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**PROJECT MANUAL**

For

**SHOREWOOD HILLS NORTH SUBDIVISION – PHASE III**

**Town of Lake Mills  
Jefferson County, Wisconsin**

**October 2015**

Prepared by:

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**SECTION 01 10 00**  
**PROJECT CONDITIONS**

**PART 1 - GENERAL**

**1.01 Section Includes**

- A. Project Location.
- B. Permits.
- C. Construction Limits.
- D. Temporary Facilities.
- E. Traffic Control.
- F. Signage and Barricades.
- G. Erosion Control.
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- N. Compaction Testing.
- O. Site Access

**1.02 Project Location**

- A. The project is located west of Rock Lake and the City of Lake Mills, just south off of CTH B in the Town of Lake Mills, Jefferson County. The project includes construction on Bridle Path, Saddle Lane, and Polo Lane.

**1.03 Permits**

- A. It is the responsibility of the Owner and/or Contractor to obtain copies of all permits required for the execution of the Work prior to the start of work. All work shall be completed in compliance with the terms and conditions of the permits.
- B. Assisting the Owner in obtaining certain permits is part of the Engineer's scope of work. The Engineer is assisting the owner in obtaining the following permits:

***Town and City Permits, if necessary***  
***WDNR WPDES Stormwater Discharge Permit***  
***WDNR Sanitary Sewer Extension Permit***

- C. The Contractor is responsible for obtaining verification from the Owner in writing that all Federal, State, County, and local permits have been issued for the project.

**1.04 Construction Limits**

- A. The construction limits shall be the street right-of-way or any easements indicated on the Drawings, unless other construction limits are indicated within the Contract Documents. The Contractor shall restore disturbed areas outside of the construction at no cost to the Owner.

**1.05 Temporary Facilities**

- A. Material Storage: The location for material storage and construction staging shall be arranged with the Owner.
- B. Contractor's Office and Sheds: A Contractor's office is not required, however the Contractor may provide an office for his convenience. Coordinate the location of all offices and sheds with the owner.
- C. Temporary Power and Telephone: Temporary power and telephone are not required, however the Contractor may provide them for his convenience at his expense.

- D. Temporary Sanitary Facilities: Provide on-site temporary toilet facilities for use of construction personnel. Provide facilities meeting applicable codes. Maintain the facilities in a sanitary condition.
- E. Upon completion of the project all temporary facilities shall be removed and the area restored to its former condition.

#### **1.06 Traffic Control**

- A. Contractor is responsible for traffic control during the construction operations. Traffic control devices and their location shall be in accordance with the requirements of WisDOT and U S Dept. of Transportation, Manual on Uniform Traffic Control Devices.

Vehicle access to the properties within the construction area shall be provided at the beginning and end of each work day. Contractor is responsible for notifying residents 48 hours prior to access restrictions. Provisions shall be made by the Contractor for the access of emergency vehicles.

- B. DOT, County, and local permits as applicable (open cuts, street closings, ROW construction, etc.).

#### **1.07 Signage and Barricades**

- A. Provide signs, barricades, and lights as appropriate to protect the public from construction hazards such as excavations; valves, manholes and other structures extending above grade; materials; and equipment.

#### **1.08 Erosion Control**

- A. The Contractor shall review and become familiar with the erosion control plans and specifications included with the Contract Documents. Erosion control facilities must be in place PRIOR to the start of construction. Damaged erosion control facilities shall be repaired within 24 hours from the time of the damage. Local erosion control permits, if required, are incidental to the Work.

#### **1.09 Site Restoration**

- A. Site restoration is incidental to the work unless specifically provided for within the Contract Documents. Site restoration includes, but is not limited to, seeding disturbed areas, surface improvements, paving, mail boxes, street and traffic signs, fencing, trees, shrubs, survey markers, and other items that may or may not be shown on the Drawings.

#### **1.10 Existing Utilities**

- A. All of the existing underground utilities located within the project area may not be shown on the Drawings and underground utilities included on the Drawings may not be accurately located. The Contractor is responsible for contacting Diggers Hotline and local utility owners prior to construction to confirm the presence and location of public and private underground utilities. The Contractor is responsible for protecting underground utilities within the project area.

#### **1.11 Maintaining Sewer Service**

- A. Sanitary sewer service to existing buildings shall be maintained at all times except for periods of relative short duration necessary to make connections. It shall be the Contractor's responsibility to notify occupants of buildings prior to interruption of service.

#### **1.12 Adjustment of Manhole Rims**

- A. In paved areas set manhole rims one-half inch below finish grade. Set the tops of the manholes to the same slope as the surrounding pavement.
- B. The adjustment of existing manhole rims on paving projects shall be the responsibility of the paving contractor. This work will be incidental to the construction unless specific bid items are included in the Bid Form.
- C. The final adjustment of new manholes shall be responsibility of the contractor who installed them. Final adjustment shall be made after the aggregate base course has been placed and the finished

elevation and slope of the pavement is known. The interior manhole seal shall also be installed at this time. This work will be incidental to the manhole construction unless specific bid items are included in the Bid Form. Adjustment does not include repair of damaged manhole castings. The contractor responsible for the damage is liable for the repair.

#### **1.13 Existing Conditions**

- A. The Contractor shall notify the Engineer in writing prior to beginning the work, or a distinct section of the work, if existing conditions are detrimental to his work or that existing facilities or improvements are damaged. Some of these conditions include substandard compaction, broken concrete sidewalk and driveways, broken or out of plumb valve boxes, and other damaged property. Failure to notify the Engineer shall place responsibility for the existing conditions and damaged items on the Contractor.

#### **1.14 Clearing and Topsoil Stripping**

- A. Clearing and grubbing, and topsoil stripping are incidental to excavation unless specific bid items are included on the Bid Form.

#### **1.15 Compaction Testing**

- A. Compaction testing required in Sections 31 22 00 - Site Preparation and Earthwork and Section 31 23 33 - Utility Excavation, Backfill, and Compaction is incidental to the Work unless a specific Bid Item is included.

#### **1.16 Site Access**

- A. The cost of maintaining vehicle access to properties within the construction area is incidental to the Work unless there is a specific Bid Item for maintaining access. The work includes grading as needed, providing crushed aggregate, and other measures necessary to keep the road passable.

END OF SECTION

## SECTION 01 31 00

### COORDINATION, CONSTRUCTION LAYOUT AND MEETINGS

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Coordination.
- B. Construction layout.
- C. Preconstruction meeting.
- D. Progress meetings.

##### 1.02 Contractor Coordination Responsibilities

- A. Coordinate scheduling, submittals, and Work of the various sections of the Contract Documents to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate various sections having independent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate the location of fixtures and outlets within the structure and with finish elements.
- E. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion.

##### 1.03 Construction Layout

- A. Owner's Representative will provide appropriate benchmarks and stakes necessary for location, elevations, lines and levels.
- B. Contractor shall schedule staking a minimum of 48 hours prior to the time the staking is needed.
- C. Contractor shall be responsible for the preservation of grade stakes and bench marks, and if disturbed, the Contractor shall pay the actual cost of having the stakes reset.

##### 1.04 Preconstruction Meeting

- A. Engineer will schedule a preconstruction meeting after the Notice of Award.
- B. Attendance: Owner, Engineer, Contractor, and major subcontractors. Other interested parties such as utility owners may be invited to attend.
- C. Agenda
  - 1. Designation of personnel representing Owner, Contractor, Subcontractors, and Engineer.
  - 2. Compaction Testing
  - 2. Construction schedule.
  - 3. Procedures and processing of field decisions, submittals, applications for payment, change orders, and contract close-out.
  - 4. CDBG Funding
    - Cancelled Checks of all payments/invoices

- Weekly Certified payroll from General Contractor and all subs sent to GEC
  - Fringe benefits with base pay
  - Statement of Compliance
  - Labor Surveys, 2 required, 1<sup>st</sup> conducted within initial 2 weeks of project
5. Job meetings.
  6. Identify in detail all removals and salvage.
  7. Safety
  8. Traffic Control
  9. Construction site erosion control.
  10. Utilities.
  11. Temporary facilities.
  12. Construction layout.
  13. Permits and easements (DOT, DNR, Commerce, county, railroad, or local).
  14. Sediment and erosion control monitoring requirements (WPDES permit).
  15. Testing.
  16. Existing conditions.
  17. As-Built drawings and information.
  18. Other items pertinent to Work.
  19. Distribution of contract documents.

#### **1.05 Progress Meetings**

- A. Progress meetings will be held throughout the progress of the Work at intervals agreed to by the Owner, Engineer and Contractor and as necessary.
- B. Engineer, Owner, job superintendent, subcontractors and suppliers shall attend as appropriate to the agenda topics.

#### **PART 2 - PRODUCTS**

Not Used.

#### **PART 3 - EXECUTION**

Not Used.

END OF SECTION

## SECTION 01 33 00

### SUBMITTALS

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Shop drawings.
- D. Product data.
- E. Samples.
- F. Manufacturer's installation instructions.
- G. Manufacturer's certificates.

##### 1.02 Submittal Procedure

- A. Transmit each submittal with Engineer accepted form.
- B. Identify revisions or resubmittals.
- C. Identify project, Contractor, subcontractor, or supplier; pertinent drawing and detail number, and specification section, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction, and coordination of information, is in accordance with the requirements of the Work and the Contract Documents. **Submittal will be returned if the Contractor's stamp is not on the submittal.**
- E. Schedule submittals to expedite the Work. Coordinate submission of related items.
- F. For each submittal review, allow 15 days excluding delivery time from and to the Contractor.
- G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the Work.
- H. Provide space for Contractor and Engineer review stamps.
- I. Revise and resubmit, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

##### 1.03 Quality Assurance

- A. The Engineer will review submittals only for general conformance with the design concept. Such review shall not relieve the Contractor or any subcontractor of responsibility for full compliance with the Contract Documents; for correctness of dimensions, clearances, and material quantities; for proper fabrication and construction techniques; for proper coordination with other trades; and for providing all devices required for safe and satisfactory construction and operation.
- B. Submittals reviewed by the Engineer and returned to the Contractor will be marked with one of the following designations:
  - 1. Reviewed.
  - 2. Review with Comments.
  - 3. Revise and Resubmit.
  - 4. Rejected.

5. See Letter for Additional Comments.

#### **1.04 Construction Progress Schedule**

- A. Submit initial schedule in duplicate within 15 days after the date of Owner-Contractor Agreement, but not later than preconstruction conference.
- B. Revise and resubmit as required.
- C. Submit revised schedule with each Application for Payment, identifying changes since previous version.
- D. Submit a computer generated or horizontal bar chart with separate line for each major section of work or operation, identifying first day of each week.
- E. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

#### **1.05 Shop Drawings**

- A. Shop Drawings include specially prepared technical data for the Work, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.
- B. Submit number of opaque reproductions required by the Contractor plus two copies which will be retained by the Engineer.
- C. Drawings shall be to scale and of adequate size to clearly show all pertinent aspects of the item.

#### **1.06 Product Data**

- A. Product Data includes standard printed information on materials, products, and systems not specially prepared for the Work, other than designation of selections from among available choices printed thereon.
- B. Submit number of opaque reproductions required by the Contractor plus three copies which will be retained by the Engineer.
- C. Mark each copy to identify applicable products, models, options, and other data. Modify drawings and diagrams to delete information that is not applicable to the Work. Supplement manufacturer's standard data to provide information unique to the Work.

#### **1.07 Samples**

- A. Samples include both fabricated and non-fabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or for testing and analysis.
- B. Submit one sample unless individual specification sections require additional samples.
- C. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate samples for interfacing work.
- D. Submit samples of finishes from full range of manufacturer's standard colors, textures, and patterns for Owner selection.
- E. Include identification on each sample, with full Project information.

#### **1.08 Manufacturer Installation Instructions**

- A. When specified in individual sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing to Engineer, in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

**1.09 Manufacturer Certificates**

- A. When specified in individual sections, submit certification by manufacturer to Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certificates as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Owner.

END OF SECTION

## SECTION 01 35 29

### ENVIRONMENTAL POLLUTION, SAFETY, AND ACCESS

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Requirements for preventing and/or reducing environmental pollution.
- B. Safety during construction operations.
- C. Public and private access to construction site.

