

# **1. CITY OF MUSKEGO** **STANDARD SPECIFICATIONS**

## **SECTION 02600 – BURIED PIPELINES**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Water mains, control and distribution appurtenances.
- B. Sanitary sewer mains, force mains and maintenance and collection appurtenances.
- C. Storm sewer mains maintenance and collection appurtenances.
- D. Bedding and backfill.
- E. Televising sanitary sewers.
- F. Casing pipe.

#### 1.02 REFERENCES

- A. SWS: Standard Specifications for Sewer and Water Construction in Wisconsin, Sixth Edition.
- B. State Specifications: State Specifications: Standard Specifications for Highway and Structure Construction, State of Wisconsin Department of Transportation, Most Current Edition.
- C. Code: Muskego Municipal Code.

#### 1.03 SUBMITTALS

- A. Provide to CITY Engineering and Utility Departments:
  - 1. Water main safe sample test reports.
  - 2. Sewer Mandrel test reports.
  - 3. Sewer Vacuum test reports.
  - 4. Submit shop drawings for all products required by the City of Muskego.

### PART 2 - PRODUCTS

#### 2.01 WATER MAIN AND RESERVOIR OVERFLOW PIPING

- A. Pipe, 2 inch and smaller. Provide one type from following:
  - 1. Polyethylene:
    - a. AWWA C-901, Pressure Class 200
    - b. Make pipe connections with pack joint connections including a Buna-N beveled gasket for sealing to outside diameter of pipe.
    - c. Integrate s split clamp locking device with stainless steel hardware into connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.
    - d. Provide stainless steel insert stiffeners for pack joint connection fittings used with polyethylene tubing.
    - e. Fittings for polyethylene tubing shall conform to AWWA C800 and be of cast brass having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc,

- lead-free (copper alloy C83600 also known as "red brass") in accordance with ASTM B62.
  - f. Fittings shall have uniformity in wall thickness and strength, and free of any defect that may affect their serviceability.
  - g. Polyethylene tubing shall be single piece, without joints, from corporation stop to curb stop.
  - h. Detector wire required per 2.01(M).
2. PVC:
- a. For 4 through 12 inch diameter: AWWA C-900, Class 150 pressure pipe with DR 18 or less.
  - b. Integral elastomeric bell and spigot joints.
  - c. SWS 8.20.0.
  - d. Detector wire required per 2.01(M).
  - e. Warning Tape per 2.01(L).
3. PVC:
- a. For 14 through 36 inch diameter: AWWA C-900, Class 150 or 235 pressure pipe with DR 18 or less as indicated on the plans.
  - b. Integral elastometric bell and spigot joints
  - c. SWS 8.20.0
  - d. Detector wire required per 2.01(M).
  - e. Warning Tape per 2.01(L).
- B. Butterfly valves (For all water main greater than 12-inches in diameter):
- 1. AWWA C-504 including:
    - a. Mechanical joint ends.
    - b. Turn counterclockwise to open.
    - c. 2 inch square operating nut.
    - d. All stainless steel hardware.
    - e. Epoxy Coated interior and exterior surfaces per AWWA C-550
  - 2. Clow M&H 4500.
  - 3. Pratt Groundhog HP250.
  - 4. Mueller Lineseal XP
  - 5. K-Flo Wolverine 506
  - 6. Val-Matic Series 2000
  - 7. SWS 8.28.0.
- C. Resilient wedge gate valves (For all water main less than or equal to 12-inches in diameter and for tapping tees):
- 1. AWWA C-515 including:
    - a. Nonrising stem.
    - b. Mechanical joint.
    - c. Actuator: wrench nut.
    - d. Opens counterclockwise.
    - e. Stem seals: O-ring.
    - f. Epoxy interior and exterior coating per ANSI/AWWA C550.
    - g. 250 p.s.i.g operating rating
    - h. SWS 8.27.0.
    - i. All stainless steel hardware.
  - 2. Clow M&H Valve Company 4067-01.
  - 3. American Flow Control Series 2500.
  - 4. Kennedy 4571.
  - 5. Clow F-6100.
- D. Valve enclosures:
- 1. Boxes:
    - a. Cast iron assembly, size DD, cover marked "water".
    - b. Manufacturers:

- i. Tyler 6860S
      - ii. Sigma VB630DD,
      - iii. Star VB DHD DW.
    - c. SWS 8.29.0.
    - d. Valve box adaptors: Adaptors, Inc.
  - 2. Manholes:
    - a. Precast.
    - b. Frame: Per SWS File No. 40 or 40A.
    - c. 60 inch diameter (minimum).
  
- E. Valve stem extenders (for valves greater than 10' bury depth):
  - 1. Securely attached to valve operating nut.
  - 2. Extend to 4 feet (plus or minus 3 inches) below finished grade.
  - 3. Provide solid shaft.
  - 4. Stainless steel.
  - 5. Epoxy coated iron with stainless steel pins or bolt.
  - 6. Spacer ring at 3 inch below operating nut.
  - 7. Set screws: Conical pointed, 2 minimum.
  - 8. One piece unit construction
  
- F. Hydrant assembly:
  - 1. AWWA C-502 and SWS 8.26.0:
    - a. Bury depth: 6 foot minimum.
    - b. Opens counterclockwise.
    - c. Break-flange.
    - d. 5-1/4 inch minimum main valve opening, 2 each National Standard 2-1/2 inch hose nozzle and one 4-1/2 inch pumper nozzle.
    - e. Painted red.
    - f. Mechanical joint connection.
    - g. Barrel extensions: Same manufacturer as hydrants.
    - h. Installation per 3.01(D).
  
