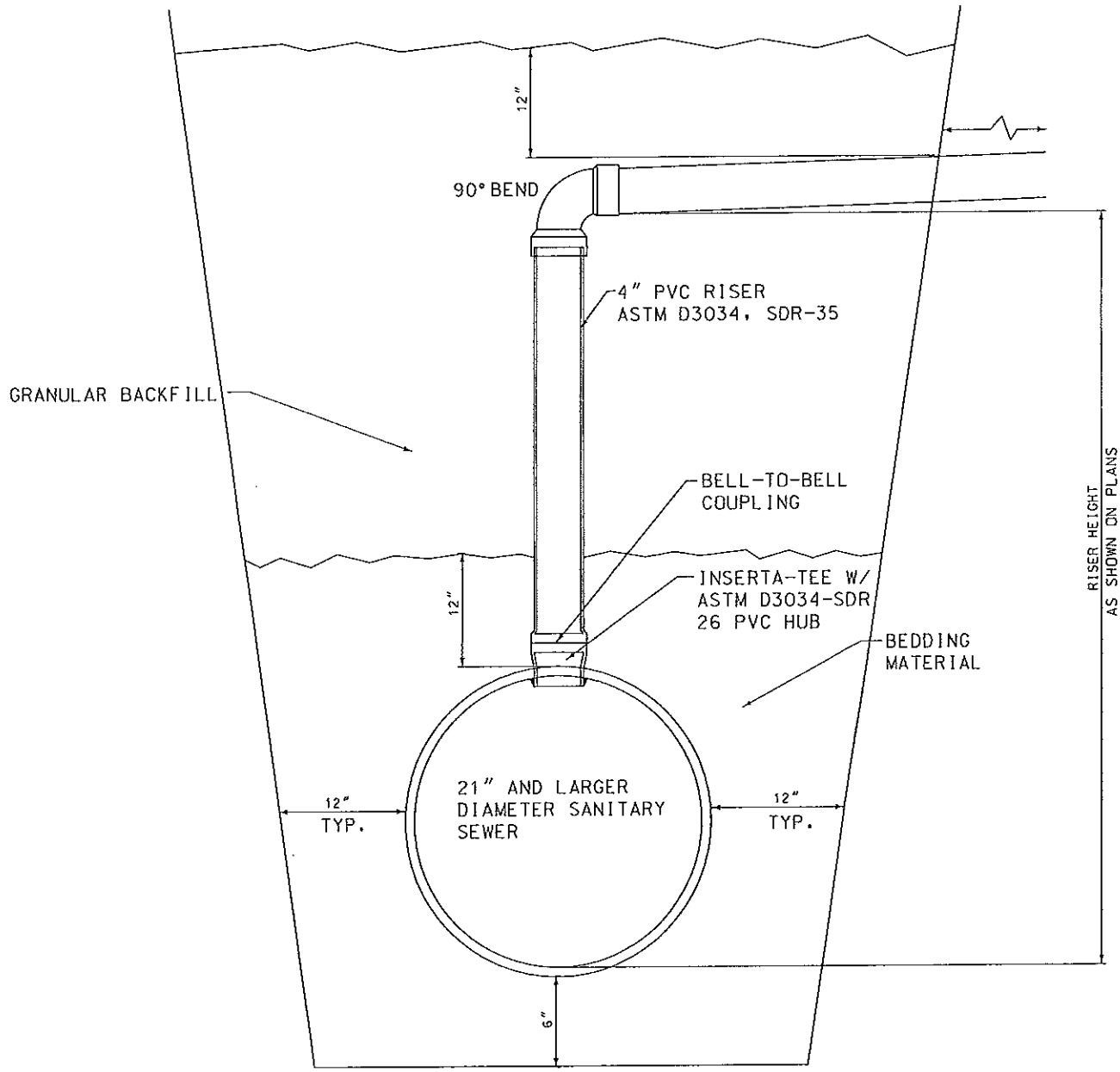


FIGURE 19
TOWN OF SOMERS
STANDARD CUL-DE-SAC



NOTE: THIS ALTERNATIVE CUL-DE-SAC MAY ONLY BE USED FOR AREAS WITHIN THE TOWN LOCATED EAST OF THE CNWRR AND NORTH OF 18TH STREET PER TOWN ORDINANCE 4-05.