##### 1.02 Environmental Pollution

- A. General: Maintain all work areas on and off the site free from environmental pollution that would be in violation of any Federal, State or local regulation.
- B. Protection of Sewers: Do not impair the operation of existing sanitary sewers. Prevent construction material, pavement, concrete, soil or other debris from entering a sewer or sewer structure. When it is necessary to divert wastewater flow to accomplish the construction work, divert the flow to sewers draining to the treatment facilities. Under no circumstances shall wastewater be allowed to flow onto the ground or into surface waters.
- C. Erosion Control: Sediment from the project site shall not be allowed to be deposited off the site or into surface waters on or off the site. Provide erosion control facilities and measures to prevent erosion.
- D. Air Quality: Minimize air pollution during construction. Wet bare soils during dry weather to minimize dust. Dust prevention is particularly important on unpaved streets and haul roads. Provide dust prevention treatments or watering to reduce dust. Provide and maintain combustion emission control devices on construction equipment and shut down motorized equipment not in use. Trash burning at the construction site will not be permitted.
- E. Noise Control: Conduct the construction operations to cause the least amount of noise. Provide intake silencers on compressors and exhaust silencers or mufflers on internal combustion engines. Do not operate construction vehicles and equipment between the hours of 8:00 P.M. and 7:00 A.M. without written permission from the Engineer.
- F. Spills: Spills of hazardous materials shall be immediately contained and cleanup provided by qualified persons. Report the spill to the applicable authority.

##### 1.03 Safety

- A. Contractor's Responsibility: The Contractor shall be solely and completely responsible for safety as set forth in Sections 6.13, 6.14, and 6.15 of the General Conditions. This requirement shall apply continuously and not be limited to normal working hours. Neither the Owner nor the Engineer nor their representatives are responsible for safety.
- B. Safety Measures and Equipment: Maintain at the job-site safety equipment and apparatus applicable to the work and as prescribed by governing codes.

Provide equipment and supplies necessary to give first aid to injured persons. Establish a procedure for immediate transporting of injured persons to local hospital or medical clinic.

Take necessary precautions to protect the general public from hazards including, but not limited to, surface irregularities or unramped grade changes in pedestrian walkways, trenches and excavations. Provide barricades, lights and signs as necessary to ensure safety to the public.

Performance of the work with respect to ladders, platforms, structure openings, temporary railings, scaffolding, shoring, lagging and machinery guards shall be in conformance with applicable

governing codes.

Maintain temporary fencing, railings, barricades or steel plates as applicable at all openings, trenches or excavations. Provide lights or reflectors as necessary or required by governing codes.

- C. Accident Reports: Immediately report all serious injuries and property damage to the Engineer. Promptly provide a written report of the incident to the Engineer giving full details of the accident including a description of the injury or damage, persons injured or involved and statements of witnesses.

If a claim is made by anyone against the Contractor or any subcontractor resulting from an accident, promptly report the facts in writing to the Engineer giving full details of the claim including investigation and restitution.

- D. Traffic Safety: Comply with all laws regarding closing or restricting the use of public streets and comply with any specific requirements indicated in other Sections or in highway permits specific to the work. Provide traffic control devices in accordance with the Manual of Uniform Traffic Control Devices. Provide properly equipped flaggers as necessary or when required by the contract documents.
- E. Fire Prevention: Execute the work in a manner that minimizes the potential for a fire. Provide fire extinguishers in construction vehicles and equipment. Provide personnel with information on reporting a fire.
- F. Use of Explosives: The use of explosives shall be in accordance with Wisconsin Administrative Code COM 7. Contractor is responsible for obtaining any required permits. For work outside of Wisconsin, comply with the applicable codes of the state in which the work is located.

#### **1.04 Site Access**

- A. Access to Property: No public or private road shall be closed except by the express permission of the Engineer or Owner. Conduct the work to ensure the least possible obstruction to traffic and normal commercial pursuits. Construct and maintain such facilities as may be required to provide access to properties. Pedestrian access to properties shall be provided at all times. Vehicle access to properties shall be maintained during all non-working hours.
- B. Where traffic will pass over backfilled areas prior to paving, the roadway shall be maintained in a manner that will allow normal vehicular traffic. Temporary driveway access shall be provided.
- C. Emergency and Public Vehicle Access: Notify the local fire and police departments and public and school transportation companies at least 24 hours prior to closing any street or portion thereof. No street closing shall be made without the concurrence of the fire and police departments. Notify the fire and police when the streets are passable for emergency vehicles. Maintain vehicle access to consecutive arterial crossings or dead end streets in excess of 300 feet unless written permission is obtained from the fire and police departments.

Provide non-working hours telephone number(s) to the fire and police departments to allow contact for emergencies.

Maintain postal service to properties affected by the construction.

END OF SECTION

## SECTION 01 50 00

### TEMPORARY FACILITIES

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Temporary utilities and construction facilities.

#### PART 2 - PRODUCTS

##### 2.01 General

- A. Materials may be new or used, suitable for the intended purpose, and shall not violate requirements of applicable codes and standards.

##### 2.02 Temporary Utilities

- A. Provide and pay for costs of electricity, water, gas, and telephone required for the performance of the work.
- B. Water and Gas: Provide necessary temporary piping, fittings, tanks, metering, and hauling as required.
- C. Electricity:
  - 1. Provide temporary electrical wiring and metering.
  - 2. Provide main service disconnect and over-current protection at a convenient location.
  - 3. Provide area distribution boxes located so that individual trades may use their own power cords for construction operations.
- D. Telephone: Provide telephone or cellular service for direct communication with the Contractor's field project representative.

##### 2.03 Temporary Sanitary Facilities

- A. Temporary Sanitary Facilities: Provide on-site temporary toilet facilities for use of construction personnel. Provide facilities meeting applicable codes. Maintain the facilities in a sanitary condition.

##### 2.04 Field Office and Sheds

- A. Field offices and sheds used to accommodate personnel, supplies, tools, and equipment are the Contractor's option.

##### 2.05 Parking and Staging Areas

- A. Provide adequate space for construction activities.
- B. Staging and material storage areas shall be maintained in an orderly fashion.

##### 2.06 Temporary Heat and Ventilation

- A. Temporary Heat:
  - 1. Provide temporary heat as needed for proper performance of the work, for curing or drying of installed work, and for protection from low temperatures.

2. After the building has been enclosed, maintain the temperature between 50°F and 75°F.
3. Once operational, the permanent heating system may be used for temporary heat. Replace any filters on permanent systems prior to final completion.

B. Temporary Ventilation:

1. Ventilate enclosed areas to assist curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gasses.
2. If permanent ventilation system is used for temporary ventilation, replace filters prior to final completion.

**2.07 Temporary Lighting**

- A. Provide and maintain lighting for construction operations and for security.

**2.08 Temporary Enclosures**

- A. Provide temporary weathertight enclosure of exterior walls for successive areas of the building as the work progresses to provide acceptable working conditions, to provide weather protection for interior materials, to allow for effective temporary heating, and to prevent unauthorized entry.

**2.09 Temporary Fencing**

- A. Provide temporary fencing, barricades, and guards to protect existing construction and trees and other vegetation indicated to remain from damage.
- B. Provide site enclosure fence, barricades, warning signs, and lights as required for safety.

**2.10 Trash Removal**

- A. Provide appropriate containers for storing and containing construction waste material, debris, and rubbish. Remove waste materials from the site at regular intervals.
- B. Recycling of materials is encouraged.

**2.11 Water, Snow, and Ice**

- A. Maintain site, excavations, and construction free of water, snow, and ice as necessary for protection and execution of the work.

**PART 3 - EXECUTION**

**3.01 Installation**

- A. Locate temporary facilities as indicated on the Drawings or as approved by the Owner.
- B. Prepare site for temporary facilities. Provide adequate drainage.

**3.02 Removal of Temporary Facilities**

- A. Remove temporary utilities and construction facilities prior to Application for Final Payment.
- B. Clean and repair damage caused by temporary facilities.
- C. Restore permanent facilities used during construction to their original condition.

END OF SECTION

Temporary Facilities  
01 50 00-2

## SECTION 01 57 13

### CONSTRUCTION SITE EROSION CONTROL

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Furnishing, installing, maintaining, and removing erosion and sediment control facilities and measures.
- B. The contractor is responsible for providing all erosion control facilities and measures necessary to control erosion and sedimentation at the work site. These facilities and measures may or may not be shown on the Drawings and their absence on the Drawings does not alleviate the contractor from providing them. Any measures and facilities shown on the Drawings are the minimum actions required.

##### 1.02 References

- A. WDNR Technical Standards - See DNR website @ <http://dnr.state.wi.us/org/water/wm/nps/stormwater/techstds.htm>.
- B. Wisconsin Department of Transportation, Erosion Control, Product Acceptability Lists for Multi-Modal Applications PAL, Current Edition.

##### 1.03 General

- A. Requirements of WDNR Technical Standards shall be followed at all times.
- B. Use surface water and erosion control facilities and measures throughout the duration of the construction activity to control the movement of surface water and to reduce the potential for erosion. Maintain the facilities and measures until permanent vegetation is established.
- C. Eroded soil material shall not be allowed to leave the construction site or to enter a waterway, lake, or wetland.
- D. The Contractor shall be responsible for furnishing, installing, and maintaining the erosion control facilities, and in general, shall use construction practices that minimize erosion.
- E. Eroded material that has left the construction site shall be collected and returned to the site by the Contractor.
- F. Prevent construction site tracking with graveled roads, access drives, and parking areas of sufficient width and length to prevent sediment from being tracked onto public and private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday.

##### 1.04 Sequencing and Scheduling

- A. Construct and stabilize erosion control measures for diversions or outlets prior to any grading or disturbance of the construction site.
- B. Install filter fabric and straw bale fences and barriers prior to disturbing the area.
- C. Turf areas that have been completed to finish grade shall be stabilized with permanent seeding within seven days. Turf areas where activity has ceased and that will remain exposed for more than 20 days before activity resumes and soil stockpiles shall be stabilized with temporary seeding or soil stabilizer.
- D. Other erosion control measures shall be in place prior to disturbance of the construction site, as applicable.

**PART 2 - PRODUCTS**

**2.01 Silt Fence**

- A. Fabric shall be a woven or nonwoven polyester, polypropylene, stabilized nylon, or polyethylene geotextile with the following minimum properties:

Property	Test Method	Requirement*
Grab tensile strength, lbs min. Machine direction Cross direction	ASTM D4632	120 100
Max. Apparent opening size, US Sieve	ASTM D 4751	No. 30
Permittivity, sec <sup>-1</sup> , min.	ASTM D4491	0.05
Min. UV stability at 500 Hrs, %	ASTM D4355	70%

\* Minimum or maximum average roll values.

**2.02 Straw Bales**

- A. Straw or hay bales in good condition with nominal dimensions of 14"W x 18"H x 30"L.
- B. Stakes: Wood stakes with minimum nominal dimension of 2" x 2" x 30".

**2.03 Sediment Logs**

- A. Wood excelsior log wrapped in biodegradable fabric or mesh and listed in the Erosion Control Product Acceptability Lists.
- B. Stakes: Wood stakes with minimum nominal dimension of 1" x 1" x 24".

**2.04 Temporary Seed**

- A. Areas needing protection during periods when permanent seeding is not applied shall be seeded with annual species for temporary protection. Provide species as follows:

Species	% Purity
Oats	98
Cereal Rye	97
Winter Wheat	95
Annual Ryegrass	97

- B. Provide oats for spring and summer. Provide cereal rye, winter wheat, or annual ryegrass for fall seeding.

**2.05 Erosion Mat**

- A. All erosion mat products shall be of the class and type indicated and shall be chosen from the Erosion Control Product Acceptability Lists.
- B. Class I: A short-term duration (six months or greater), light duty, organic mat. Netting shall be non-organic, photodegradable or biodegradable netting. The weight of the netting shall not exceed 15% of the total blanket weight. The netting shall be sufficiently bonded to the parent material to prevent separation for the life of the product.
  1. Type A: A netted product for use on slopes 2.5 to 1 or flatter with a minimum product permissible shear stress of 50 Pa (1.0 lbs/ft<sup>2</sup>). Not to be used in channels.
  2. Type B: A double netted product for use on slopes 2 to 1 or flatter or in channels with a minimum product permissible shear stress of 70 PA (1.5 lbs/ft<sup>2</sup>).
- C. Class II: A long-term duration (3 years or greater), organic mat. The weight of the netting shall not exceed 15% of the total blanket weight. The netting shall be bonded sufficiently to the parent material to prevent separation of the net from the parent material for the life of the product.
  1. Type A: Jute fiber only to be used for reinforcing sod.
  2. Type B: For use on slopes 2:1 or flatter, or in channels with a minimum product permissible shear stress of 95 Pa (2.0 lbs/ft<sup>2</sup>). Non-organic, photodegradable, or biodegradable netting allowed.