  - 3. American Flow Control. Waterous Pacer WB-67-250
  - 4. Kennedy Guardian K-81.
  - 5. Mueller Super Centurion 5 1/4" A423 SC350.
  - 6. Hydrant lead:
    - a. PVC AWWA C-900 Class 200 SDR 14 or less.
  - 7. Marker Flag:
    - a. "HYDRAFINDER".
    - b. 5 feet long.
    - c. Fiberglass, red and white.
    - d. Springload action.
  
- G. Fittings: SWS 8.22.0.
  - 1. Joints:
    - a. Buried: Mechanical.
    - b. In structures: Flanged.
  - 2. Pressure rating:
    - a. Full body: 250 PSI.
    - b. Compact: 350 PSI.
  - 3. Material:
    - a. Ductile iron:
      - 1) Class 52 wall thickness.
      - 2) Bituminous exterior coating per ANSI/AWWA C110/A21.10.
      - 3) Cement lined and bituminous coated interior per ANSI/AWWA C104/A21.4.
      - 4) Cor-Blue tee bolts.
  
- H. Service lines, valves and fittings.

1. Lines, 2 inch and smaller (1-1/4 inch minimum):
    - a. Polyethylene:
      1. AWWA C-901, Pressure Class 200
      2. Make pipe connections with pack joint connections including a Buna-N beveled gasket for sealing to outside diameter of pipe.
      3. Integrate a split clamp locking device with stainless steel hardware into connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.
      4. Provide stainless steel insert stiffeners for pack joint connection fittings used with polyethylene tubing.
      5. Fittings for polyethylene tubing shall conform to AWWA C800 and be of cast brass having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc, lead-free (copper alloy C83600 also known as "red brass") in accordance with ASTM B62.
      6. Fittings shall have uniformity in wall thickness and strength, and free of any defect that may affect their serviceability.
      7. Polyethylene tubing shall be single piece, without joints, from corporation stop to curb stop.
      8. Detector wire required per 2.01(M).
  2. Corporation valves for copper:
    - a. Flared fitting. Must withstand 150 PSI pressure test.
    - b. Mueller B-25000
    - c. Ford FB1000-xx-Q-NL
    - c. A.Y. McDonald 4701.
  3. Curb valves for copper:
    - a. Must withstand 150 PSI pressure test.
    - b. Mueller B-25154
    - c. Ford B44-xxxM-Q-NL
    - d. A.Y. McDonald 6104
  4. Curb boxes:
    - a. Screw-on style.
    - b. Mueller H-10300
    - c. Ford EM 2-65-56
    - d. A.Y. McDonald 5614.
  5. Teflon tape on threaded joints.
  6. Valve stem extenders (for valves greater than 10' bury depth):
    - a. Securely attached to valve operating nut.
    - b. Extend to 4 feet (plus or minus 3 inches) below finished grade.
    - c. Provide solid shaft.
    - d. Stainless steel.
    - e. Epoxy coated iron with stainless steel pins or bolts.
    - f. Spacer ring at 3 inch below operating nut.
    - g. Set screws: Conical pointed, 2 minimum
    - h. One Piece unit construction
- I. PVC main tapping saddle for service lines 2-inch and smaller:
1. Wide Band Single Piece Body.
  2. Stainless steel
  3. Cascade CS-22
  4. Cascade CSC-2
  5. Mueller SS Series.
- J. Tapping sleeves with gate valve 16 inch and under:
1. Stainless steel with ductile iron flange.
  2. Cascade CST-SL
  3. Romac 306
  4. Smith Blair 662
- K. Air release assemblies:

1. In valve box: SWS 4.12.0
  2. In vault: SWS 4.11.0., except provide HS20 load-rated flat top slab.
- L. Warning tape:
1. "TERRA TAPE STANDARD 250" by Reef Industries, Inc. or "Shieldtec: by Empire Level Manufacturing Corporation.
  2. Tape shall read: "CAUTION - WATER LINE BURIED BELOW".
  3. Color: Blue.
  4. Width: 3 inches.
- M. Detector wire:
1. Direct burial rated insulated AWG #12 copper conductor.
  2. Trenchless installation Aircraft cable, nylon-coated stainless steel, 3/8-inch diameter.
  3. Splices: Water proof. Plymouth Plyflex low voltage splice kit. Graybar catalog number 2635.
  4. Color: Blue.
  5. Anode bags:
    - a. All service laterals shall have a temporary 1 pound magnesium anode bag installed at the ROW line.
    - b. All hydrants and termination points shall have a temporary 5 pound magnesium anode bad installed.
- N. Buttruss concrete: Class F SWS 8.35.3. Use one of the following:
1. Ready-mixed.
  2. Job site mixed above grade.
- O. Restrained joints:
1. Strapping following SWS 4.9.0.
  2. EBAA Iron Megalug.
- P. Location boxes:
1. Top section valve box, size DD, 26-inch length.
  2. Cover marked "water".
  3. Hardwood blocking.
  4. Per Detail Drawing #4C.