FIGURE 20
TOWN OF SOMERS
ALTERNATIVE CUL-DE-SAC



FLEXIBLE RISER TO FLEXIBLE SEWER MAIN
21" AND LARGER SHALLOW SEWERS

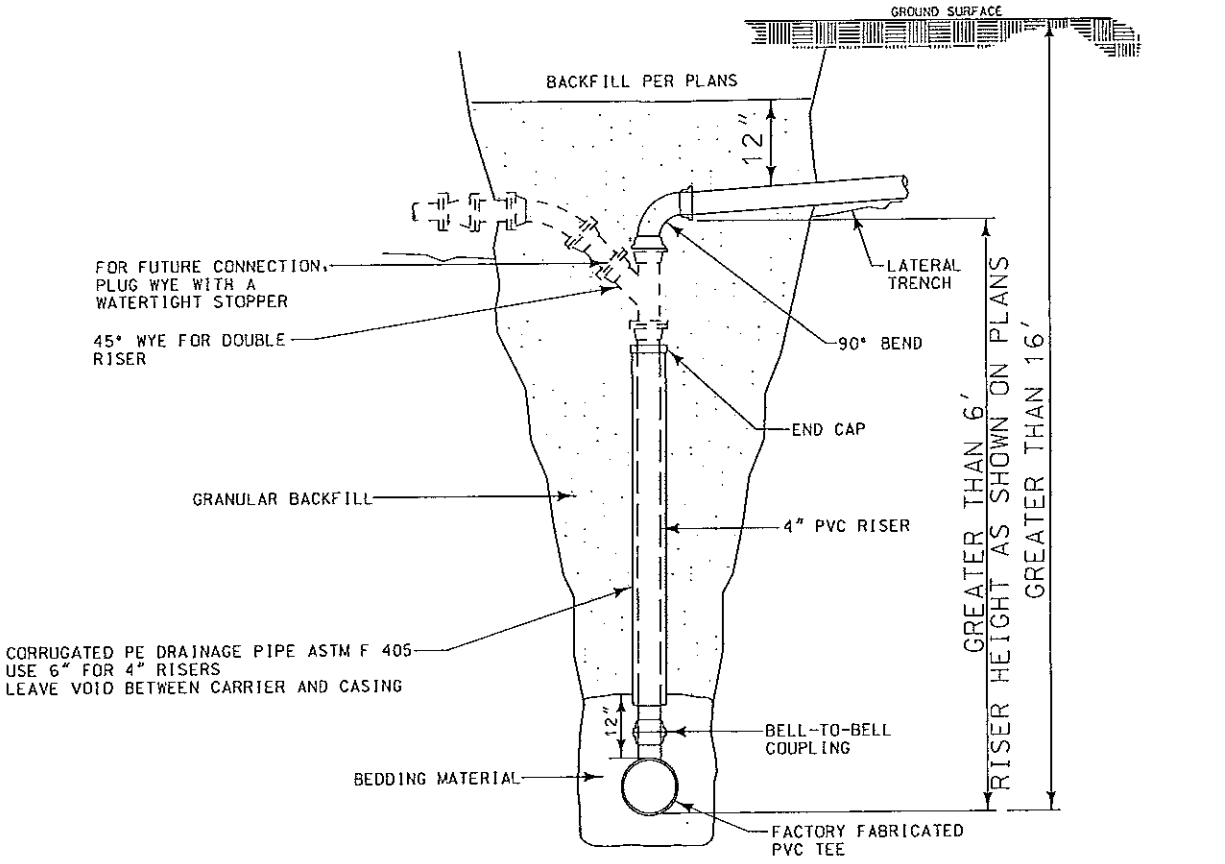
TOWN OF SOMERS	R05-0020-000

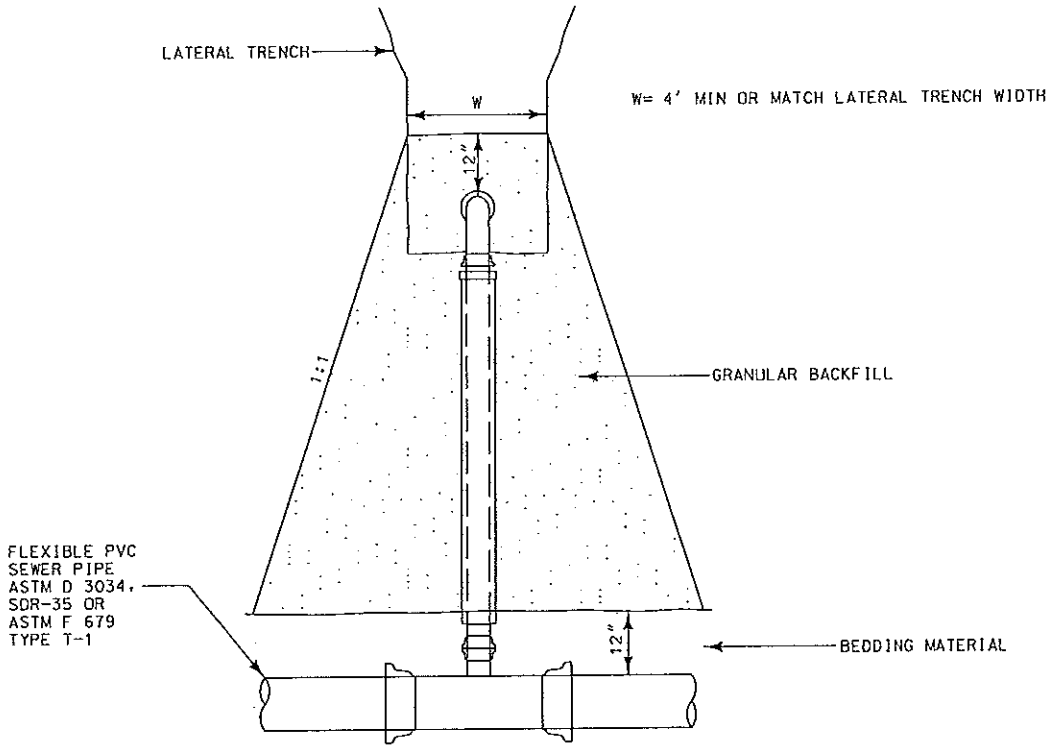
CRISPELL-SNYDER, INC.
PROFESSIONAL CONSULTANTS
Lake Geneva (262)348-5500 Madison (608)244-6277 Milwaukee Regional (262)250-8000
Racine (262)554-8530 Fox Valley (715)752-4620

A-10

LOCATION:	TOWN OF SOMERS
	KENOSHA COUNTY, WISCONSIN
SCALE: NONE	DATE: OCTOBER,2006
DRAWN BY:	C. ELVIN

REVISION/PLOT DA DetailShallowRiser.dgn 10-24-06 C.E.