3. Type C: For use on slopes 2:1 or flatter, or in channels with a minimum product permissible shear stress of 95 Pa (2.0 lbs/ft<sup>2</sup>). Only 100% organic fibers allowed. Woven mats are allowed with a maximum opening of ½ inch. Use in environmentally sensitive areas that have a high probability of entrapping animals in the plastic netting.

D. Staples: U-shaped No. 11 gauge or greater wire with a span width of one to two inches and a length of not less than 6 inches for firm soil and 12 inches for loose soil.

**2.06 Soil Stabilizer**

A. Soil stabilizer shall be a polyacrylamide (PAM) and calcium solution intended to reduce the erodibility of bare soils. The product shall achieve an 80% reduction in soil loss induced by a two inch per hour rainfall simulator.

B. PAM mixtures shall be environmentally benign, harmless to fish, aquatic organisms, wildlife, and plants. Only anionic PAM will be permitted.

C. Anionic PAM, in pure form shall have no more than 0.05% free acrylic monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency. The anionic PAM in pure form shall not exceed 200 pounds per batch.

D. The product provided shall be listed in the WisDOT PAL for Type B Soil Stabilizer.

**2.07 Inlet Protection**

A. Type A: Use around field inlets until permanent stabilization methods have been established. Use on pavement inlets prior to installation of curb and gutter or pavement.

B. Type B: Use on inlets without curb head after casting and grate are in place.

C. Type C: Use on street inlets with curb head.

D. Type D: Use in areas where other typed of inlet protection are incompatible with roadway and traffic conditions causing possible safety hazards when ponding occurs at inlet.

E. Geotextile: Type FF meeting the requirements of the latest edition of WisDOT PAL.

**PART 3 - EXECUTION**

**3.01 Installation of Diversions**

A. Temporary diversions shall be designed and installed in accordance with WDNR Conservation Practice Standard, Construction Site Diversion (1066).

**3.02 Installation of Silt Fence and Straw Bale Barriers**

A. Install straw bale barriers and sediment logs in accordance with the Drawings and WDNR Conservation Practice Standard, Sediment Bale Barrier (1055).

B. Install silt fence in accordance with the Drawings and WDNR Conservation Practice Standard, Silt Fence (1056).

C. Silt fence and straw bale barriers shall be placed on the contour to the extent practicable. Place fences parallel to the slope with the ends of the fence turned upslope a distance of one to two feet. The parallel spacing shall not exceed the maximum slope lengths as indicated in the following Table:

Fence and Barrier Spacing			
Slope	Spacing		
<2%	100'		
2 - 5%	75'		
5 - 10%	50'		
10 - 33%	25'		
>33%	20'		

**3.03 Temporary Seeding**

- A. Provide a seedbed of loose soil to a minimum depth of 2 inches.
- B. Apply seed evenly at the rate shown in the following table. Rake or drag to cover the seed to a depth of 1/4 inch.

Species	Lbs./Acre
Oats	131
Cereal Rye	131
Winter Wheat	131
Annual Ryegrass	80

**3.04 Erosion Mat Installation**

- A. Remove stones, clods, sticks, or other foreign material that would damage the mat or interfere with the mat bearing completely on the surface.
- B. Install erosion mat in accordance with the manufacturer’s recommendations.
- C. After seeding has been completed, roll blankets out parallel to the direction of water flow, with the netting on top. Spread the blankets without stretching, making sure the fibers are in contact with the soil. Overlap adjacent strips in accordance with the manufacturer’s recommendations. Overlap strip ends a minimum of 10 inches with the upgrade strip on top. Bury the upgrade end of each strip in a vertical trench at least 6 inches deep.
- D. Staple the mat strips in accordance with the manufacturer’s recommendations. Staple longitudinal overlaps and outer edges at maximum intervals of 3 feet. Staple strip ends at maximum intervals of 16 inches. Place staples throughout the mat at maximum 3-foot intervals. Insert staples flush with the ground surface.

**3.05 Soil Stabilizer**

- A. The manufacturer shall provide detailed written instructions on the storage, mixing, and application procedures.
- B. The soil stabilizer may be applied by spraying or by dry spreading.
- C. Application Rates: Apply at the rate recommended by the manufacturer.
- D. Do not apply within 30 feet of body of water (i.e. lake, river, stormwater pond).

**3.06 Ditch Erosion Control**

- A. The following erosion control measures are minimum requirements for all ditches. The Drawings may include more specific measures.

Ditch Erosion Control		
Slope Range	Method	Bale Checks
0 - 1%	Seed and mulch	None
1% - 4%	Seed and mulch with erosion mat	1% - 2%; Every 200' 2% - 4%; Every 100'
4% - 6%	Staked sod	Every 75'
>6%	Staked sod and/or riprap as specified by Engineer on Drawings	Every 75' for sod

- B. Stone Ditch Checks: Unless otherwise indicated on the Drawings, install stone ditch checks at intervals of one ditch check for every two feet of drop in channel grade.

### **3.07 Installation of Sod in Ditches**

- A. Lay sod so that joints of abutting ends of strips are not continuous. Lay each strip snugly against previously laid strips.
- B. Roll or firmly tamp sod to press the sod into the underlying soil.
- C. Turn the upper edges of the strips into the soil.
- D. Stake strips along the longitudinal axis at 18-inch intervals and near the top edge of the strip. Provide wood lath or similar stakes, 12 inches long. Leave top of stake approximately 1/2 inch above sod surface.

### **3.08 Installation of Other Facilities**

- A. Inlet protection barriers, channel stabilization, grassed waterways, rock lined waterways, sediments traps, sediment basins, and other forms of erosion control measures shall be designed and installed in accordance with *WDNR Technical Standards*.

### **3.09 Maintenance**

- A. Inspect diversions within 24 hours after each rainfall or daily during periods of prolonged rainfall, until the vegetative cover is stabilized. Make necessary repairs immediately.
- B. Inspect filter fabric fences and barriers within 24 hours after each rainfall or daily during periods of prolonged rainfall. Necessary repairs or replacement shall be made immediately. Remove sediment deposits when deposits reach one-half the height of the fence. Follow manufacturer's recommendations for replacing fabric due to weathering.
- C. Inspect straw bale fences and barriers within 24 hours after each rainfall or daily during periods of prolonged rainfall. Necessary repairs or replacement shall be made immediately. Remove sediment deposits when deposits reach one-third the height of the bales. Replace bales after three months.
- D. Inspect all seeding, sod, mulches, mats and nets within 24 hours after each rainfall or daily during periods of prolonged rainfall. Additional mulch, netting or matting shall be applied immediately when necessary to maintain suitable coverage. Make inspections until vegetative cover is established. Water seeding and sod when necessary to promote establishment.
- E. All other soil erosion control measures should be inspected and repaired immediately, if required, within 24 hours after storm event or daily during periods of prolonged rainfall.

### **3.10 Removal**

- A. After final vegetation is established, remove bales, silt fences, *ditch checks*, *diversions*, and other erosion control facilities. Restore areas disturbed by the removals.

### **3.11 Monitoring for WPDES Permit**

- A. Unless indicated otherwise within the Contract Documents, the Contractor shall be responsible for the monitoring requirements of the WPDES permit for storm water discharges associated with construction activities.
- B. Erosion and sediment controls shall be routinely inspected at least every seven days, and within 24 hours after a precipitation event of 0.5 inches or greater. Weekly written reports of all inspections shall be maintained and submitted to the Engineer. The reports shall contain the following information:
  - 1. Date, time, and exact place of inspection.
  - 2. Name(s) of individual(s) performing inspection.
  - 3. An assessment of the condition of erosion and sediment controls.
  - 4. A description of any erosion and sediment control implementation and maintenance performed.
  - 5. A description of the sites present phase of construction.
- C. The Engineer will provide the Contractor with the appropriate DNR form (see section 00 62 30) to use for the inspections.

END OF SECTION

**SECTION 01 61 00**  
**MATERIAL AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 Section Includes**

- A. Products.
- B. Transportation and handling.
- C. Storage and Protection.
- D. Installation.

**1.02 Products**

- A. Materials and equipment shall be new and unused. Do not use materials and equipment removed from existing construction, except as specifically required or allowed by the Contract Documents.
- B. Where two or more of the same products or components are required they shall be of the same manufacturer and interchangeable.
- C. Each major component of equipment shall have a nameplate.

**1.03 Transportation and Handling**

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Deliver products in undamaged condition in manufacturer's original containers or packaging with identifying labels intact and legible.
- C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- D. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- E. Arrange delivery of products in accordance with construction schedules; coordinate to avoid conflict with the Work and conditions at the site.

**1.04 Storage and Protection**

- A. Store products in accordance with manufacturer's instructions with seals and labels intact and legible.
- B. Store sensitive products in weathertight, climate-controlled enclosures.
- C. For exterior storage of fabricated products, place on supports, above ground.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- F. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in an acceptable condition.
- G. Provide coverings as necessary to protect installed products from damage by traffic and subsequent construction operations. Remove when no longer needed.
- H. In the event of damage, replace the damaged item or make repairs as instructed by the Engineer.

### **1.05 Installation**

- A. When Contract Documents require that installation of the Work shall comply with manufacturer's printed instructions, obtain and distribute copies to parties involved in the installation. Maintain one set of instructions at the site.
- B. Handle, install, connect, clean, condition, and adjust products in accordance with the instructions. Where job conditions or specified requirements conflict with the manufacturer's instructions, notify the Engineer.

END OF SECTION

## SECTION 01 71 33

### RESTORATION

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Restoration of site following construction.
- B. Items to be restored include, but are not limited to, the following:
  - 1. Asphalt, concrete or gravel roadways
  - 2. Driveways
  - 3. Sidewalks and curb & gutter
  - 4. Fences and retaining walls
  - 5. Lawns, grassed areas, trees and shrubbery
  - 6. Culverts and ditches
  - 7. Property corners and survey monuments
- C. Specific items of restoration may be noted on the drawings or included elsewhere in the specifications.

##### 1.02 Quality

- A. Restoration, when completed, shall equal or surpass the conditions existing before construction.
- B. When specifications are included for specific items of restoration, the work shall be performed in accordance with the applicable specification.

#### PART 2 - PRODUCTS

##### 2.01 Materials

- A. Materials shall be in accordance with specifications when the restoration item is covered by a specification. This includes such items as paving and concrete work.
- B. When there is no specification to cover a particular restoration item, materials used shall be the same as the existing or similar if existing material is unavailable.

#### PART 3 - EXECUTION

##### 3.01 Roadways

- A. Roadways shall be restored in kind unless otherwise specified.
- B. Pavement
  - 1. Unless noted on the drawings or otherwise specified, the Contractor is required to restore only the pavement removed or damaged during construction.
  - 2. The edges of all asphalt and concrete pavements shall be saw-cut to produce a straight, vertical edge for abutting new pavement.
  - 3. Unless otherwise specified, depth of pavement shall equal that existing prior to construction.
- C. Shoulders
  - 1. Unless otherwise noted, the following conditions shall govern shoulders:
    - a. In residential areas where turf is maintained to the edge of the pavement, the shoulders shall be topsoiled and seeded.
    - b. In rural areas or in residential areas where turf is not maintained to the edge of the pavement, gravel shoulders shall be constructed. Unless otherwise noted, gravel shoulders shall have a minimum compacted thickness of 4" and width of 4 feet.

##### 3.02 Driveways

- A. Driveways shall be restored in kind to the width of the existing drive.

- B. Minimum material thickness shall be as follows:
  - 1. Concrete: 6" with 3" compacted gravel.
  - 2. Gravel: 6" compacted thickness.
  - 3. Asphalt:
    - Residential – 2" with 6" compacted gravel.
    - Commercial – 3" with 8" compacted gravel.