## 2.02 GRAVITY SANITARY SEWER

- A. Pipe. Use one type from following:
1. Polyvinyl chloride and fittings solid wall:
    - a. 4 inch through 15 inch and bury depth 16' or less: Type PSM, ASTM D-3034, SDR 35.
    - b. 4 inch through 15 inch and bury depth 16' thru 22': Type PSM, ASTM D-3034, SDR 18.
    - c. SWS 8.3.0 and 8.10.0.
  2. Reinforced concrete:
    - a. 18 inch and larger or bury depth 22' or greater: Circular Pipe, ASTM C-76, wall thickness C, Class as per drawings.
    - b. Joints: Type R-4 Air Test Gasket, ASTM C-361.
    - c. SWS 8.3.0 and 8.6.0.
- B. Pressure-rated pipe. Use one type from following:
1. Polyvinyl chloride pipe:
    - a. 4 inch through 12 inch AWWA C900 SDR18 or less.
    - b. 14 inch and 16 inch AWWA C905 SDR18 or less.
  2. 18 inch and larger: Concrete.
  3. Fittings for PVC pipe shall follow SWS 8.22 and:
    - a. Joints:

- 1) Buried:
  - a. Mechanical.
  - b. Push-on.
- 2) In structures: Flanged.
- b. Pressure rating:
  - 1) Full body: 250 PSI.
  - 2) Compact: 350 PSI.
- c. Material ductile iron:
  - 1) Class 52 wall thickness.
  - 2) Bituminous exterior coating per ANSI/AWWA C110/A21.10.
  - 3) Cement lined and bituminous coated interior per ANSI/AWWA C104/A21.4.
  - 4) Cor-Blue tee bolts.
- d. Material PVC Pressure Fittings:
  - 1) AWWA C907 for water.
  - 2) PVC cell classification 12454-B per ASTM D1784 with minimum design basis 4,000 psi.
  - 3) Pressure class must match pipe.
  - 4) Third party certified to CSA B1373.
  - 5) Conform to AWWA C900/C905.
  - 6) SDR18 or less.
  - 7) Blue Brute.

C. Bulkhead and Plug: SWS 3.2.25.

D. Structures:

- 1. Manholes: SWS 3.5.0. and 8.39.0.
- 2. Frame: SWS File No. 14A approximate weight 385 pounds.
  - a. Neenah R-1661-B (non-modernized).
  - b. East Jordan 1641.
- 3. Cover: Self sealing, concealed pick hole, no vents. SWS File No. 14B, approximate weight 108 pounds.
  - a. Bolt-down covers required outside of pavement areas.
- 4. Rubber sleeves for frame/chimney seal:
  - a. New Construction/Rebuilds
    - i. Internal/External
      - 1. Adaptor Inc.
      - 2. Approved Equal
    - ii. External
      - 1. Cretex Specialty Products.
      - 2. NPC FlexRib Seal
  - b. Existing manhole adjustments
    - i. Cretex Specialty Products.
    - ii. NPC FlexRib Seal
- 5. Pipe to manhole connection: Follow SWS 3.5.7.
  - a. NPC Kor-N-Seal High Pressure Series
- 6. Frame and chimney sealants: SWS 8.42.0.
- 7. Flat decks - HS20 loading.
- 8. External joint wrap manholes.
  - i. Follow SWS 3.2.12.
  - j. MacWrap External Joint Sealer
  - k. Esky Wrap
  - l. Caddilloc Inc.
- 9. Anchored manhole frame and cover: SWS File No. 32.
- 10. All Manholes shall have the flow line extended to allow for proper access and installation of CCTV camera equipment and cleaning equipment.

E. Risers:

- 1. SWS 3.2.26.

2. Flexible riser to flexible main greater than 6 feet, or main greater than 16 feet deep, see Standard Details #5B & #5C.

F. Laterals:

1. SWS 5.3.10 and 5.3.11 and same material as main.
2. 6 inch.
3. Test tee with plugs.
4. Connection to main: Wyes.
5. Adapt pressure rated pipe to SDR35 with manufactured (molded) fittings.
6. Connect all laterals to main line, no manhole connections unless permission is granted by the City.

G. Warning tape:

1. "TERRA TAPE STANDARD 250" by Reef Industries, Inc. or "Shieldtec" by Empire Level Manufacturing Corporation.
2. Tape shall read: "CAUTION - BURIED SANITARY SEWER".
3. Color: Orange.
4. Width: 3 inches.

H. Detector wire:

1. Direct burial rated insulated AWG #12 copper conductor.
2. Trenchless installation Aircraft cable, nylon-coated stainless steel, 3/8-inch diameter.
3. Splices: Water proof. Plymouth Plyflex low voltage splice kit. Graybar catalog number 2635.
4. Color: Orange.
5. Anode bags: All service laterals shall have a temporary anode bag installed at the ROW line.
  - a. 1 pound magnesium

I. Location boxes:

1. Top section valve box, size DD, 26-inch length.
2. Cover marked "Sewer".
3. Hardwood blocking.
4. Per Standard Detail Drawing #5A as it relates to the locator box.
5. Located at manholes/structures. Spaced at a maximum every 1000 feet.

## 2.03 SANITARY SEWER FORCE MAIN

A. Pipe. Use one type from following:

1. PVC Class 150, AWWA C-900, SDR 18 or less with integral bell and spigot joints with an elastomeric seal.
2. Ductile iron:
  - a. SWS 8.18.0.
  - b. AWWA thickness Class.
  - c. Bell and spigot push-on joint SWS 8.18.2.
  - d. Exterior/lining: Ceramic epoxy
    1. Nominal Thickness: 40 mils.
    2. All cut ends and bell fittings protected with factory supplied field applied touch-up coating.
    3. Protecto 401.
  - e. Polyethylene film wrap: SWS 8.21.0.
3. Polyethylene:
  - a. Material designation: PPI PE3408.
  - b. Material classification: Type III, Class C, Category 5, Grade P34.
  - c. Cell classification: 345434C per ASTM D3350.
  - d. Pressure class: As shown on Drawings.