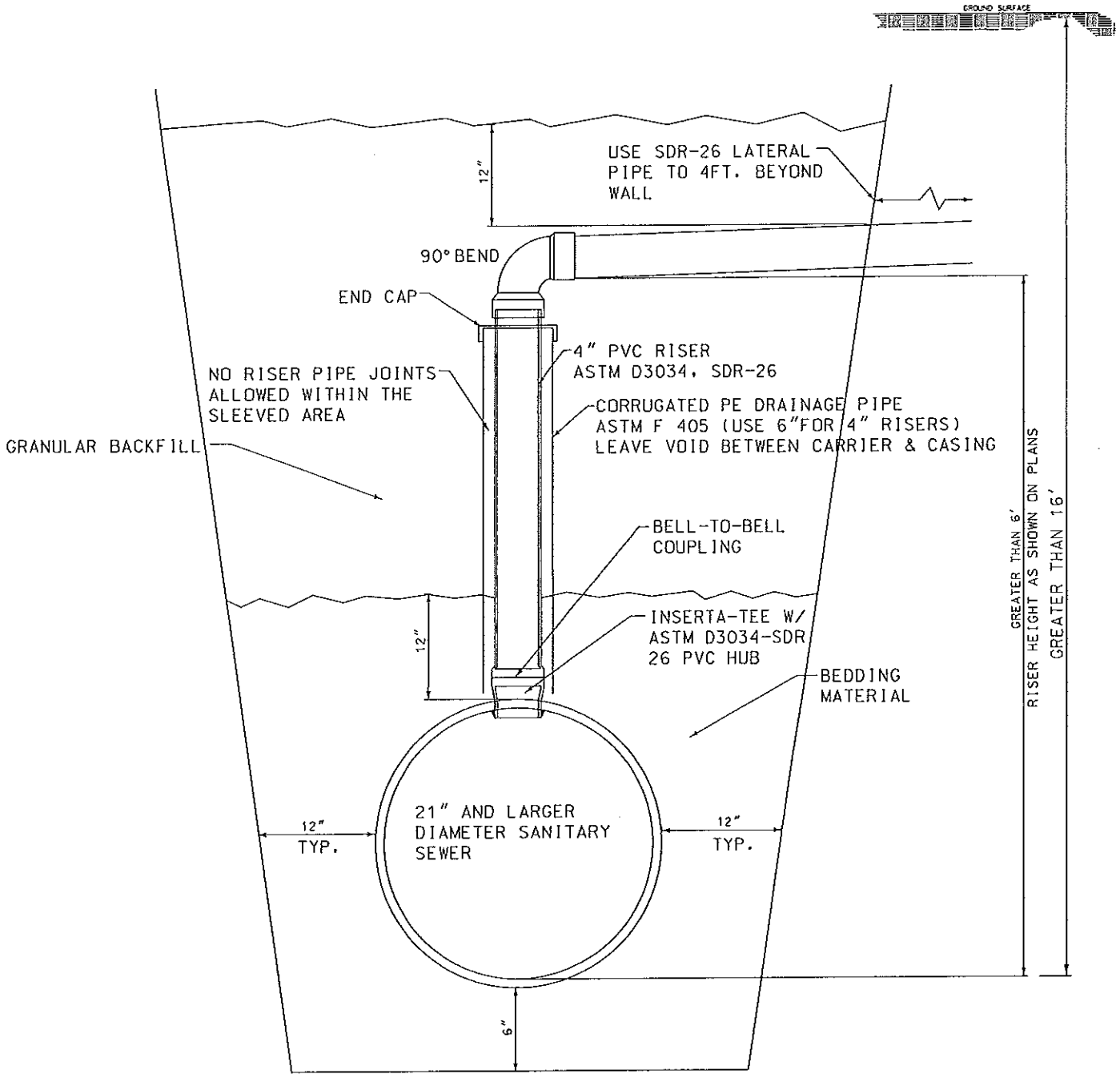
FLEXIBLE RISER TO FLEXIBLE SEWER MAIN
8" THROUGH 18" DEEP SEWERS

TOWN OF SOMERS	R05-0020-000

CRISPELL-SNYDER, INC.
PROFESSIONAL CONSULTANTS
Lake Geneva (262)348-5500 Madison (608)244-5277 Milwaukee Regional (262)250-8000
Racine (262)554-8530 Fox Valley (715)752-4520

A-11

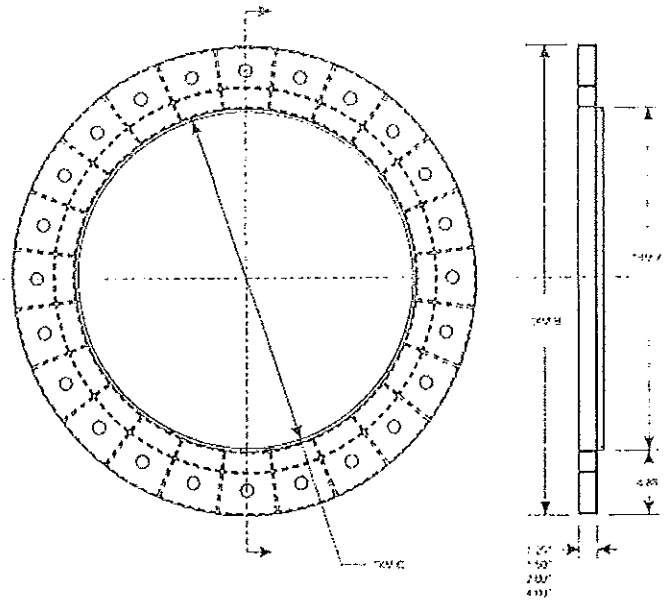
LOCATION: TOWN OF SOMERS
KENOSHA COUNTY, WI
SCALE: NONE DATE: OCTOBER,2006
DRAWN BY: C. ELVIN



FLEXIBLE RISER TO FLEXIBLE SEWER MAIN
21" AND LARGER DEEP SEWERS

TOWN OF SOMERS	R05-0020-000
CRISPELL-SNYDER, INC. PROFESSIONAL CONSULTANTS	LOCATION: TOWN OF SOMERS
Lake Geneva (262)348-5600 Madison (608)241-6277 Milwaukee Regional (262)250-8000 Racine (262)554-8530 Fox Valley (715)752-4620	KENOSHA COUNTY, WISCONSIN
A-12	SCALE: NONE DATE: OCTOBER, 2006
	DRAWN BY: C. ELVIN

REVISION/PLOT D: 10-26-06 C.E. DETAILDETRISER.DGN



DESCRIPTION-

PLASTIC INJECTION MOLDED ADJUSTING RING

MOLDED FROM HIGH DENSITY POLYETHYLENE AS DEFINED IN ASTM SPECIFICATION D1248-84

ACTUAL RESIN PROPERTIES WLL VARY ALLOWING FOR THE UTILIZATION OF 100% REGRIND MATERIAL

THE PERCENT OF POST CONSUMER WASTE TO INDUSTRIAL WASTE WLL VARY WTH AVAILABIUTY AND PROPERTY RETENTION NEEDS

COLOR, SHADE, AND UNIFORMITY WLL VARY WTH THE MIX OF THE POST CONSUMER AND INDUSTRIAL WASTE MATERIALS

DIMENSIONS SHOWN ARE NOMINAL - ACTUAL SIZE WILL VARY WTHIN ALLOWABLE TOLERANCE AND REQUIRED FIT

DIMENSION SCHEDULE

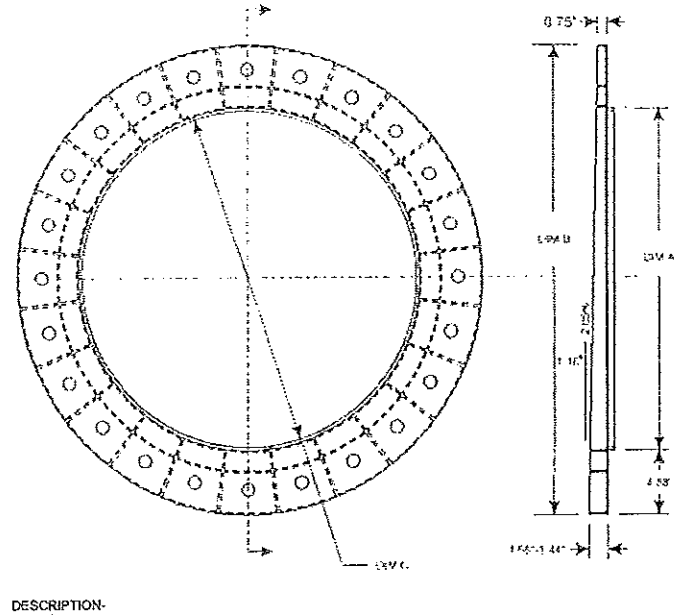
CONE SIZE	DIM A	DIM B	DIM C
24"	23.75"	33.50"	23.25"
27"	26.75"	36.50"	26.25"
30"	29.75"	39.50"	29.25"
36"	35.75"	45.50"	35.25"