### **3.03 Sidewalks and Curb & Gutter**

- A. Sidewalk
  - 1. Replace to original width.
  - 2. Thickness:
    - a. Standard: 4"
    - b. At drives: 6"
- B. Curb & Gutter
  - 1. Replace to original grade and cross section.

### **3.04 Fences and Retaining Walls**

- A. Repair any damage and replace at original location.

### **3.05 Lawns, Grassed Areas, Trees and Shrubbery**

- A. Lawns and Grassed Areas
  - 1. Restore in accordance with Section 32 92 19.
- B. Trees
  - 1. Replace trees damaged or destroyed which are located outside of easements or rights-of-ways.
- C. Shrubbery
  - 1. Remove and replant whenever possible.
  - 2. Replace damaged or destroyed shrubbery located outside of easements or right-of-ways.

### **3.06 Culverts and Ditches**

- A. All existing culverts shall be reopened and natural drainage restored. Restore culverts broken or damaged during construction to their original condition, size, and location. The Contractor shall notify Engineer of any previously damaged culverts prior to construction activities or as soon as the damaged condition is known.
- B. Restore all drainage ditches destroyed, damaged or otherwise modified during construction. Ditches so reconstructed shall be built in their original locations and cross section or as otherwise shown on the Drawings.

### **3.07 Property Corners & Survey Monuments**

- A. Restore and/or replace all survey monuments and property corners destroyed, damaged, or disturbed during construction. All work under this section must be completed by a Registered Land Surveyor and must be completed in accordance with applicable state and/or local statutes, codes, and guidelines.

END OF SECTION

## SECTION 31 22 00

### SITE PREPARATION AND EARTHWORK

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Clearing site of debris, grass, trees and other plant life in preparation for construction.
- B. Protection of existing structures, trees or vegetation to remain.
- C. Stripping of topsoil from areas to be incorporated into the work.
- D. Excavation, filling and compaction for site grading and paved surface subgrade preparation.

##### 1.02 References

- A. ASTM D 1557 - Standard Test Methods Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- B. ASTM D2487 - Classification of Soils for Engineering Purposes.
- C. ASTM D2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

##### 1.03 Submittals

- A. Submit compaction test reports.

#### PART 2 - PRODUCTS

##### 2.01 Materials

- A. Common Fill: On-site or off-site natural soil free from organic matter, debris, vegetation, stones larger than 6" and frozen material and classified in ASTM D2487 as follows:
  - GW - Well-graded gravels, gravel-sand mixtures, little or no fines.
  - GP - Poorly-graded gravels, gravel-sand mixtures, little or no fines.
  - GM - Silty gravels, gravel-sand-silt mixtures.
  - GC - Clayey gravels, gravel-sand-clay mixtures.
  - SW - Well-graded sands, gravelly sands, little or no fines.
  - SP - Poorly-graded sands, gravelly sands, little or no fines.
  - SM - Silty sands, sand-silt mixture.
  - SC - Clayey sands, sand-clay mixtures.
  - ML - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
  - CL - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.

- B. Breaker Run: Crushed stone meeting the following gradation:

5-Inch Breaker Run	
Sieve Size	% Passing by Weight
5 inch	90 - 100
1-1/2 inch	20 - 50
No. 10	0 - 10

3-Inch Breaker Run	
Sieve Size	% Passing by Weight
3 inch	90 - 100
1-1/2 inch	60 - 85
3/4 inch	40 - 65
No. 4	15 - 40
No. 10	10 - 30
No. 40	5 - 20
No. 200	2 - 12

- C. Geotextile: A geotextile fabric woven from polyester or polypropylene. The geotextile shall be insect, rodent, mildew, rot, and UV resistant. The geotextile shall have the following minimum requirements:

Geotextile Properties		
Property	Test Method	Requirement*
Grab Tensile Strength, lbs.	ASTM D4632	200
Elongation, %	ASTM D4632	15
Puncture, lbs.	ASTM D4833	120
Trapezoidal Tear, lbs.	ASTM D4533	80

\*Minimum average roll value

Mirafi 500X, TenCate Geosynthetics; 80EX, Thrace-LINQ, Inc; Soiltex ST205N, Geo-Synthetics, Inc. or equal.

### PART 3 - EXECUTION

#### 3.01 Protection

- A. Locate and identify existing utilities that are to remain and protect them from damage.
- B. Protect trees, plants, structures, site improvements and features designated to remain.
- C. Protect bench marks, property corners and other survey monuments from damage or displacement.

#### 3.02 Clearing

- A. Clear area within the clearing limits shown on the Drawings. If no clearing limits are shown, clear five feet outside of the grading limits, but not beyond project property boundaries.
- B. Remove trees, saplings, shrubs, bushes, vines and undergrowth within the clearing limits to the height above ground as follows:
  1. Trees over six inch diameter; six inches.
  2. Trees, shrubs and bushes under six inch diameter; three inches.
  3. Vines and undergrowth; two inches.

#### 3.03 Grubbing

- A. Remove all stumps, main root balls and root systems to the minimum depths indicated:
  1. Beneath footings: 18 inches.
  2. Beneath paved roads, parking areas and walks: 12 inches below sub-grade.
  3. Beneath turf: 8 inches.
  4. In fill areas: 12 inches.

#### 3.04 Topsoil Excavation

- A. Cut heavy growths of grass from areas to be stripped.
- B. Strip topsoil from all areas to be excavated, regraded or landscaped to a depth that prevents the intermingling of the topsoil with the subsoil.
- C. Topsoil is defined as surficial soil containing organic matter that sustains plant life.

- D. Stockpile the stripped topsoil on the site for reuse. If stockpile location is not shown on the Drawings, coordinate the location with the Engineer.
- E. Provide erosion protection for all stockpiled topsoil.

### **3.05 Pavement Removal**

- A. Remove existing pavement and dispose of off-site. Removal of pavement will be considered incidental to the work unless indicated otherwise.
- B. Provide a straight saw cut joint between pavement being removed and pavement to remain. Use power saw for cutting. Steel disk cutters mounted on power shovel bucket are not acceptable.

### **3.06 Lines and Grade**

- A. Streets
  - 1. Construct the finish subgrade to the line, grade, and cross section as shown on the Drawings.
  - 2. The Engineer will provide grade stakes at a minimum distance of 50 feet along the centerline. Provide Engineer with a minimum of 48 hours notice of the need for grade stakes.
  - 3. Contractor may use slope meters or GPS type controls on machines for grade control. However, the contractor is responsible for verifying the finish grade elevations with a level at a minimum of every 50 feet along the centerline.
- B. Site Grading
  - 1. Construct the finish subgrade to contours shown on the Drawings.
  - 2. The Engineer will provide grade stakes as appropriate for the Work.
  - 3. Contractor may use slope meters or GPS type controls on machines for grade control. However, the contractor is responsible for verifying the finish grade elevations.

### **3.07 Grading and Subgrade Preparation**

- A. Cut and fill to the required grades and cross section and contours.
- B. Scarify surface of cut areas and compact to the degree required for subsequent backfill.
- C. Place fill material in continuous layers not exceeding 8" compacted thickness.
- D. For proposed streets and parking lots, roll the surface with a steel drum roller to provide a relatively impervious surface where additional filling or excavation is necessary or placement of base course will be delayed.
- E. Maintain surface drainage during construction.
- F. Remove excess material from site. If borrow is needed, provide material meeting requirements of 2.01 for common fill.
- G. Grading contractor shall grade roads and other surfaces to be paved to rough subgrade elevation prior to installation of utilities. After utility installation, the grading contractor shall grade to finish subgrade elevation.
- H. Prior to placement of topsoil, areas that have been compacted by construction traffic shall be scarified to a minimum depth of 12 inches using a chisel plow or ripper arms on a dozer. Scarifying shall be performed along the contour.

### **3.08 Compaction**

- A. Adjust moisture content of fill material to accomplish the required degree of compaction.
- B. Use a sheepsfoot roller for cohesive soils and a smooth drum vibratory roller for granular soils.
- C. Compact to the percent of maximum dry density as listed below in accordance with ASTM D1557.

Compaction Requirements		
Area	Cohesive Soils	Granular Soils
Beneath Turf	85%	85%
Beneath Walks & Curbs	90%	95%
Beneath Paving	90%	95%
Building Pad Area	90%	95%
Storm Water/Treatment Pond Berms	90%	95%

### 3.09 Proof Rolling

- A. Proof roll the finished pavement subgrade in the presence of the Engineer. Provide 24-hour notice to the Engineer as to when the proof-rolling will be performed.
- B. Prior to proof rolling, the entire roadway subgrade shall have a relatively smooth surface, suitable for observing soil reaction during proof rolling.
- C. Provide a loaded tri-axle dump truck with a minimum gross weight of 30 tons.
- D. Proof rolling shall be accomplished in a series of traverses parallel to the centerline of the street or parking area. The truck shall traverse the length of the street or parking area once for each 12 feet of width. Additional passes may be directed by the Engineer.
- E. Soft areas, yielding areas, cracked areas, or areas where rolling or wave action is observed shall be considered indicative of unsatisfactory subgrade. Such areas shall be undercut, replaced with suitable fill material, and recompacted.
- F. Once the subgrade has been proof rolled and approved, protect the soils from becoming saturated, frozen, or adversely affected.

### 3.10 Subgrade Stabilization

- A. If ordered by the Engineer or if indicated in the Contract Documents, subgrade material that cannot be adequately compacted shall be removed and replaced with breaker run material and/or geotextile.
- B. The depth of the undercut, breaker run size, and/or geotextile requirement will be at the discretion of the Engineer.
- C. Unless otherwise indicated within the contract documents, subgrade stabilization with breaker run material will be paid for by the in-place cubic yard including excavation, furnishing and placement of breaker run material, and disposal of undercut material.

### 3.11 Geotextile Placement

- A. Clear area of sharp objects, stumps, and large stones that would puncture geotextile.
- B. Roll geotextile onto the subgrade by hand in the longitudinal direction. Overlap adjacent strips two feet.
- C. Back-dump aggregate onto the geotextile beginning at a point just before the fabric and on firm soil. No vehicular traffic will be allowed directly on the geotextile. Spread the aggregate with a bulldozer. The first lift shall be as thick as possible to prevent over-stressing of the subgrade.
- D. Take care during aggregate placement to prevent damage to the geotextile. Repair damages or tears by placing a piece of geotextile over the damaged area. Overlap the repair piece onto the undamaged area a minimum of three feet.
- E. Compaction: Perform initial compaction with bulldozers while spreading. Perform final compaction with a vibratory compactor, first without vibration for several passes, followed with vibration. Do not grade down ruts; fill with additional aggregate and compact.

### **3.12 Tolerances**

- A. Top Surface of Road Subgrade:
  - 1. Rough Grade: Plus or minus 0.25 ft.
  - 2. Finish Subgrade: Plus or minus 0.05 ft.
- B. Top Surface of General Grading: Plus or minus 0.1 ft.

### **3.13 Field Quality Control**

- A. Field inspection will be performed by an authorized representative of the Owner.
- B. Contractor is responsible for meeting the compaction requirements. The Contractor shall hire and pay for an independent testing firm to perform compaction tests to confirm the in-place density.
- C. For general grading perform one test per 9,000 square yards or part thereof of fill placed per lift. In addition, perform one test per building lot where fill is placed. For streets perform one test per 1,000 square yards or part thereof of fill placed per lift. Engineer or Owner's Representative will direct location of tests.
- D. Additional tests may be required if compaction requirements are not being met. The cost of these additional tests are the responsibility of the Contractor.
- E. Determination of moisture content shall be in accordance with ASTM D3017. Determination of density shall be in accordance with ASTM D2922.

### **3.14 Disposal**

- A. Dispose of all plant material off-site at a location meeting state landfill requirements.
- B. Burning at the site will not be permitted.
- C. Dispose of excess soil materials or unsuitable material off-site unless on-site disposal is indicated, or approved by Owner.