- B. Fittings for ductile iron and PVC pipe:
1. Joints:
    - a. Buried: Mechanical.
    - b. In structures: Flanged.
  2. Pressure Rating:
    - a. Full body: 250 PSI.
    - b. Compact: 350 PSI.
  3. Material:
    - a. Ductile iron:
      - 1) Class 52 wall thickness.
      - 2) Bituminous exterior coating per ANSI/AWWA C110/A21.10.
      - 3) Interior lining: Ceramic epoxy
        - a. Nominal Thickness: 40 mils.
        - b. All cut ends and bell fittings protected with factory supplied field applied touch-up coating.
        - c. Protecto 401.
      - 4) Buried: Cor-Blue tee bolts. Exposed: Stainless steel.
- C. Restrained joints:
1. Strapping following SWS 4.9.0.
  2. EBAA Iron Megalug
- D. Fittings for polyethylene pipe:
1. ASTM D3261.
  2. Pressure class:
    - a. Molded fittings: Match pipe.
    - b. Fabricated fittings: Increase pressure rating one class.
  3. Butt fused or flanged.
  4. Exposed: Molded flange adaptor with ductile iron or stainless steel backup ring and stainless steel bolts.
  5. Buried: Molded mechanical restrained joint adaptor with stainless steel internal stiffener and ductile iron or stainless steel backup ring with Cor-Ten hardware.
- E. Plug valves.
1. Manufacturers: (Valves 8" and less)
    - a. DeZurik Series 100.
    - b. Val-Matic Cam-Centric.
 Manufacturers: (Valves greater than 8")
    - a. DeZurik Series 100 or other OWNER approved series.
    - b. No equal or substitutions permitted.
  2. Valve boxes:
    - a. Cast iron, size DD, cover marked "sewer".
    - b. Manufacturers:
      1. Tyler 6860S
      2. Sigma VB630DD
      3. Star VB DHD DW.
    - c. SWS 8.29.0.
    - d. Valve box adaptors: Adaptors, Inc.
  3. Actuator: Rotary gear type for valves 8 inches and larger.
  4. Valve stem extenders (for valves greater than 10' bury depth):
    - a. Securely attached to valve operating nut.
    - b. Extend to 4 feet (plus or minus 3 inches) below finished grade.
    - c. Provide solid shaft.
    - d. Stainless steel.
    - e. Epoxy coated iron with stainless steel pins or bolts.
    - f. Spacer ring at 3 inch below operating nut.
    - m. Set screws: Conical pointed, 2 minimum
    - n. One Piece unit construction



- F. Structures:
1. Valve manholes: SWS 3.5.0 and 8.39.0.
  2. Frame: SWS File No. 14A. Approximate weight 385 pounds.
    - a. Neenah 1660 (non-modernized).
    - b. East Jordan 1641.
  3. Cover: Self sealing, concealed pick hole, no vents. SWS File No. 14B, approximate weight 108 pounds. Bolt down as required by City.
  4. Rubber sleeves for frame/chimney seal:
    - a. New Construction/Rebuilds
      1. Internal/External
        - a. Adaptor Inc.
        - b. Approved Equal
      2. External
        - a. Cretex Specialty Products.
        - b. NPC FlexRib Seal
    - b. Existing manhole adjustments
      1. Cretex Specialty Products.
      2. NPC FlexRib Seal
  5. Pipe to manhole connection: Follow SWS 3.5.7.
  6. Frame and chimney sealants: SWS 8.42.0.
  7. Flat decks - HS20 loading.
  8. Frame adjusting rings: Schneider Fuel & Supply.
  9. External joint wrap:
    - a. Follow SWS 3.2.12.
    - b. Mac Wrap external joint sealers.
    - c. Esky Wrap
    - d. Caddilloc Inc
  10. Anchored manhole frame and cover: SWS File No. 32.
- G. Air release assemblies:
1. In valve box: SWS 4.12.0 except include:
    - a. Valve stem extenders (for valves greater than 10' bury depth):
      - i. Securely attached to valve operating nut.
      - ii. Extend to 4 feet (plus or minus 3 inches) below finished grade.
      - iii. Provide solid shaft.
      - iv. Stainless steel.
      - v. Epoxy coated iron with stainless steel pins or bolts.
      - vi. Spacer ring at 3 inch below operating nut.
      - vii. Set screws: Conical pointed, 2 minimum
      - viii. One Piece unit construction
    - b. Lid: marked "sewer".
    - c. Drain stop: Female iron pipe inlet and flared copper outlet. Ford B21-333.
    - d. Drain stop: A.Y. McDonald 6105 with A.Y. McDonald 4753 copper flare by male iron pipe thread.
  2. In vault: SWS 4.11.0, except provide HS20 load-rated flat top slab.
- H. Warning tape:
1. "TERRA TAPE STANDARD 250" by Reef Industries, Inc..
  2. Tape shall read: "CAUTION - BURIED PRESSURE SEWAGE FORCE MAIN".
  3. Color: Orange.
  4. Width: 3 inches.
- I. Detector wire:
1. Direct burial rated insulated AWG #12 copper conductor.
  2. Trenchless installation Aircraft cable, nylon-coated stainless steel, 3/8-inch diameter.
  3. Splices: Water proof. Plymouth Plyflex low voltage splice kit. Graybar catalog number 2635.
  4. Use different color insulation for each pipeline.