DIMENSION SCHEDULE

CONE SIZE	DIM A (mm)	DIM B (mm)	DIM C (mm)
610mm	603.3	850.9	590.6
686mm	679.5	927.1	666.8
762mm	755.7	1003.3	743.0
914mm	908.1	1155.7	895.4

POLYETHYLENE MANHOLE ADJUSTMENT RING

FLAT DESIGN



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914mm	908.1	1155.7	895.4

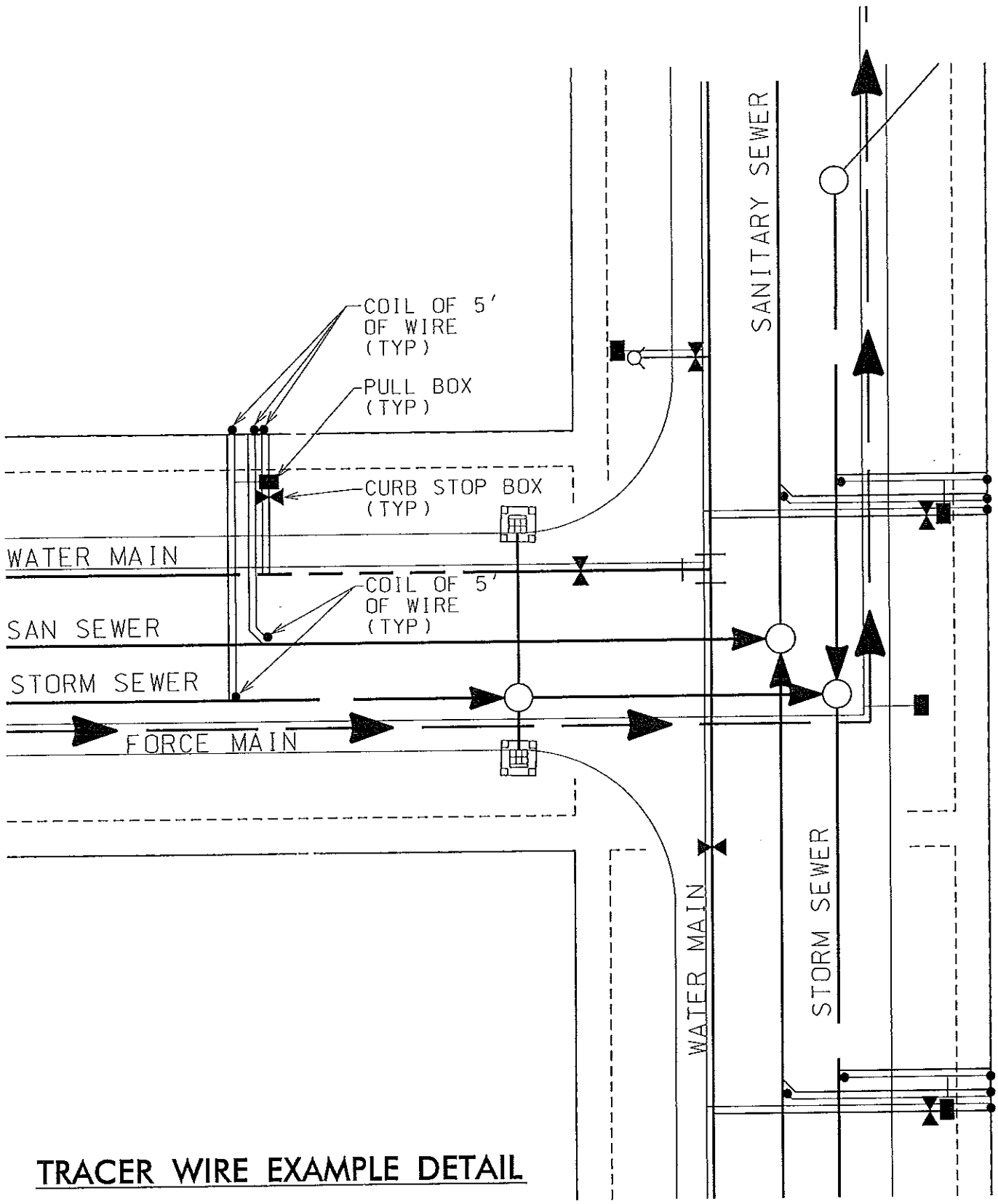
POLYETHYLENE MANHOLE ADJUSTMENT RING

WEDGE DESIGN

POLYETHYLENE MANHOLE ADJUSTING RINGS INSTALLATION INSTRUCTIONS

1. Clean the concrete cone or top slab with a whisk broom or chisel to obtain a flat seating surface, eliminating all rocks, gravel, blacktop, protruding concrete or frozen debris.
2. Apply an approved sealant to the first HDPE ring. Place the sealant 360 degrees on the flat side of the ring, as close as possible to the male lip. (A second application of sealant can be applied between the first sealant and the holes, helping the first ring to seat level if surface irregularities are present.)
3. Place the ring male hp down, inside the cone or top slab opening. ***
4. Place sealant around the second ring on the flat side, as close to the male lip as possible, being careful to cover the entire 360 degrees of the ring. Install the second ring on top of the first, compressing the sealant by standing on the rings.
5. Continue step 4 using 4", *r,* 1-1 /2", 1-1 /4', and 3/4' x 1-1 /2" sloped rings as required for each manhole to obtain a height difference of 1/4' of grade, after the casting is installed.
6. Prior to placing the casting, install an approved sealant to the top of the last ring so the sealant is between the casting and the flat portion of the top ring (all 360 degrees).
7. When directed by the engineer, wrap filter fabric around the top 1 to 2 inches of the concrete cone, the entire height of the rings, and the casting flange. Overlap the flange approximately 4 to 6 inches, (usually an 18" width of fabric is sufficient). Place dirt around fabric as necessary to hold in place.