END OF SECTION

## SECTION 31 23 33

### UTILITY EXCAVATION, BACKFILLING AND COMPACTION

#### PART 1 – GENERAL

##### 1.01 Section Includes

- A. Excavation of trenches for below grade piping and conduit.
- B. Backfilling and compaction

##### 1.02 References

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregate.
- B. ASTM D1557 - Standard Test Methods Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3- C. ASTM D2487 - Classification of Soils for Engineering Purposes.</sup>

##### 1.03 Submittals

- A. Submit 50 lb. sample of off-site backfill materials.
- B. Submit gradation of select granular backfill.

#### PART 2 – PRODUCTS

##### 2.01 Materials

- A. Crushed Stone: Hard, durable particles of crushed stone or gravel substantially free from shale or lumps of clay or loam meeting the following gradation:

Crushed Stone Gradation	
Sieve Size	% Passing By Weight
2 Inch	100
1-1/2 Inch	90 - 100
1 Inch	35 - 70
3/4 Inch	0 - 15
1/2 Inch	0 - 5

- B. Trench Backfill: Natural soils, free of organic matter, trash, deleterious materials, stones larger than eight inches and frozen material and classified in ASTM D2487 as follows:

GW - Well-graded gravels, gravel-sand mixtures, little or no fines.  
GP - Poorly-graded gravels, gravel-sand mixtures, little or no fines.  
GM - Silty gravels, gravel-sand-silt mixtures.  
GC - Clayey gravels, gravel-sand-clay mixtures.  
SW - Well-graded sands, gravelly sands, little or no fines.  
SP - Poorly-graded sands, gravelly sands, little or no fines.  
SM - Silty sands, sand-silt mixture.  
SC - Clayey sands, sand-clay mixtures.  
ML - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.  
CL - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.

Soils classified in ASTM D2487 as follows are not acceptable:

OL - Organic silts and organic silty clays of low plasticity.  
MH - Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.  
CH - Inorganic clays of high plasticity, fat clays.

OH - Organic clays of medium to high plasticity, organic silts.  
 Pt - Peat and other highly organic soils.

- C. Select Granular Backfill: Durable particles ranging from fine to coarse in a substantially uniform combination. Sufficient fine material shall be present to fill all the voids of the coarse material. Some fine clay or loam particles are desirable, but they shall not be present in the form of lumps. Granular backfill shall conform to the following gradation:

Granular Backfill Gradation	
Sieve Size	% Passing By Weight
3 Inch	100
2 Inch	95 - 100
No. 4	35 - 60
Finer than No. 200	5 - 15

- D. Bedding: See individual specification sections.

**PART 3 – EXECUTION**

**3.01 Examination**

- A. Verify fill materials to be used are acceptable.

**3.02 Preparation**

- A. Identify required lines, levels, contours, and datum.
- B. Maintain and protect existing utilities remaining which pass through work area.
- C. Protect plant life, lawns, and other features remaining as a portion of the final landscaping.
- D. Protect benchmarks and existing features from excavation equipment and vehicular traffic.
- E. Protect above and below grade utilities which are to remain.
- F. Strip topsoil and stockpile on-site for reuse.
- G. When excavating across or within existing pavement, saw cut in neat straight lines.

**3.03 Minor Trench Water**

- A. Do not allow water to accumulate in the trench.
- B. Provide all equipment needed to accomplish the Work. Unless indicated otherwise, no additional compensation will be made for removing trench water.
- C. No additional compensation will be made for crushed stone used for trench drainage.
- D. Dispose of water in a suitable manner, and in accordance with regulations of the Wisconsin Department of Natural Resources, without damage to property.

**3.04 Excavation**

- A. Excavate subsoil to required depth and grade.
- B. Cut trenches sufficiently wide to enable installation of the utilities and allow inspection. Normal trench width below the top of the pipe shall be the nominal pipe diameter plus 24 inches.
- C. Do not undercut trench walls.
- D. Trench walls more than five feet in depth shall be shored, cut back to stable slope or provided with equivalent means of protection in accordance with the applicable rules of the Department of Labor, Occupational Safety and Health Administration (OSHA). Provide a ladder for trench exit in trenches

over four feet deep.

- E. Excess excavation below the required level shall be backfilled with crushed stone at the Contractor's expense.
- F. If the trench bottom is unstable due to soil material or groundwater conditions, an additional 3 inches shall be excavated and backfilled with crushed stone as specified in Part 2. There will be no extra payment for the additional excavation and stone. If it is necessary to excavate to a greater depth to provide a stable trench, the Contractor will be paid for the additional excavation and stone, if the extra excavation was ordered by the Engineer or approved by the Engineer prior to the work being performed.
- G. Remove ledge rock, boulders or large stones to provide a minimum clearance of 6 inches between the pipe and the rock. See Section on Rock Excavation, if included.
- H. Not more than 100 feet of trench shall be open ahead or behind the pipe laying. Additional trenching will not be allowed if earlier trenches have not been backfilled or if the trench surfaces are unsatisfactory.
- I. Utility contractor is responsible for the disposition of excess material resulting from the utility construction. Stockpile excess excavated material in areas designated on the Drawings. If stockpile areas are not designated on the Drawings, dispose of the material offsite.

### 3.05 Backfilling

- A. Backfill trenches with excavated material meeting the requirements for backfill specified in Part 2 above. Use select granular backfill only when indicated on the Drawings or elsewhere in the Project Manual.
- B. Backfill trenches to the rough subgrade elevation, plus or minus 0.25 ft.
- C. Place material in continuous layers not exceeding 8 inches compacted thickness. Compact each layer to the percent of maximum dry density as listed below in accordance with ASTM D1557.
- D. Compaction Requirements: Meet the following compaction requirements:

Compaction Requirements		
Area	Cohesive Soil	Granular Soil
Beneath Turf	85%	85%
Beneath Structures	90%	95%
Beneath Paving	90%	95%

- E. Maintain moisture content of backfill materials to attain required compaction density.

### 3.06 Restoration

- A. Remove excess excavation immediately after completion of backfilling.
- B. If site restoration is required, commence immediately after backfilling is completed.
- C. Maintain roadways in a driveable condition, acceptable to the Engineer, prior to pavement restoration.

### 3.07 Field Quality Control

- A. Field inspection will be performed by an authorized representative of the Owner.
- B. Contractor is responsible for meeting the compaction requirements. The Contractor shall hire an independent testing firm to perform compaction tests to confirm the in-place density.
- C. Testing Requirements: Four tests at various depths per 400 feet of trench. Engineer or Owner's Representative will direct the location of the tests.
- D. Additional tests may be required if compaction requirements are not being met. The cost of these

additional tests are the responsibility of the Contractor.

- E. Determination of moisture content shall be in accordance with ASTM D3017. Determination of density shall be in accordance with ASTM D2922.

END OF SECTION

**SECTION 31 37 16**

**RIPRAP**

**PART I - GENERAL**

**1.01 Section Includes**

- A. Furnishing and placing of stone riprap.
- B. Geotextile.

**1.02 References**

- A. ASTM D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
- B. ASTM D4751 - Test Method for Determining Apparent Opening Size of a Geotextile.
- C. ASTM D4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- D. State of Wisconsin Standard Specifications for Highway and Structure Construction, Current Edition (WIDOT).

**1.03 Submittals**

- A. Submit gradation for each riprap size to be used for the Work.

**PART 2 - PRODUCTS**

**2.01 Materials**

- A. Riprap: Durable field stone or quarry stone, sound, hard and free from seams or cracks. Stones shall be generally round or cubiform in shape with a weight of approximately 165 lbs/cf. Slabby or elongated pieces having a width or thickness less than one-third the length shall not exceed ten percent of the total. The riprap shall conform to the following gradations:

Gradation - Diameter in Inches				
Class	D <sub>Max</sub>	D <sub>50</sub>	D <sub>Min</sub>	WIDOT Equiv. Riprap
1	6	3	2	- - -
2	12	6	3	Light
3	18	9	5	Heavy
4	24	12	7	Extra Heavy

- B. Geotextile: A nonwoven fabric consisting of polypropylene, polyethylene, or polyamide. Fabric shall be resistant to insects, rodents, mildew and rot, and protected from UV degradation. Fabric shall meet the following minimum values:

Geotextile Requirements			
Property	Test Method	Requirements*	
		Riprap Class 1 & 2	Riprap Class 3 & 4
Grab tensile strength, lbs. min.	ASTM D4632	205	300
Elongation, percent min.	ASTM D4632	50	50
Puncture strength, lbs	ASTM D4833	500	800
Max. Apparent opening size, US Sieve	ASTM D 4751	No. 80	No. 100

\*Typical or average values

## **PART 3 - EXECUTION**

### **3.01 Geotextile Placement**

- A. Provide geotextile as required for the class of riprap to be installed.
- B. Remove stones or sharp objects from the subgrade that could damage the geotextile.
- C. Unroll geotextile directly on the prepared surface.
- D. Overlap adjacent sides and ends a minimum of two feet.
- E. Toe-in geotextile at top and bottom of slope.

### **3.02 Riprap Placement**

- A. Use riprap class indicated on Drawings.
- B. Place riprap from bottom to top.
- C. Provide a uniform distribution of the various size stones to produce a well-keyed mass.
- D. Place to the depth indicated on the Drawings.
- E. Do not drop stones from a height greater than one foot.

END OF SECTION

**SECTION 32 11 23**

**CRUSHED AGGREGATE BASE COURSE**

**PART 1 - GENERAL**

**1.01 Section Includes**

- A. Furnishing and placing crushed aggregate base course as a foundation for asphaltic concrete pavement or Portland cement concrete pavement.

**1.02 References**

- A. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregate.
- B. ASTM D1557 - Standard Test Methods Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- C. Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition (WisDOT).

**1.03 Submittals**

- A. Submit aggregate gradation; ASTM C136.
- B. Submit truck weight slips. Include as a minimum, truck number, date, time, gross weight, tare weight and net weight.

**PART 2 - PRODUCTS**

**2.01 Crushed Aggregate**

- A. Meet material requirements of WisDOT.
- B. Gradation
  - 1. Except for reclaimed asphaltic pavement, conform to the gradations listed in the following table:

Sieve Size	Percentage Passing By Weight		
	3-Inch Base	1 1/4-Inch Base	3/4-Inch Base
3-Inch	90 - 100	---	---
1 1/2-Inch	60 - 85	---	---
1 1/4-Inch	---	95 - 100	---
1-Inch	---	---	100
3/4-Inch	40 - 65	70 - 93	95 - 100
3/8-Inch	---	42 - 80	50 - 90
No. 4	15 - 40	25 - 63	35 - 70
No. 10	10 - 30	16 - 48	15 - 55
No. 40	5 - 20	8 - 28	10 - 35
No. 200	2 - 12	2 - 12 <sup>a, c</sup>	5 - 15 <sup>b</sup>

- a. Limited to a maximum of 8 percent in base course placed between new and old pavement.
- b. 8 - 15 percent passing when base is  $\geq$  50% crushed gravel.
- c. 4 - 10 percent passing when base is  $\geq$  50% crushed gravel.
- 2. Use 1 1/4-Inch Base in top 4 or more inches of base. Use 3-Inch Base or 1 1/4-Inch Base in the lower base layers.
- 3. Use 3/4-Inch Base in the top 3 inches of unpaved portion of the shoulder. Also, if using 3-Inch Base in the lower base layers, use 3/4-Inch Base in the top 3 inches of the shoulder foreslopes. Use 3/4-Inch Base or 1 1/4-Inch Base elsewhere in shoulders.

## **2.02 Reclaimed Asphaltic Pavement**

- A. If Contract Documents allow reclaimed asphaltic pavement, the material shall conform to the following:
  - 100 percent passing a 1 1/4-inch sieve.
  - 75 percent or less passing a No. 4 sieve.
  - Asphalt content between 3 and 6.5 percent.

## **PART 3 - EXECUTION**

### **3.01 Preparation**

- A. Check subgrade for conformity with grade and cross section.
- B. Remove depressions and ruts that may have been caused after subgrade completion.
- C. Proof-roll subgrade prior to placing aggregate with a loaded tandem-axle dump truck under the observance of the Engineer. Subgrade shall not rut or displace significantly under the weight of the loaded truck. Soft or unstable areas that cannot be improved by additional compaction shall be undercut, replaced with suitable fill material, and recompacted.