- a. Color: Orange
- 5. Anode bags: All service laterals shall have a temporary anode bag installed at the ROW line.
  - a. 1 pound magnesium

- J. Location boxes:
  - 1. Top section valve box, size DD, 26-inch length.
  - 2. Cover marked "sewer".
  - 3. Hardwood blocking.
  - 4. Per Standard Detail #5A.
  - 5. Located at manholes/structures. Spaced at a maximum every 1000 feet.

## 2.04 SANITARY PRESSURE SEWER

- A. Pipe. Use one type from following:
  - 1. Polyethylene:
    - a. Class 160.
    - b. ASTM Ds2239.
    - c. SDR 11 HDPE.
  - 2. PVC:
    - a. SDR 18
    - b. SCHED 40.D.W.V.
- B. Fittings for polyethylene pipe:
  - 1. ASTM D3261.
    - a. Molded fittings: Match pipe.
    - b. Fabricated fittings: Increase pressure rating one class.
  - 2. Pressure class:
  - 3. Butt fused or flanged
  - 4. Exposed: Molded flange adaptor with ductile iron or stainless steel backup ring.
  - 5. Buried: Molded mechanical restrained joint adaptor with stainless steel internal stiffener and ductile iron or stainless steel backup ring with Cor-Ten hardware.
  - 6. Threaded transition fittings.
    - a. Stainless steel HDPE.
    - b. Brass to HDPE.
    - c. HDPE same as sanitary pressure sewer material.
    - d. ASTM 2513D.
- C. Material PVC Pressure Fittings:
  - 1. AWWA C907 for water.
  - 2. PVC cell classification 12454-B per ASTM D1784 with minimum design basis 4,000 psi.
  - 3. Pressure class must match pipe.
  - 4. Third party certified to CSA B1373.
  - 5. Conform to AWWA C900/C905.
  - 6. SDR18 or less.
  - 7. Blue Brute.
- D. Sanitary pressure laterals:
  - 1. Pipe material same as pressure sewer.
  - 2. Curb valves.
    - a. Must withstand 150 psi pressure test.
    - b. Mueller H-10287.
    - c. Ford B11-M.
    - d. A.Y. McDonald 76105.
  - 3. Curb boxes.
    - a. Screw on style.
    - b. Plain lid or "sewer".
    - c. Mueller H-10300-99002.
    - d. Ford EM 2-65-57R.

- e. A.Y. McDonald 5615.
  - 4. Teflon tape on threaded joints.
  - 5. Valve stem extenders (for valves greater than 10' bury depth):
    - a. Securely attached to valve operating nut.
    - b. Extend to 4 feet (plus or minus 3 inches) below finished grade.
    - c. Provide solid shaft
    - d. Stainless steel
    - e. Epoxy coated iron with stainless steel pins or bolts
    - f. Spacer ring at 3 inches below operating nut.
    - g. Set screws: Conical pointed, 2 minimum
    - h. One Piece unit construction
- E. Air release assemblies:
- 1. Valve Box: SWS 4.12.0.
    - a. Valve stem extenders (for valves greater than 10' bury depth):
      - i. Securely attached to valve operating nut.
      - ii. Extend to 4 feet (plus or minus 3 inches) below finished grade.
      - iii. Provide solid shaft.
      - iv. Stainless steel.
      - v. Epoxy coated iron with stainless steel pins or bolts.
      - vi. Spacer ring at 3 inch below operating nut.
      - vii. Set screws: Conical pointed, 2 minimum
      - viii. One Piece unit construction
    - b. Plain lid or "sewer".
  - 2. Drain stop.
    - a. F.I.P. inlet.
    - b. Flared copper outlet.
    - c. Ford B21-333.
    - d. A.Y. McDonald 6105 with A.Y. McDonald 4753 copper flare by M.I.P. thread.
- F. Warning tape:
- 1. "TERRA TAPE STANDARD 250" by Reef Industries, Inc. or "Shieldtec" by Empire Level Manufacturing Corporation.
  - 2. Tape shall read : "CAUTION-BURIED PRESSURE SEWAGE FORCE MAIN."
  - 3. Color: Orange.
  - 4. Width: 3 inches.
- G. Detector wire:
- 1. Direct burial rated insulated AWS #12 copper conductor.
  - 2. Trenchless installation Aircraft cable, nylon-coated stainless steel, 3/8-inch diameter.
  - 3. Splices: Water proof. Plymouth Plyflex low voltage splice kit. Graybar catalog number 2635.
  - 4. Use different color insulation for each pipeline.
    - a. Color: Orange
  - 5. Anode bags: All service laterals shall have a temporary anode bag installed at the ROW line.
    - a. 1 pound magnesium
- H. Location boxes:
- 1. Top section valve box, size DD, 26-inch length.
  - 2. Cover marked "sewer".
  - 3. Hardwood blocking.
  - 4. Per Standard Detail #5A.
  - 5. Located at manholes/structures. Spaced at a maximum every 1000 feet.

## 2.05 STORM SEWER

- A. Main lines:
  - 1. Reinforced concrete pipe (RCP): ASTM C-76 and SWS 8.6.0 with Mastic or rubber-gasket ASTMC-443 joints.
  - 2. Nonreinforced concrete pipe: SWS 8.5.0.
  - 3. Reinforced concrete horizontal elliptical pipe: ASTM C-507 and SWS 8.6.0.
  - 4. Provide Internal Safety Cage at all outlet pipes 15 inch or greater.
  - 5. The first three joints from an end section shall require joint restraints.
  