*** If the cone or top slab is eccentric, and does not allow the ring to seat flush, use a wood saw to cut a portion (usually 90 - 120 degrees is sufficient) of the male lip off until the ring can sit flush on the concrete.



TRACER WIRE EXAMPLE DETAIL

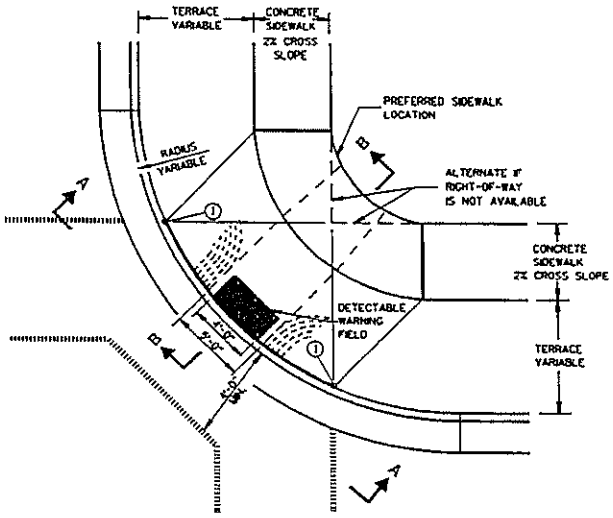
REVISION/PLOT DA Detail\TracerWireExample.dgn 10-24-06 c.e.

TOWN OF SOMERS	R05-0020-000

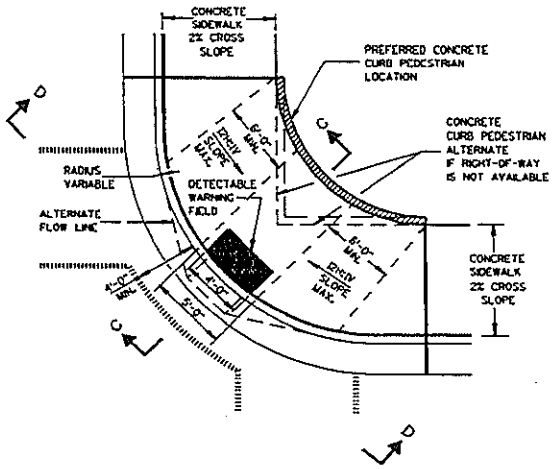
CRISPELL-SNYDER, INC.
PROFESSIONAL CONSULTANTS
Lake Geneva (262)348-5500 Madison (608)244-6277 Milwaukee Regional (262)250-8000
Racine (262)554-8530 Fox Valley (715)752-4620

A-14

LOCATION: TOWN OF SOMERS	
KENOSHA COUNTY, WI	
SCALE: NONE	DATE: OCTOBER,2006
DRAWN BY: C. ELVIN	



PLAN VIEW
TYPE 1 RAMP
(CENTER OF CORNER RADIUS)



PLAN VIEW
TYPE 1-A RAMP
(NO TERRACE)

GENERAL NOTES

DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

RAMPS SHALL BE BUILT AT 12H:1V OR FLATTER, WHEN NECESSARY. THE SIDEWALK ELEVATION MAY BE LOWERED TO MEET THE HIGH POINT ON THE RAMP.

TYPE 1 RAMPS SHALL HAVE A NORMAL SIDEWALK APRON AND CURB ON BOTH SIDES OF RAMP.

DETECTABLE WARNING FIELD SHALL BE MEASURED AND PAID BY THE SQUARE FOOT AS "CURB RAMP DETECTABLE WARNING FIELD". THE CONCRETE PEDESTRIAN CURB, IF NEEDED, SHALL BE MEASURED AND PAID BY THE LINEAL FOOT AS "CONCRETE CURB PEDESTRIAN". CONCRETE SIDEWALK IN THE CURB RAMP AREA SHALL BE MEASURED AND PAID BY THE SQUARE FOOT AS CONCRETE SIDEWALK, INCLUDING THE AREA UNDER THE DETECTABLE WARNING FIELD.

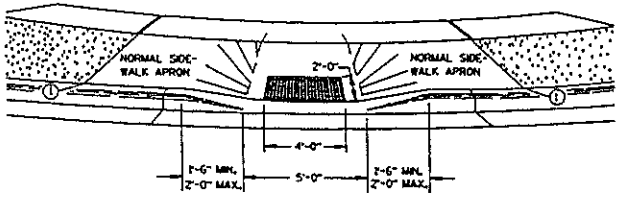
SELECT CURB RAMP DETECTABLE WARNING FIELD MATERIALS AND DEVICES FROM THE DEPARTMENT'S APPROVED MATERIALS LIST. THE COLOR OF THE DETECTABLE WARNING FIELD IS SPECIFIED ELSEWHERE AND IS INCIDENTAL TO THE BID ITEM OF "CURB RAMP DETECTABLE WARNING FIELD".

SURFACE TEXTURE OF THE RAMP SHALL BE OBTAINED BY COARSE BROOMING TRANSVERSE TO THE SLOPE OF THE RAMP.

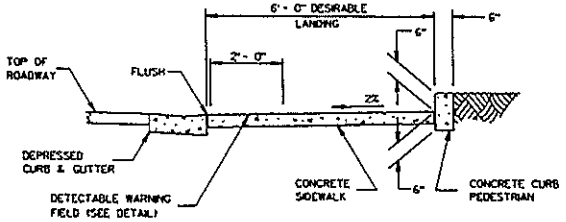
① THIS POINT IS AN EXTENSION OF OUTSIDE EDGE OF APPROACHING SIDEWALK WHERE IT MEETS THE BACK OF CONCRETE CURB.

② GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 11%. PROVIDE DRAINAGE AWAY FROM CURB RAMP AT GUTTER FLAG INTERFACE.