### **3.02 Lines and Grade**

- A. Construct the base course to the line, grade and cross section as shown on the Drawings or as directed by the Engineer.
- B. For streets without curb and gutter, the Engineer will provide grade stakes at a minimum distance of 50 feet along the centerline. For streets with curb and gutter, the Engineer will stake the curb and gutter and will provide centerline cuts and fills from the curb stakes. Provide Engineer with a minimum of 48 hours notice of the need for grade stakes.
- C. Contractor may use slope meters or GPS type controls on machines for grade control. However, the contractor is responsible for verifying the finish grade elevations with a level at a minimum of every 50 feet along the centerline.

### **3.03 Equipment**

- A. The weight, type, capacity and method of operation of all hauling and spreading equipment shall be appropriate for the work and shall not damage the subgrade or previously laid base course. Spreading equipment shall be designed and operated to spread the material in uniform layers without significant segregation.
- B. Motor graders used for mixing and shaping shall have weight, rigidity and design suitable for the work.
- C. Compaction equipment shall be of the rolling type, vibratory type or combination thereof. Tamping rollers shall exert a weight of not less than 150 pounds per square inch of tamping surface on each tamping foot in a transverse row. Pneumatic-tire rollers or other equipment shall have a weight of not less than 150 pounds per linear inch of overall rolling width.

### **3.04 Placing Base Course**

- A. Place material in a manner to minimize segregation and to facilitate spreading in a uniform layer.
- B. Place material in maximum 6-inch thick compacted layers. If material is placed in more than one layer, each layer shall be approximately the same thickness.
- C. Compact each layer to 95 percent of the maximum dry density in accordance with ASTM D1557. If material is deficient in moisture content for readily attaining the required density, moisten the material as necessary.
- D. All material placed on the subgrade or previous layer shall be spread, shaped and compacted on the same day.

### **3.05 Tolerances**

- A. Smoothness: Maximum variation of 3/8 inch when measured with a 10-foot straight edge.
- B. Compacted Thickness: Plus or minus 1/4 inch.

### **3.06 Proof Rolling**

- A. Proof roll the completed base course with a loaded tandem-axle dump truck. The surface shall not rut, displace, or roll under the weight of the loaded truck. Soft or unstable areas that cannot be improved by additional compaction shall be replaced and recompact. Proof rolling shall be done in the presence of the Engineer.

### **3.07 Field Quality Control**

- A. Contractor is responsible for meeting the compaction requirements. The Engineer or authorized representative of the owner has the option to require the Contractor to hire an independent testing firm, at the Contractor's expense, to perform compaction tests to confirm the in-place density.
- B. Field inspection will be performed by the Engineer or an authorized representative of the Owner.
- C. Determination of moisture content shall be in accordance with ASTM D3017. Determination of density shall be in accordance with ASTM D2922.
- D. If tests indicate the work does not meet the specified requirements, remove and replace the work.

END OF SECTION

## SECTION 32 12 16

### ASPHALTIC CONCRETE PAVEMENT

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Construction of a one or two course asphaltic concrete pavement to the thickness and cross-section indicated on the Drawings or in the written Bid Documents.
- B. Provide the mix indicated on the Drawings or in the written Bid Documents.

##### 1.02 References

- A. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition (WIDOT).

##### 1.03 Submittals

- A. Preconstruction Submittals
  - 1. Submit mix design, meeting all necessary criteria for all mixtures to be used on the project. Conduct the mix design in accordance with WIDOT 460.
- B. Construction Submittals:
  - 1. Submit density testing records.
  - 2. Submit truck weight slips.

##### 1.04 Quality Assurance

- A. Qualifications of Asphalt Producer: Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in the production of hot-mix, hot-laid asphalt concrete.
- B. Qualifications of Testing Agency: Use only recognized commercial-testing laboratory experienced in testing asphalt concrete materials.

##### 1.05 Job Conditions

- A. Weather Limitations
  - 1. Asphalt concrete surface course material shall not be placed during the calendar period between October 15th and May 1st except with written approval of Engineer.
  - 2. Asphalt concrete material shall not be placed when air temperature is less than 35°F as measured 3 feet above the ground in the shade and away from the effects of artificial heat.
  - 3. Asphalt concrete materials shall not be placed on frozen or excessively wet base course or when it is raining.
- B. Traffic Control
  - 1. Maintain vehicular and pedestrian traffic during paving operations as required for other construction activities.
  - 2. Provide flagmen, barricades, warning signs and lights as needed to provide for safety and movement of traffic.

## PART 2 - PRODUCTS

### 2.01 Asphaltic Mixture Design

- A. Conduct the asphaltic mixture design in accordance with WIDOT Table 460-2. Mixture requirements are as follows:

Mixture Type	E - 0.3	E - 1	E - 3
ESALs x 10 <sup>6</sup> (20 yr design life)	<0.3	0.3 - <1	1 - <3
LA Wear (AASHTO T 96)			
100 revolutions (max % loss)	13	13	13
500 revolutions (max % loss)	50	50	45
Soundness (AASHTO T 104) (sodium sulfate, max % loss)	12	12	12
Freeze/Thaw (AASHTO T 103) (specified counties, max % loss)	18	18	18
Fractured Faces (ASTM D5821) (one face/2 face, % by count)	60 / ___	60 / ___	75 / 60
Thin or elongated (ASTM D4791) (max % by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)
Fine Aggregate Angularity (AASHTO T 304, Method A, min)	40	40	43
Sand Equivalency (AASHTO T 176, min)	40	40	40
Gyratory Compaction			
Gyrations for N <sub>ini</sub>	6	7	7
Gyrations for N <sub>des</sub>	40	60	75
Gyrations for N <sub>max</sub>	60	75	115
Air Voids, %V <sub>a</sub>	4.0	4.0	4.0
% G <sub>mm</sub> @ N <sub>des</sub>	96.0	96.0	96.0
% G <sub>mm</sub> @ N <sub>ini</sub>	<91.5 <sup>(1)</sup>	<90.5 <sup>(1)</sup>	<89.0 <sup>(1)</sup>
% G <sub>mm</sub> @ N <sub>max</sub>	≤98.0	≤98.0	≤98.0
Dust to Binder Ratio <sup>(2)</sup> (% passing 0.075/P <sub>be</sub> )	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2
Voids filled with Binder (VFB or VFA, %)	70 - 80 (4) (5)	65 - 78 (4)	65 - 75 (4)
Tensile Strength Ratio - TSR (ASTM D4867)			
no antistripping agent	0.70	0.70	0.70
with antistripping agent	0.75	0.75	0.75
Draindown at Production Temperature (%)	-----	-----	-----

- (1) The Percent maximum density at initial compaction is only a guideline.  
(2) For a gradation that passes below the boundaries of the caution zone (ref. AASHTO MP3), the dust to binder ratio limits are 0.6 - 1.6.  
(3) For 3/8" nominal maximum size mixtures, the specified VFB range is 73 - 76%.  
(4) For 1 1/2" nominal maximum size mixtures, the specified VFB lower limit is 67%.  
(5) For 1" nominal maximum size mixtures, the specified VFB lower limit is 67%.

### 2.02 Aggregate

- A. Provide aggregate conforming to WIDOT Table 460-1. Aggregates shall consist of hard durable particles and shall not contain more than a combined total of one percent, by mass, of lumps of clay, loam, shale, soft particles, organic matter, adherent coatings, and other deleterious matter. The composite aggregates shall conform to the requirements of the Mixture Requirements Table and the Aggregate Gradation Table.

Aggregate Gradation Percent Passing By Weight				
Sieve Size	1-Inch	3/4-Inch	1/2-Inch	3/8-Inch
1-1/2 Inch	100	---	---	---
1 Inch	90 - 100	100	---	---
3/4 Inch	90 max	90 - 100	100	---
1/2 Inch	---	90 max	90 - 100	100
3/8 Inch	---	---	90 max	90 - 100
No. 4	---	---	---	90 max
No. 8	19 - 45	23 - 49	28 - 58	20 - 65
No. 200	1 - 7	2 - 8	2 - 10	2 - 10
% Min VMA	12.0	13.0	14.0	15.0

- B. Unless otherwise designated in the contract, the nominal size of aggregate used in the mixture shall conform to the following:

Pavement Thickness	Aggregate Size	
	Binder	Surface
3"	1/2"	1/2"
3 1/2"	1/2"	1/2"
4"	3/4"	1/2"
4 1/2"	3/4"	1/2"
5"	3/4"	1/2"

### 2.03 Asphalt Cement

- A. [PG 58-28] [PG 64-22] *Note to Engineer: Use PG 64-22 for higher volume roads.*
- B. Tack Cost: Emulsified asphalt - Grade SS-1; WIDOT 455.

## PART 3 - EXECUTION

### 3.01 Lines and Grade

- A. Lines and grade shall be as shown on the drawings or as given by the Engineer.
- B. When curb & gutter is in place, the Contractor shall use the curb & gutter for line and grade.
- C. Parking lots will be staked as required.

### 3.02 Surface Preparation

- A. Proof Roll
1. Proof-roll prepared base surface using heavy rubber-tired roller or loaded tandem-axle dump truck under the observance of the Engineer. Aggregate surface shall not rut or displace significantly under the weight of the equipment. Soft or unstable areas that cannot be improved by additional compaction shall be undercut, replace with suitable fill material, and recompact.
  2. Do not begin paving until necessary corrections are made.
- B. Loose and Foreign Material
1. Remove loose and foreign materials from compacted base or old surface course immediately before paving.
  2. Use power brooms or blowers and hand brooming as required.
- C. Tack Coat
1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or Portland cement concrete and similar surfaces.
  2. Apply at a rate of 0.025 gallons per square yard of surface with a power distributor.
  3. Apply only when air temperature is 36° F or higher.
  4. Apply tack coat by brush to contact surfaces of curbs, gutters, manholes and other structures projecting into or abutting asphalt concrete pavement.

- D. Existing Pavement Correction
  1. Fill potholes, sags and depressions.
  2. Material may be placed by hand.

**3.03 Frame Adjustments**

- A. Set frames of subsurface structures to final grade. Covers shall be 1/2 inch below surface of adjacent pavement.

**3.04 Preparing the Mixture**

- A. Comply with applicable sections of WIDOT 450 for material storage, control, mixing and for plant equipment and operation.

**3.05 Equipment**

- A. Provide size and quantity of equipment to complete the work specified within the project time schedule.
- B. Paving shall be placed with a self-propelled spreading and finishing machine that spreads the hot-asphalt concrete mixture without tearing, shoving or gouging the surface and that controls pavement edges to true lines without use of stationary forms.
- C. Rolling equipment shall be self-propelled steel-wheel rollers of the three-wheel, tandem or three-axle tandem type. Three-wheel and tandem rollers shall be rated at not less than 8 tons. Three-axle tandem rollers shall be rated at not less than 12 tons.

**3.06 Placing the Mix**

- A. Do not place asphaltic mixture when the air temperature approximately three feet above grade, in shade, and away from artificial heat source is less than 36°F.
- B. Place asphalt concrete mixture on prepared surface, spread and strike off using paving machine.
- C. Spread mixture at a temperature between 250°F and 350°F.
- D. Inaccessible and small areas may be placed by hand.
- E. Place each course at thickness so that when compacted, it will conform to the indicated grade cross section, finish thickness and density specified.
- F. Compacted Thickness of Individual Layers:

Pavement Thickness	Layer Thickness	
	Binder	Surface
3"	1 1/2"	1 1/2"
3 1/2"	1 3/4"	1 3/4"
4"	2 1/4"	1 3/4"
4 1/2"	2 3/4"	1 3/4"
5"	3"	2"

- G. Paver Placing
  1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section and at high side of sections on one-way slope and in direction of traffic flow.
  2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
  3. Complete binder course for a section before placing surface course.
- H. Hand Placing
  1. Spread, tamp and finish mixture using hand tools in areas where machine spreading is not possible.
  2. Place mixture at a rate that will ensure handling and compaction before mixture becomes cooler than acceptable working temperature.

- I. Joints
  - 1. Carefully make joints between old and new pavements or successive day's work to ensure a continuous bond between adjoining work.
  - 2. Clean contact surfaces free of sand, dirt or other objectionable material, and apply tack coat.
  - 3. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.