- B. Sump lines and sump line cleanouts:
  - 1. SWS 8.10.0.
  - 2. PVC SDR 35.
  - 3. Cleanout frost sleeves: Neenah R1977.
  - 4. See Standard Details #6A, #6B, #6C.
  - 5. Follow 2.03.I. for detector wire.
  
- C. Structures:
  - 1. Manholes: SWS 3.5.0 and 8.39.0.
  - 2. Inlet frame and cover: Neenah R-3501R with Type C grate.
  - 3. Inlet: SWS 3.6.0 for precast.
  - 4. Manhole frame and cover: Neenah R-2467 with type D open grate, approximate weight 500 pounds.
  - 5. Concrete block: State Specifications 519.2.2 (salt resistant pink block.).
  - 6. Inlet and catch basin mortar: State Specifications 519.2.3.
  - 5. Flat Decks: HS20 Design Loading.
  
- D. Rural section culverts when approved by the CITY.
  - 1. Road crossing culverts: minimum 18 inch diameter.
  - 2. Driveway culverts: minimum 15 inch diameter.
  - 3. Arch pipe equivalent may be used.
  - 4. Gauge: Follow DOT minimums per size.
  - 5. Materials:
    - a. Reinforced Concrete: State Specification 522.2
    - b. Reinforced Concrete Horizontal Elliptical: State Specification 523.2.
  
- E. Apron endwalls: State Specifications Sections 520 through 525 for apron endwalls and same material as pipe.
  
- F. Pipe grates: SWS 8.16.0. Lead paint shall not be used.
  
- G. Storm Drain Markers:
  - 1. Markers manufactured by Almetek Industries, Inc.-Available from City of Muskego.
  - 2. Markers installed adjacent to all storm inlets at time of final curb pour.
  - 3. Shall be installed using supplied hardware into wet concrete on upslope of curb head flush with surface.
  
- H. Warning tape:
  - 1. "TERRA TAPE STANDARD 250" by Reef Industries, Inc. or "Shieldtec: by Empire Level Manufacturing Corporation.
  - 2. Tape shall read: "CAUTION – STORM SEWER LINE BURIED BELOW".
  - 3. Color: Yellow.
  - 4. Width: 3 inches.
  
- I. Detector wire:
  - 1. Direct burial rated insulated AWG #12 copper conductor.
  - 2. Trenchless installation Aircraft cable, nylon-coated stainless steel, 3/8-inch diameter.
  - 3. Splices: Water proof. Plymouth Plyflex low voltage splice kit. Graybar catalog number 2635.
  - 4. Color: Yellow.

5. Anode bags: All service laterals shall have a temporary anode bag installed at the ROW line.

a. 1 pound magnesium

J. Location boxes:

1. Top section valve box, size DD, 26-inch length.
2. Cover marked "sewer".
3. Hardwood blocking.
4. Per Standard Detail #5A as it relates to the locator box.
5. Located at manholes/structures. Spaced at a maximum every 1000 feet.

## 2.06 BEDDING AND COVER MATERIALS

- A. Crushed Limestone chips: SWS 8.43.2(a).
- B. Around and over Underground Facilities: Follow respective owner's requirements.
- C. Cover: Same material as bedding.

## 2.07 BACKFILL

- A. Spoil: SWS 8.43.5.
- B. Aggregate slurry: SWS 8.43.8.
- C. 1-1/4" Crushed Limestone: State Specifications

## 2.08 CASING PIPE

- A. Material: ASTM A-53 steel, Grade B, 35000 PSI minimum yield strength.
- B. Dimensions:
  1. Follow SWS drawing file no. 49.
  2. Follow Permit requirements.
- C. Cellular concrete fill: SWS 8.35.5.

## 2.09 SURFACE RESTORATION

- A. Pavement: See 02500.
- B. Lawn: See 02900.
- C. Curb and gutter: See 02500.
- D. Concrete sidewalk: See 02500.

## 2.10 INSULATION

- A. SWS 8.50.0.

## PART 3 - EXECUTION

### 3.01 WATER MAIN INSTALLATION

- A. Follow SWS Part IV.