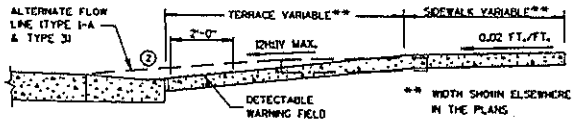
LEGEND
- ½" EXPANSION JOINT-SIDEWALK
- CONTRACTION JOINT FIELD LOCATED
- PAVEMENT MARKING CROSSWALK (WHITE)
- ALTERNATIVE LAYOUT



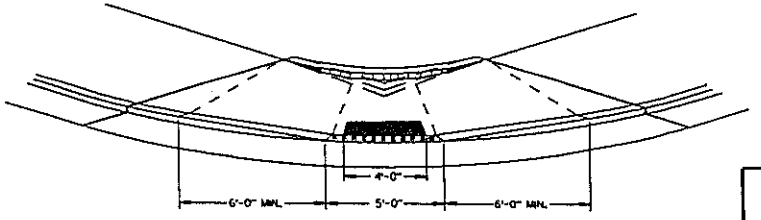
VIEW A-A



SECTION C-C



SECTION B-B



VIEW D-D

CURB RAMPS
TYPES 1 AND 1-A

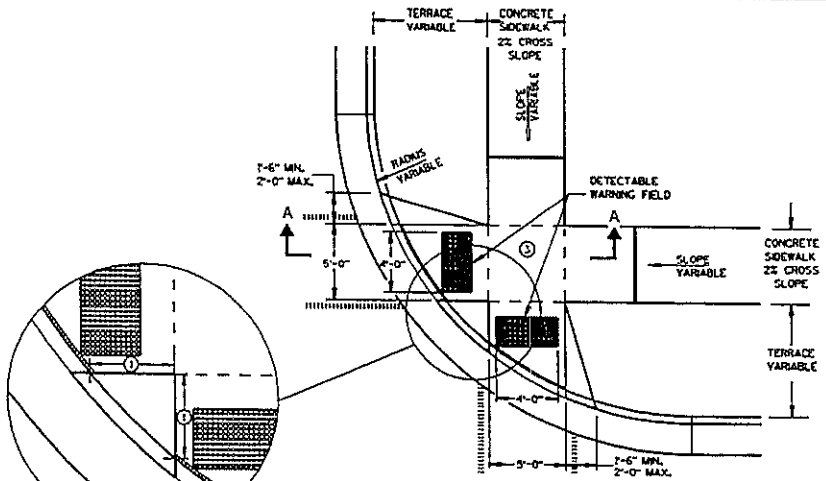
STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

A-15 | 6

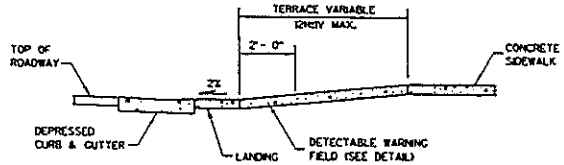
6

S.D.D. 8 D 5-11a

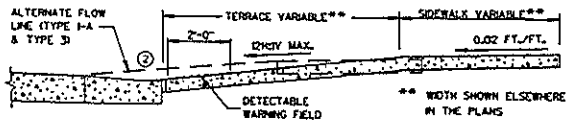
S.D.D. 8 D 5-11a



PLAN VIEW
TYPE 2 RAMP
(ON LINE WITH SIDEWALK)



SECTION A-A



SECTION B-B

GENERAL NOTES

USE THE TYPE 3 RAMP ONLY WHEN A TYPE 1 OR TYPE 2 CANNOT BE ACHIEVED BECAUSE OF FIELD CONDITIONS.

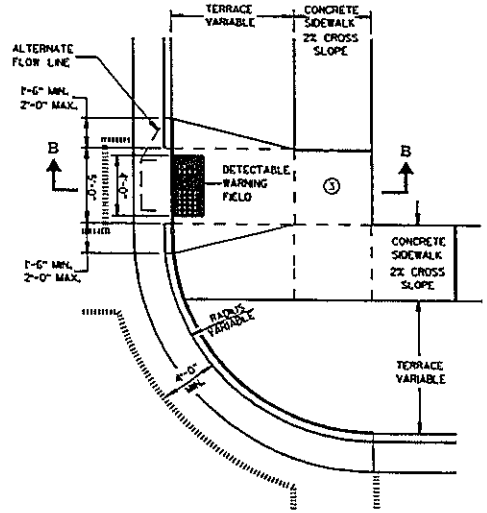
(1) WHEN THIS DISTANCE IS LESS THAN 6'-0" IT MAY BE DIFFICULT TO ACHIEVE A 12H:1V SLOPE, OR FLATTER, ON THE RAMP. REDUCE CURB HEIGHT IN TRIANGLE AREA TO ACHIEVE 12H:1V SLOPE, OR FLATTER, ON RAMP. 2" MINIMUM CURB HEIGHT.

(2) GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 11%. PROVIDE DRAINAGE AWAY FROM CURB RAMP AT GUTTER FLAG INTERFACE.

(3) PROVIDE LANDING AT TOP OF RAMP WITH NO MORE THAN 2% SLOPE IN ANY DIRECTION.

LEGEND

- ½" EXPANSION JOINT-SIDEWALK
- CONTRACTION JOINT FIELD LOCATED
- PAVEMENT MARKING CROSSWALK (WHITE)
- ALTERNATIVE LAYOUT



PLAN VIEW
TYPE 3 RAMP
(OUTSIDE OF CROSSWALK AREA)

CURB RAMPS
TYPES 2 AND 3

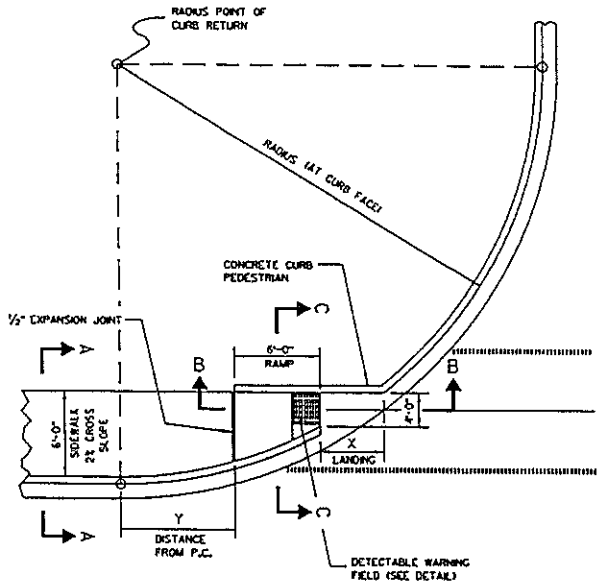
STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

6

6

S.D.D. 8 D 5-11b

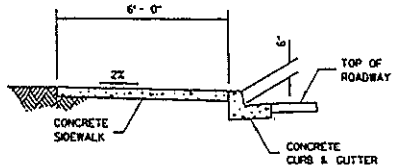
S.D.D. 8 D 5-11b



CURB RAMP TYPE 4A
PLAN VIEW

RADIUS (AT CURB FACE)	X	Y
20 FEET	6'-1¾"	2'-7¼"
30 FEET	7'-11¾"	4'-8¼"
40 FEET	9'-5¼"	6'-5"
50 FEET	10'-8¾"	7'-11¼"
60 FEET	11'-10¼"	9'-3½"