### **3.07 Compacting the Mix**

- A. While the mixture is still hot, compact thoroughly and uniformly by rolling. Provide sufficient number of rollers to obtain the required density and accomplish the rolling.
- B. Begin rolling operations as soon after placing as the mixture will bear weight of roller without excessive displacement.
- C. Do not permit heavy equipment, including rollers, to stand on finished surface before it has thoroughly cooled or set.
- D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.
- F. Do not roll centers of sections first.
- G. Breakdown Rolling
  - 1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
  - 2. Check crown grade and smoothness after breakdown rolling.
  - 3. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.
- H. Second Rolling
  - 1. Follow breakdown rolling as soon as possible while mixture is hot and in condition for compaction.
  - 2. Continue second rolling until mixture has been thoroughly compacted.
- I. Finish Rolling
  - 1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
  - 2. Continue rolling until roller marks are eliminated and course has attained specified density.

### **3.08 Pavement Density**

- A. Pavements shall be built with the Maximum Density Method, WIDOT 460.3.3, unless otherwise specified.
- B. Ordinary Compaction: Compact leveling, wedging, patching layers, driveways, and other non-traffic areas to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment. Comply with WIDOT 450.3.2.6.
- C. Maximum Density Method: All courses or layers thereof of plant mixed asphaltic mixtures for which the Maximum Density Method is used shall be compacted to a density not less than the percentage shown in the Table of Maximum Required Density, WIDOT Table 560-3, for the applicable mixture and course.

### **3.09 Pavement Density Determination**

- A. General
  - 1. Density testing shall be performed by an independent testing firm, hired by the contractor or by a trained and qualified employee of the Contractor if approved by the Engineer. Densities may be determined on the basis of cored/sawed holes or nuclear methods.
  - 2. Density determination will be made as soon as practical after placement and compaction and prior to placement of subsequent layers. Do not re-roll compacted mixtures represented by samples or tests having deficient densities. Do not operate below the specified maximum

- density on a continuing basis. Stop production until the source of the problem is determined and corrected.
3. A lot shall represent 750 tons of a mixture, or the quantity placed in one day if less than 750 tons, for each density requirement. Densities of binder and surface course mixtures shall be determined on the basis of nuclear methods. Random testing locations will be established by the Engineer.
- B. Tests: Five random tests will be taken on each lot. The lot density shall be the average of all samples taken.
- C. Compact all layers to the percent of the target maximum density as shown in the following table.

Minimum Required Density <sup>(1)</sup>			
Location	Layer	% of Target Maximum Density	
		Mixture Type	
		E-0.3, E-1, E-3	E-10, E-30
Traffic Lanes <sup>(2)</sup>	Lower	91.5 <sup>(3)</sup>	92.0 <sup>(3)</sup>
	Upper	91.5	92.0
Shoulders and Appurtenances	Lower	89.5	89.5
	Upper	90.5	90.5

- (1) The table values are for lot density. If any individual test result falls below 88% of the target maximum density, the engineer may investigate the acceptability of that material.
- (2) Includes parking lanes as determined by engineer.
- (3) Minimum reduced by 2% for <3 million ESAL's and 1% for >3 million ESAL's, when the first lift of lower layer constructed on crushed aggregate or recycled base courses.

- D. Density Deficiency: When the density of a lot of compacted binder or surface course is less than the specified minimum, payment will be adjusted in accordance with the following table:

Adjusted Payment Schedule	
Percent Lot Density Below Specified Minimum	Percent of Contract Price
From 0.5 to 1.0 inclusive	98
From 1.1 to 1.5 inclusive	95
From 1.6 to 2.0 inclusive	91
From 2.1 to 2.5 inclusive	85
From 2.6 to 3.0 inclusive	70
More than 3.0	*

- \* The lot shall be removed and replaced with a mixture at the specified density and, when acceptably replaced, will be paid for at the contract price; or the engineer may permit the unacceptable material to remain in place with a 50 percent reduction in payment..

### 3.10 Surface and Thickness Requirements

- A. Surface Requirements
1. Provide final surface of uniform texture conforming to required grade and cross-section.
  2. Test finished surface of each asphalt concrete course for smoothness using a 10-foot straightedge applied parallel to and at right angles to centerline of paved area.
  3. Check surface areas at intervals directed by Engineer.
    - a. Binder course: 1/4 inch in 10 feet.
    - b. Surface course: 1/4 inch in 10 feet.
- B. Thickness Requirements
1. If the Engineer believes that the thickness of the compacted base or surface course is not at the specified thickness, the Contractor may be required to obtain 4-inch diameter samples to verify the thickness. The samples shall be obtained by sawing or coring and all sample holes shall be repaired with fresh mix and compacted.
  2. If the thickness is not as specified it will be the Engineer's option to adjust the contract price, require an overlay, or require some other remedial action.

### **3.11 Patching**

- A. Remove and replace defective areas.
  - 1. Cut out and fill with fresh hot-asphalt concrete.
  - 2. Compact by rolling to specified density and surface smoothness.
  - 3. Remove deficient areas for full depth of course.
  - 4. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
  - 5. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

### **3.12 Cleaning and Protection**

- A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened and, in no case, sooner than 6 hours.
- B. Provide barricades and warning devices as required to protect pavement and the general public.

END OF SECTION

## SECTION 32 92 19

### SOIL PREPARATION AND SEEDING

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Fertilizer.
- D. Seeding.
- E. Mulching.

##### 1.02 Quality Assurance

- A. Comply with requirements of state regulations regarding grass seed and fertilizer.
- B. Fertilizer
  - 1. Each container shall be plainly marked with the analysis of the contents showing the minimum percentages of total nitrogen, available phosphorous and soluble potash. Containers or packages shall be new and unopened.
  - 2. When furnished in bulk, each shipment shall be accompanied by an invoice indicating minimum percentages of the contents listed above.
- C. Seed
  - 1. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging and location of packaging. Containers or packages shall be new and unopened.
  - 2. Seed shall not be used later than one year later than the test date appearing on the label.
  - 3. Sampling and testing of seed for purity, germination and weed seed content shall be in accordance with "Rules for Testing Seed" published by the Association of Official Seed Analysts.

##### 1.03 Submittals

- A. Submit composition of fertilizer and seed mixture.
- B. Submit, upon request, manufacturer's certification that materials meet specification requirements.
- C. Submit, upon request, results of seed purity and germination tests.
- D. Submit topsoil test results for all topsoil borrow.

#### PART 2 - PRODUCTS

##### 2.01 Topsoil

- A. Provide reclaimed topsoil from the site unless the contract documents require topsoil borrow.
- B. Reclaimed Topsoil: Topsoil stripped from the site consisting of loam, sandy loam, silt loam, or silty-clay loam, or clay loam, humus-bearing soil, adapted to sustaining plant life. The soil shall be free of subsoil, foreign matter, plant material, objects larger than one inch in any dimension, and toxic or other substances harmful to plant growth.
- C. Topsoil Borrow: Topsoil from offsite consisting of natural loam, sandy loam, silt loam, or silty-clay loam, or clay loam, humus-bearing soil, adapted to sustaining plant life. The soil shall be free of subsoil, foreign matter, plant material, objects larger than one inch in any dimension, and toxic or other substances harmful to plant growth. The soil shall have a pH range of 5.5 to 8.0 and a maximum soluble salt level of 500 PPM. Topsoil originating from agricultural fields shall be free of

residual herbicide and other contaminants.

## 2.02 Fertilizer

- A. Standard commercial fertilizer with the following available nutrients by weight:
1. Nitrogen - not less than 10%.
  2. Phosphoric Acid - not less than 10%
  3. Potash - not less than 10%

## 2.03 Seed

- A. Seed mixtures shall be Olds Seeds or equal of grass species and varieties, proportions by weight, and minimum percentages of purity and germination as indicated in the following schedule.

Species	Purity Min. %	Germination Min. %	Quick-2-Gro	Survivor	Boulevard	Wear-n-Tear
Kentucky Bluegrass	98	85	25	15		50
Creeping Red Fescue	97	85	25	30	25	10
Turf Type Tall Fescue	98	85		40	25	
Fine Fescue	97	85				
Dawson Red Fescue	97	85				
Perennial Ryegrass	97	85	25	15	25	40
Annual Ryegrass	97	90	25			
Alkaligrass	98	85			25	

Unless otherwise provided in the Contract Documents, the selection of seed mixtures shall be as follows:

1. Quick-2-Gro: Use for general seeding within new subdivisions.
2. Survivor: Use for seeding lawns where soils are light and sandy.
3. Wear-n-Tear: Use for seeding lawns where soils are loam or clay.
4. Boulevard: Use for boulevard areas behind curb to sidewalk or ROW, from shoulder to ROW on rural section roads, and street or parking lot islands.

## 2.04 Mulch Materials

- A. Hay: Straw or hay in air-dry condition substantially free from noxious weed seeds or objectionable foreign matter.
- B. Paper Fiber: Mulch consisting of recycled newsprint fibers, wetting agent, deforming agent and green dye with a dry moisture content of 9 to 15 percent.
- C. Wood Cellulose: Wood cellulose fibers manufactured from virgin wood fibers that form a blotter-like ground cover that readily absorbs water and allows infiltration to the underlying soil. Moisture content shall not exceed 15 percent at the time of delivery. The mulch shall be dyed green and shall have the property of becoming dispersed and suspended when agitated in water.
- D. Erosion Control Revegetative Mat: A light duty, organic, non-netted mat with a minimum thickness of 3/8 inch and biodegradable yarn or glue on 12 inch maximum centers in the longitudinal direction. The mat shall be capable of withstanding moderate foot traffic without tearing or puncturing. Acceptable products are those listed in the Wisconsin Department of Transportation, Erosion Control Product Acceptability Lists for Class I, Type Urban mats. Anchoring devices shall be biodegradable, non-splintering and shall last for at least two months and shall substantially degrade in four months.

## 2.05 Tackifiers

- A. Latex-Base: A latex emulsion polymer with a composition by weight of 48 percent styrene, 50 percent butadiene and 2 percent additive; 42 to 46 percent solids; and a pH of 8.5 to 10.
- B. Guar Gum: Guar gum tackifiers consisting of a minimum of 95 percent Guar gum by weight with the remaining consisting of dispersing and cross-linking additives.

- C. Other: Water soluble natural vegetable gums or guar gums blended with gelling and hardening agents or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids and other gums.

**PART 3 - EXECUTION**

**3.01 Inspection**

- A. Examine area to receive soil preparation to ensure subsoil is ready for finish grading.
- B. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

**3.02 Preparation of Subsoil**

- A. Eliminate uneven areas or low spots. Make changes in gradual and blend slopes into level areas.
- B. Do not prepare or place frozen soils or soils with excessive moisture.
- C. Remove weeds, roots, trash, debris, concrete, asphalt, crushed aggregate, and any stones larger than two inches in any dimension.
- D. Scarify subsoil to a depth of three inches.

**3.03 Placing of Topsoil**

- A. Spread topsoil evenly to a compacted depth of four inches.
- B. Place during dry weather.
- C. Grade to eliminate rough or low areas and to ensure positive drainage. Grading shall be approved by the Engineer.
- D. Remove stones and other objects larger than one inch in any dimension.

**3.04 Fertilizing**

- A. Apply fertilizer at a rate of seven pounds per 1000 square feet.
- B. Apply fertilizer uniformly, incorporating it into the soil by light disking or harrowing.
- C. Apply fertilizer prior to seeding.

**3.05 Seeding**

- A. Do not sow seed on frozen soil or when wind exceeds 5 MPH.
- B. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- C. Seeding Dates:
  1. Spring/Summer: April 1 to August 14.
  2. Fall: August 15 to October 1.

- D. Application Rate:

Application Rate	
Mixture	Lbs/1000 Sq. Ft.
Quick-2-Gro	5 - 6
Survivor	5 - 6
Wear-n-Tear	4 - 5
Boulevard	5 - 6

- E. Broadcasting

1. Sow seed evenly with a spreader or seeding machine.
2. Do not broadcast or drop seed when wind velocity exceeds 5 MPH.
3. Broadcast one half of seed.
4. Broadcast remaining half of seed at right angles to first seed pattern.

5. Cover seed to a depth of 1/4" by raking, dragging or cultipacting.
6. Roll seeded area with roller weighing a maximum of 150 pounds per foot of roller width.
7. Water seeded area with fine spray, if required, to promote growth.