- B. Ductile iron:
1. Provide electric continuity using strapping or metallic retainer glands.
  2. Wrap ductile iron pipe and fittings with polyethylene film.
  3. Provide detector wire.
    - a. Color: Blue
  4. Provide strapping on all mechanical joints on water mains 16" and larger.
- C. PVC pipe:
1. Remove beveled pipe end at connections to mechanical joint or flanged fittings.
  2. Use tapping saddles for services for service lines 2 inch and smaller.
  3. Provide detector wire.
    - a. Color: Blue
  4. Provide strapping for all mechanical joints on water mains 16" and larger.
- D. Hydrants:
1. Secure hydrant valves directly to main lines with one of following:
    - a. Mechanical joint anchoring type hydrant tees.
    - b. Strapping.
    - c. EBAA Iron Megalug.
  2. Provide minimum 6 foot cover over lead.
  3. Position centerline of lowest hydrant outlet nozzle 20 inches (plus or minus 2) above finish grade.
  4. Use six foot original height assembly with adjustment sections to appropriate height above grade.
  5. Provide detector wire same as mainline pipe detector wire color.
  6. Provide concrete buttresses at each hydrant unless strapped per SWS 4.9.0
- E. Valves:
1. Water main running north/south shall have the butterfly valves installed so that the nut is oriented to the east side of the water main. Water main running east/west shall have the butterfly valves installed so that the nut is oriented to the south side of the water main.
  2. Valves shall be rotated when necessary to keep valve box out of curb and gutter. All locations shall be verified with City of Muskego.
- F. Buttresses: Follow SWS 4.3.13.
- G. Services.
1. Wet tap service connections at normal operating system pressure.
  2. Lateral locations on Drawings are tentative. Actual locations shall be marked by property owners with wooden stakes.
  3. When utilizing PVC or HDPE, the service shall be installed by snaking the line for slack in the service to minimize the potential for pulling the service line from the corporation stop.
  4. For 2 inch and smaller follow SWS Part V and:
    - a. Provide curb stop and box at right-of-way line.
    - b. Provide 2 by 6 inch hardwood marker at curb box location from invert of service to 2 feet above finished grade.
    - c. Provide tail piece. Follow SWS File No. 51 drawing.
  5. For 2-1/2 inch and larger follow SWS Part IV and V and:
    - a. Provide tee connection.
    - b. Anchor valve to tee with anchor tee or strapping.
    - c. Provide plug and buttress.
    - d. Provide 2 by 6 inch hardwood marker at end of service from invert of service to 2 feet above finished grade.
- H. Pressure test main line before and after services 2-inch and smaller are installed. Follow SWS 4.15.0.

- I. Disinfect pipelines: SWS 4.16.0.
  - J. Bacteriological testing shall be done after successful pressure test by: CONTRACTOR with Wisconsin DNR-certified independent laboratory.
  - K. All valves and services need to be operable and tested by the CONTRACTOR with a representative from the City there for final approval.
  - L. Water wasted from pipeline that may reach bodies of surface water may not contain any substances in concentrations that adversely affect the water as determined by the Wisconsin Administrative Code NR 105 and 106. For chlorine, no total residual chlorine may be measured in water being discharged to a surface water. Advise UTILITY of proposed discharge schedule to arrange DNR-required measurements.
  - M. Connections to existing mains and services: Make after all services are installed, tests passed, and safe sample report is submitted and approved by UTILITY.
- 3.02 GRAVITY SANITARY SEWER INSTALLATION
- A. Before starting, install and brace bulkhead and/or plug in the connection to existing sewer. Leave in place until new sewer has been cleaned and accepted. After first span of sewer is installed, install a second plug in the discharge pipe of the first upstream manhole. Anchor installed plugs. Verify condition of plugs with on-site review technician daily and prior to precipitation events.
  - B. Follow SWS Part III.
  - C. Set manhole frames to finish grade after placement of curb and gutter and before asphalt placement.
  - D. Laterals. Follow SWS Part V and:
    - 1. 1/4 inch per foot maximum slope.
    - 2. Provide 2 by 6 inch hardwood marker at end of lateral from invert of lateral to 2 feet above finish grade.
    - 3. Lateral locations on Drawings are tentative. Actual locations shall be marked by property owners with wooden stakes.
    - 4. Provide test tee at end of lateral or right-of-way line, whichever is further.
  - E. Air test: SWS 3.7.3.
  - F. Go-No-Go Test: SWS 3.2.6(i)4.
  - G. Manhole chimney seals.
    - 1. Prepare chimney, cone, mortar, and frame following seal manufacturer's requirements.
      - a) All internal chimney seals shall have butyl rubber installed around the steal bands.
    - 2. Install seals with AASHTO M-198-type B butyl rubber caulk.
    - 3. Test seals in CITY's presence following SWS 3.5.4(f)1.a.
    - 4. Install seals with an approved hydraulic installation tool to ensure positive seal.
  - H. Manhole vacuum test.
    - 1. Follow SWS 3.7.6. and MMSD rules, Chapter 2.
    - 2. Test after backfilling.
  - I. Manhole correction period tests: Water test all seals. Follow SWS 3.5.4(f)1.a.
  - J. Televising and videotaping of mains. Shall be videotaped by the Muskego Sewer UTILITY after:

1. Manhole benches installed.
2. After binder course placement and prior to surface course placement.
3. Pipework successfully tested.
4. Lines are thoroughly cleaned.
5. Contact UTILITY Department at 262-679-4128 after completion of 1-4 to schedule.
6. Prior to acceptance for use.

### 3.03 SANITARY SEWER FORCE MAIN INSTALLATION

- A. Follow SWS Part IV (Delete 4.3.12.).
- B. Pressure test. Follow SWS 4.15.2 except test at pipe pressure rating or 150 PSI whichever is less.
  1. Pressure test shall be done with liquid, not air unless otherwise approved by the City of Muskego.
- C. Polyethylene:
  1. Butt-fuse joints following ASTM D2657 and manufacturer's recommendations.
  2. Connect to flanged pipe with molded flange adaptor with ductile iron backup ring.
  3. Install following ASTM D2321, SWS, and manufacturer's recommendations.
  4. Provide embedment material from 6 inches below pipe to 12 inches above top of pipe and compact to 85 percent Standard Proctor density (AASHTO T-99).