INTERMEDIATE RADII CAN BE INTERPOLATED



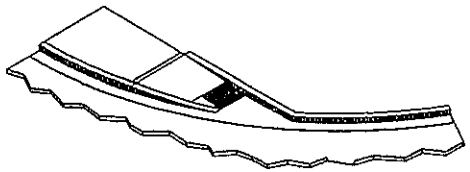
SECTION A-A

GENERAL NOTES

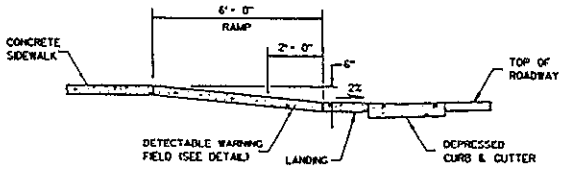
AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.

RAMP SLOPES SHALL NOT BE STEEPER THAN 12:1.

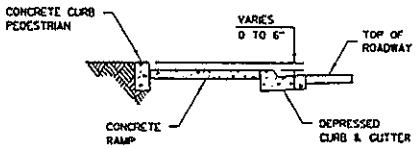
SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%.



ISOMETRIC VIEW



SECTION B-B



SECTION C-C

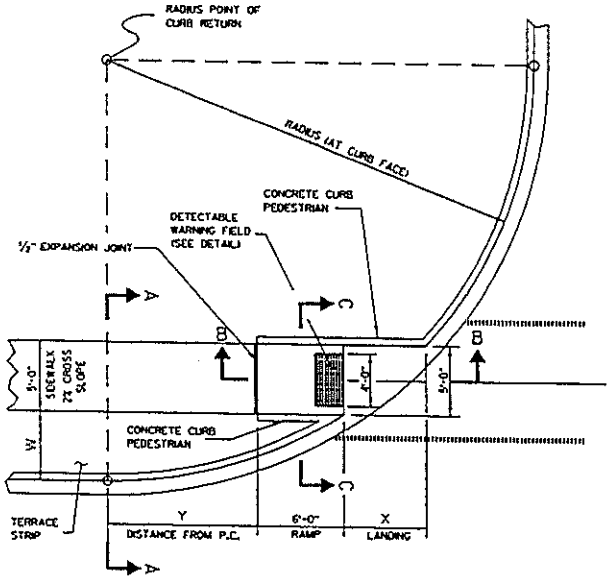
LEGEND

- ½" EXPANSION JOINT-SIDEWALK
- CONTRACTION JOINT FIELD LOCATED
- PAVEMENT MARKING CROSSWALK (WHITE)

CURB RAMPS
TYPE 4A

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

6
S.D.D. 8 D 5-11c



CURB RAMP TYPE 4B
PLAN VIEW

GENERAL NOTES

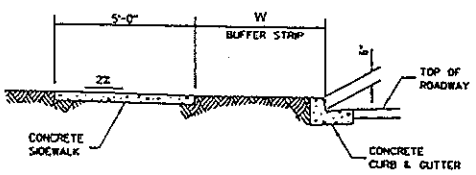
AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.

RAMP SLOPES SHALL NOT BE STEEPER THAN 12:1.

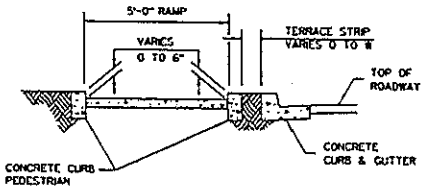
SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%.

RADIUS (AT CURB FACE)	W = 3'-0"		W = 4'-0"		W = 5'-0"		W = 6'-0"		W = 7'-0"	
	X	Y	X	Y	X	Y	X	Y	X	Y
20 FEET	5'-5½"	4'-6½"	4'-8½"	6'-0"	4'-1"	7'-2¾"	3'-7"	8'-3½"	3'-1½"	9'-2½"
30 FEET	7'-5¾"	7'-1"	6'-5½"	8'-10½"	5'-9¼"	10'-7"	5'-2½"	12'-0"	4'-0¾"	13'-3¼"
40 FEET	8'-9½"	9'-2½"	7'-10"	11'-5¼"	7'-1"	13'-4½"	6'-5¾"	15'-3¾"	5'-11½"	16'-7¼"
50 FEET	10'-¾"	11'-¾"	9'-1¼"	13'-11¼"	8'-2½"	15'-9½"	7'-6½"	17'-9"	6'-11¾"	19'-6¼"
60 FEET	11'-2½"	12'-8¾"	10'-¾"	15'-6½"	9'-2½"	17'-11¾"	8'-5¾"	20'-1¾"	7'-10½"	22'-1½"
70 FEET	12'-2¾"	14'-3¼"	11'-¼"	17'-4"	10'-1"	19'-11¾"	9'-3¾"	22'-4¼"	8'-8¼"	24'-6¼"
80 FEET	13'-2"	15'-8½"	11'-10½"	18'-11¾"	10'-10¾"	21'-10"	10'-1"	24'-4¾"	9'-5"	26'-8¾"
90 FEET	14'-½"	17'-½"	12'-8¼"	20'-6½"	11'-7¾"	23'-7"	10'-9¾"	26'-3¾"	10'-1¼"	28'-9½"
100 FEET	14'-10½"	18'-3¾"	13'-5½"	22'-0"	12'-4¼"	25'-2¾"	11'-3¾"	28'-1½"	10'-9"	30'-9"

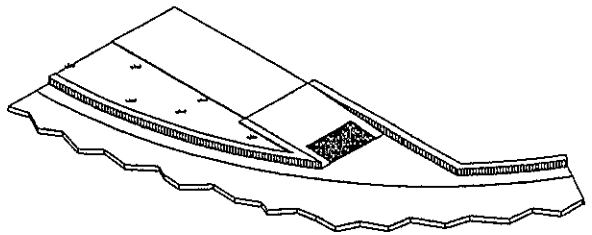
INTERMEDIATE RADII CAN BE INTERPOLATED



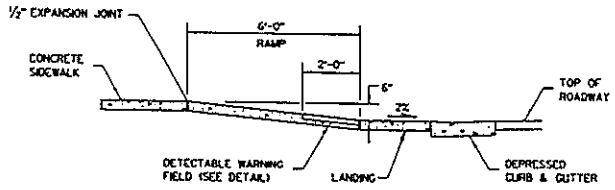
SECTION A-A



SECTION C-C



ISOMETRIC VIEW



SECTION B-B

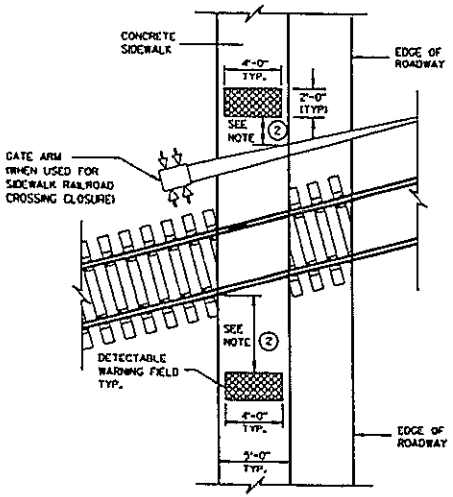
LEGEND

——— ½" EXPANSION JOINT-SIDEWALK

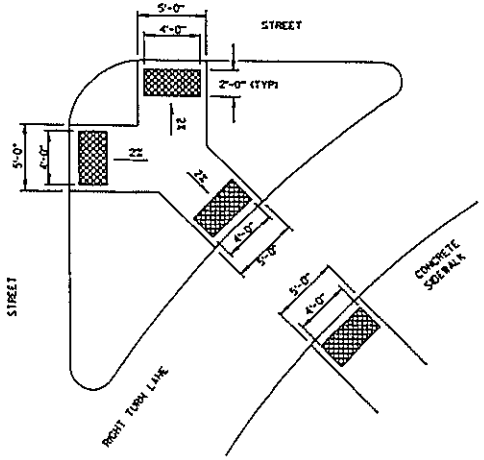
– – – CONTRACTION JOINT FIELD LOCATED

▪▪▪▪▪▪▪▪▪▪ PAVEMENT MARKING CROSSWALK (WHITE)

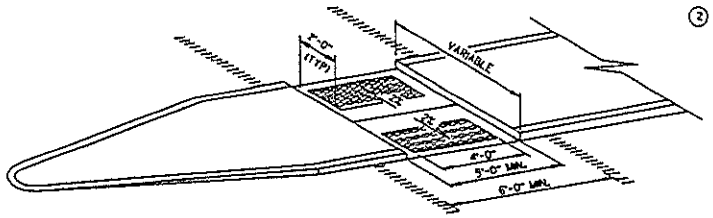
CURB RAMPS TYPE 4B
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION



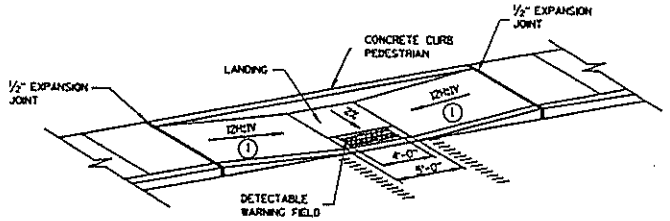
TYPE 8
DETECTABLE WARNINGS
AT RAILROAD CROSSING



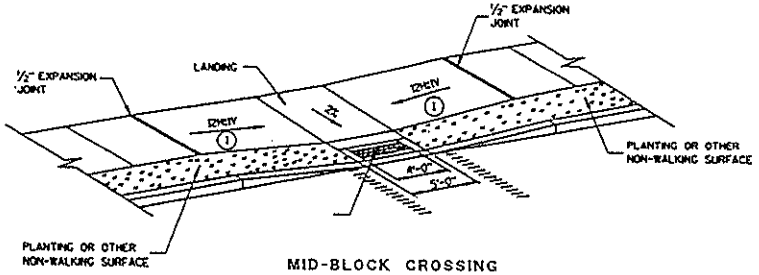
TYPE 6
DETECTABLE WARNING AT ISLANDS



MEDIAN ISLAND
NON-ELEVATED CROSSING
TYPE 5



MID-BLOCK CROSSING
TYPE 7A



MID-BLOCK CROSSING
TYPE 7B

NOTE: THESE PARALLEL AND PARALLEL/PERPENDICULAR CURB RAMPS MAY BE USED AT INTERSECTIONS AND MID BLOCK LOCATIONS.

GENERAL NOTES

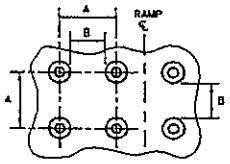
SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%.

(1) SLOPE SIDEWALK TOWARD LANDING AS SHOWN WHERE THERE IS NO TERRACE OR WHERE THE TERRACE WIDTH IS LESS THAN 6 FEET WIDE.

(2) THE EDGE OF THE DETECTABLE WARNING FIELD NEAREST TO A RAILROAD CROSSING SHALL BE 1.5 FEET ± 0.5 FROM THE FACE OF THE GATE ARM IF THE GATE ARM EXTENDS ACROSS THE SIDEWALK. WHERE THERE IS NO PEDESTRIAN GATE, THE EDGE OF THE DETECTABLE WARNING FIELD NEAREST TO THE RAILROAD CROSSING SHALL BE 15 FEET FROM THE NEAREST RAIL.

LEGEND

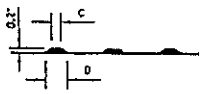
- ½" EXPANSION JOINT-SIDEWALK
- CONTRACTION JOINT FIELD LOCATED
- PAVEMENT MARKING CROSSWALK (WHITE)



PLAN VIEW

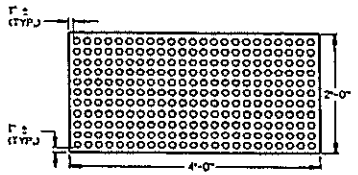
	MIN.	MAX.
A	1.6"	2.4"
B	0.65"	1.5"
C	*	*
D	0.9"	1.4"

* THE C DIMENSION IS 50% TO 65% OF THE D DIMENSION.



ELEVATION VIEW

TRUNCATED DOMES
DETECTABLE WARNING
PATTERN DETAIL



PLAN VIEW

DETECTABLE WARNING
FIELD (TYPICAL)

CURB RAMPS
TYPES 5, 6, 7A, 7B & 8

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

APPROVED
9/9/05 — DATE
/S/ Jerry H. Zogg — ROADWAY STANDARDS DEVELOPMENT ENGINEER
FHWA

S.D.D. 8 D 5-11a

6

6

S.D.D. 8 D 5-11a