### 3.04 SANITARY SEWER PRESSURE MAIN INSTALLATION

- A. Follow SWS Part IV (Delete 4.3.12.).
- B. Pressure test. Follow SWS 4.15.2 except test at pipe pressure rating or 150 PSI whichever is less.
  1. Pressure test shall be done with liquid, not air unless otherwise approved by the City of Muskego.
  2. Low Pressure Sewers shall be at a recommended test pressure of the pipe manufacture or at double the pressure of the grinder pump connected to the pressure sewer system.
- C. Polyethylene:
  1. Butt-fuse joints following ASTM D2657 and manufacturer's recommendations.
  2. Connect to flanged pipe with molded flange adaptor with ductile iron backup ring.
  3. Install following ASTM D2321, SWS, and manufacturer's recommendations.
  4. Provide embedment material from 6 inches below pipe to 12 inches above top of pipe and compact to 85 percent Standard Proctor density (AASHTO T-99).

### 3.05 STORM SEWER INSTALLATION

- A. Follow SWS Part III.
- B. Set manhole frames to finish grade after placement of curb and gutter and before asphalt placement or final grading if in terrace area.
- C. Set inlet frames to interim grade per City standard detail #7A.
- D. Catch basin or inlet frames may not be corbelled to meet curb and gutter. Catch basin or inlet structures shall be replaced if the offset is greater than 1 inch.
- E. Sump lines.
  1. Pitch to inlet or manhole.
  2. Bed and cover PVC following SWS 3.2.6.i.
  3. Provide detector wire.
    - a. Color: Yellow



- F. End grates to be placed on all outlets 15 inches and greater.
  - G. All apron endwall inlets shall have trash racks.
- 3.06 RURAL SECTION – CULVERTS: If Permitted By City.
- A. Follow State Specifications: 520.3, except 520.3.1
  - B. Driveways:
    - 1. Private entrance and temporary culverts. Provide minimum 6 inches of 3/8 inch crushed stone chips below pipe.
    - 2. Provide concrete headwalls.
  - C. Road crossing culverts:
    - 1. Provide minimum 6 inches of 3/4 inch crushed stone chips below pipe.
- 3.07 LOCATION AIDS
- A. Warning tape: Place 18 inches below finished grade for:
    - 1. All force mains.
    - 2. All water mains.
    - 3. All sump lines.
    - 4. All sanitary pressure sewers.
  - B. Detector wire:
    - 1. Attach with tape to:
      - a. All force mains.
        - i. Color: Green
      - b. All water mains.
        - i. Color: Blue
      - c. All sump lines.
        - i. Color: Yellow
      - d. All sanitary pressure sewers.
        - i. Color: Green
    - 2. Do not splice between location boxes without CITY's approval.
    - 3. Anodes:
      - a. Install temporary anode bags at end of each utility lateral.
      - b. Install temporary anode bags at each hydrant and termination points.
  - C. Install location boxes at:
    - 1. 1000 feet maximum intervals.
    - 2. At every hydrant.
    - 3. At Sanitary and Storm Sewer Manhole/Structure as directed by the City of Muskego.
    - 4. For sump lines install detector wire in each frost sleeve.
  - D. City requires detector wire to be tested and traceable over all proposed utilities with no traceable breaks along the utility alignment. City presence is required during all tests. Standard industry equipment is required for testing. If traceable test fails, Contractor shall fix the issue and notify the City when ready to retest.
- 3.08 CASING PIPE
- A. Follow SWS drawing file no. 49.
  - B. Fill annular space in casing pipe with cellular concrete.
  - C. Provide bulkheads at each end of casing pipe.
  - D. For sewer pipe follow SWS 2.4.0.

E. For water pipe follow SWS 4.13.2.

F. Required for all stream crossings.

### 3.09 EXCAVATED MATERIAL

A. Excavated Material: Deliver surplus excavated material to CITY designated locations within 4 radial miles from Work. If CITY designates in writing that disposal be made more than 4 radial miles from the Work, CONTRACTOR will be paid for that portion of the haul exceeding 4 radial miles by Change Order. Surplus excavated material for which CITY does not designate a disposal site shall be disposed at CONTRACTOR's cost. After delivery to the designated location, such material shall be graded level by CONTRACTOR.

### 3.10 CLEANUP

A. Clean dirt and construction material from haul roads:

1. At end of each working day.
2. As needed during the day to avoid creating hazards or complaints.
3. As requested by CITY.
4. In accordance with Municipal Code Chapter 29.

### 3.11 INSULATION

A. Follow SWS 4.17.2 when depth of cover is less than 5 feet over sanitary sewer, water main and force main.

B. Follow SWS 4.17.2. when depth of cover is less than 4 feet over sump lines.

### 3.12 BEDDING AND COVER

A. Follow SWS 3.2.6(b) Class B.

### 3.13 TRENCH BACKFILLING AND CONSOLIDATION

A. Material:

1. New or proposed roadway: From 5 feet behind back of curb or edge of pavement in paved areas and driveways:
  - a. Aggregate slurry.
  - b. Crushed stone screenings.
  - c. Top 12 inches 1-1/2 inch T.B. crushed limestone.
2. In existing roadways:
  - a. Aggregate slurry.
3. Other areas: Spoil.
4. Around and over Underground Facilities: Follow respective owner's requirements.

B. Consolidation:

1. Mechanically compact trench backfill. Follow SWS 2.6.14(b), except CONTRACTOR shall pay for compaction testing.

### 3.14 SURFACE RESTORATION

A. Pavement: See 02500.

B. Lawn: See 02900.

C. Curb and gutter: See 02500.

- D. Concrete sidewalk: See 02500.
- 3.15 CLEARING AND GRUBBING
- A. Follow SWS 2.2.15. Prune damaged trees and apply approved tree dressing to cut.

END OF SECTION