F. Drilling

1. Drill seed following elevation contours.
2. Seed to uniform depth.
3. Roll seeded area with roller weighing a maximum of 150 pounds per foot of roller width.
4. Water seeded area with fine spray, if required, to promote growth.

**3.06 Mulching**

- A. Place mulch on same day that the area is seeded.
- B. Do not place straw or hay mulch or sprayed-on mulches during periods of high wind.
- C. Mulch type and method is the Contractor's option unless a specific type or method is indicated on the Drawings or in the Contract Documents.
- D. Hay/Straw Mulch
  1. Method 1 - Spread straw or hay treated with a tackifier over the area using a blowing machine. Spread the material uniformly to a depth of 1/2 to 1 inch using 1 1/2 to 3 tons of material per acre. The amount of tackifier used shall be in accordance with the manufacturer's recommendations.
  2. Method 2 - Spread hay or straw over the area by hand or using a blowing machine. Spread the material uniformly to a depth of 1/2 to 1 1/2 inch using 1 1/2 to 3 tons of material per acre. Immediately after spreading, anchor the mulch into the soil using a mulch tiller.
- E. Paper Fiber: Apply with hydraulic spray equipment in a water slurry at the rate necessary to provide a 1/4 inch layer. Use the color of the material as a metering agent. Take care not to spray material on adjacent surfaces.
- F. Wood Cellulose: Apply with hydraulic spray equipment in a water slurry at the rate of 1500 pounds per acre. Use the color of the material as a metering agent. Take care not to spray material on adjacent surfaces.
- G. Mat: Remove all clods, stones or other materials that could damage the mat. Place mat over seeded area without overlapping. Anchor mat in accordance with the manufacturer's recommendations.

**3.07 Establishment**

- A. Establishment Period:
  1. For areas seeded during the spring or summer planting season the establishment period shall be 90 days.
  2. For areas seeded during the fall planting season the establishment period shall be through June 1 of the following year.
- B. Acceptable Establishment: At the end of the establishment period the grass shall be healthy, uniform in density and color, and substantially free of weeds with uniform coverage of at least 70 percent of a representative one square yard plot and bare spots not exceeding 6 inches by 6 inches.
- C. Re-seed areas that fail to grow an acceptable stand of grass.

**3.08 Protection**

- A. Protect all seeded areas, as necessary, to prevent trampling and/or damage by erecting temporary fences, barriers, signs, etc.

END OF SECTION

## SECTION 33 05 26

### TRACER WIRE

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Furnishing and installation of tracer wire and accessories for non-metallic sewer laterals, force main, and water main.

##### 1.02 Related Sections

- A. Section 33 05 23.12 - Directional Boring.
- B. Section 33 11 13 - Water Main Construction.
- C. Section 33 31 00 - Sanitary Sewer Construction.
- D. Section 33 33 13 - Pressure Sewer.
- E. Section 33 34 00 - Force Main.
- F. Section 33 41 13 - Storm Sewer Construction.

#### PART 2 - PRODUCTS

##### 2.01 Wire

- A. No. 12 AWG PVC coated copper conductor rated for wet conditions.
- B. Color:
  - 1. Water Main - Blue.
  - 2. Sanitary Sewer Main/Laterals - Green.
  - 3. Sewer Force Main - Green.
  - 4. Storm Sewer - Brown.

##### 2.02 Terminal Box

- A. Type A: Cast iron rim and lid, ABS plastic body with 2 ½-inch shaft and flared base, terminal blocks on lid, 24" length, lid marked water; Bingham & Taylor P200NFG or equal.
- B. Type B: Cast iron valve box top, approximate length of 24 inches, lid marked sewer or water.
- C. Unless otherwise noted within the Contract Documents, use Type A for terminal boxes located within turf areas, sidewalks, or driveways and Type B for terminal boxes located within street paving.

##### 2.03 Accessories

- A. Connectors: Water tight connectors designed for electrical continuity.

#### PART 3 - EXECUTION

##### 3.01 Installation - General

- A. Tracer wire shall be installed in the same trench, inside bore holes, and inside casing with pipe during the pipe installation.
- B. Tracer wire shall be laid flat on the top of the pipe and taped to the pipe at minimum 10-ft. intervals.
- C. The wire shall be protected from damage during installation of the pipe. No breaks or cuts in the tracer wire or wire insulation shall be permitted.

- D. Tracer wire shall be continuous as much as possible. Where splices are necessary use connectors. Soldering or twisted wires are not allowed.
- E. At the point of connection to cast or ductile iron pipe, the tracer wire shall be connected to the pipe by cad welding. The connection shall be completely sealed with a mastic manufactured for underground use.
- F. For laterals, the single tracer wire shall be connected to the main line tracer wire with a connector.
- G. Bring the wire to the surface at maximum intervals of 500 feet or as shown on the Drawings. Wires shall terminate within a terminal box. Provide an extra 18 inches of wire at the termination point.
- H. For directional drilling, auguring, or boring installations two tracer wires shall be installed.

### **3.02 Testing**

- A. Contractor shall perform a continuity test on all tracer wire in the presence of the Engineer. If the tracer wire is found to be not continuous, Contractor shall repair the failed segment at his own expense.

### **3.03 Measurement and Payment**

- A. Unless otherwise indicated within the Contract Documents, furnishing and installation of tracer wire is incidental to the Work.
- B. Terminal boxes will be paid for at the Bid Price. If a Bid Item for terminal boxes is not included on the Bid Form, the furnishing and installation is incidental to the Work.

END OF SECTION

**SECTION 33 31 00**  
**SANITARY SEWER CONSTRUCTION**

**PART 1 - GENERAL**

**1.01 Section Includes**

- A. Furnishing, installation, and testing of sanitary sewers.
- B. Furnishing and installation of service laterals.

**1.02 Related Sections**

- A. Section 31 23 33 - Utility Excavation, Backfill and Compaction.
- B. Section 33 05 26 - Tracer Wire.
- C. Section 33 39 13 - Sewer Manholes.

**1.03 References**

- A. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- B. ASTM A746 - Ductile Iron Gravity Sewer Pipe.
- C. ASTM C12 - Installing Vitrified Clay Pipe Lines.
- D. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- E. ASTM D698 - Test Methods for Moisture - Density Relations of Soil and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12-inch (304.8 mm) Drop.
- F. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- G. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- H. ASTM D2487 - Clarification of Soils for Engineering Purposes.
- I. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- J. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- K. ASTM D2855 - Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- L. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- M. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- N. ASTM F402 - Safe Handling of Solvent Cements Used for Joining Thermoplastic Pipe and Fittings.
- O. ASTM F679 - Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
- P. ASTM F1417 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
- Q. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- R. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids.
- S. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch, for Water Distribution

#### **1.04 Submittals**

- A. Submit manufacturers' product literature for pipe, joints, and fittings.
- B. Submit as-built measurements.

#### **1.05 Quality Assurance**

- A. All pipes and fittings shall be new and unused.
- B. Each length of pipe shall be clearly marked with the manufacturer's name, the type of pipe, and the pipe class.
- C. Provide at least one person thoroughly trained and experienced in the skills required, who shall be completely familiar with the work described in this section, who shall be present at all times during progress of the work of this section, and who shall direct all work performed under this section.
- D. Infiltration/exfiltration testing required.
- E. Deflection testing of PVC pipe required.

### **PART 2 - PRODUCTS**

#### **2.01 Sewer Pipe**

- A. PVC
  - 1. 15" Diameter and Less: ASTM D3034, SDR-35.
  - 2. 18" Diameter and Greater: ASTM F679, SDR-35.
  - 3. Elastomeric joints, ASTM D3212, approved by the Wisconsin Department of Natural Resources.
- B. Ductile Iron: ASTM A746 or AWWA C151, Class 50; cement-mortar lined; mechanical joints or push-on joints, AWWA C111.

#### **2.02 Sewer Pipe - Water Main Quality**

- A. Use only when indicated on Drawings.
- B. Ductile Iron: AWWA C151, Class 52; cement-mortar lining; ASTM C104; with flexible restrained joints capable of being deflected 4 degrees after assembly. Provide Griffin Snap-Lok pipe or equal.
- C. PVC: AWWA C900, Class 150 (DR-18) with cast iron O.D.; rubber gasket joints.

#### **2.03 Service Laterals**

- A. PVC: ASTM D3034, SDR-35, ASTM D2665 or ASTM D1785, Schedule 40; elastomeric joints, ASTM D3212 or solvent cement.
- B. Cast Iron Soil Pipe: ASTM A74, service weight; elastomeric joints, ASTM C564.

#### **2.05 Bedding and Cover Material - Rigid Pipe (Ductile Iron and Cast Iron)**

- A. Bedding

1. Class B - Crushed Stone: Hard durable particles of crushed stone or gravel, free from shale and lumps of clay or loam, conforming to the following gradation:

Sieve Size	% Passing By Weight
1"	100
3/4"	90 - 100
3/8"	20 -55
No. 4	0 - 10
No. 8	0 - 5
No. 200	0 - 5

2. Class C - Excavated soils listed in ASTM D2487 as the following are acceptable:

GW - Well-graded gravels, gravel-sand mixtures, little or no fines.  
 GP - Poorly-graded gravels, gravel-sand mixtures, little or no fines.  
 GM - Silty gravels, gravel-sand-silt mixtures.  
 GC - Clayey gravels, gravel-sand-clay mixtures.  
 SW - Well-graded sands, gravelly sands, little or no fines.  
 SP - Poorly-graded sands, gravelly sands, little or no fines.  
 SM - Silty sands, sand-silt mixture.  
 SC - Clayey sands, sand-clay mixtures.

Excavated soils listed in ASTM D2487 as the following are not acceptable:

ML - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.  
 CL - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.  
 OL - Organic silts and organic silty clays of low plasticity.  
 MH - Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.  
 CH - Inorganic clays of high plasticity, fat clays.  
 OH - Organic clays of medium to high plasticity, organic silts.  
 Pt - Peat and other highly organic soils.

If excavated material is unsuitable, use Class B material.

- B. Cover: Cover material shall be finely divided material free of debris, organic material and large stones.

## 2.06 Bedding and Cover Material - Flexible Pipe (PVC)

- A. Bedding and Cover: Provide offsite bedding and cover material meeting the requirements of ASTM D2321, Class IA, IB, II or III material, which materials are described as follows:

1. Class IA - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1"	100
3/4"	90 - 100
3/8"	20 -55
No. 4	0 - 10
No. 8	0 - 5

2. Class IB - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1/2"	100
3/8"	85 - 100
No. 4	10 - 30
No. 200	0 - 5

3. Class II - Clean coarse-grained soils with 100% passing the 1-1/2" sieve and less than 5% passing the No. 200 sieve. Generally including sands, gravels, and sand-gravel mixtures with little or no fines. ASTM D2487 Soil Types GW, GP, SW and SP are included in this class.
4. Class III - Coarse-grained soils with fines with 100% passing the 1-1/2" sieve and 12% - 50% passing the No. 200 sieve. Generally includes silty or clayey sands, gravels, or sand-gravel mixtures. ASTM D2487 Soils Types GM, GC, SM and SC, are included in this class.
5. If the excavated material conforms to one of the bedding classes, it may be used for bedding.

## **PART 3 - EXECUTION**

### **3.01 Lines and Grades**

- A. The use of a laser beam for maintaining line and grade is required unless other methods are approved by the Engineer or Owner's Representative. Check elevations of all sewers with a level every 50 feet where the grades are equal to or less than one percent and every 100 feet where the grades are greater than one percent.
- B. A person qualified to operate the equipment shall be present when the laser is in use.

### **3.02 Handling of Pipe**

- A. All pipes and accessories shall be handled with care to avoid damage. Pipe and accessories shall not be dropped or dumped.
- B. All material found to have cracks or flaws shall be removed from the job site.
- C. Contractor is responsible for arranging suitable sites for material storage.

### **3.03 Laying Pipe**

- A. Lay pipe uniformly to line and grade so that the finished sewer will have a smooth and uniform invert. Noticeable variations from true alignment and grade will be sufficient cause for the rejection of the work.
- B. Proceed upgrade, with the spigot ends pointing in the direction of flow.
- C. Pipe shall be laid so that each pipe rests on the full length of its barrel.
- D. Do not lay next pipe until previous pipe is backfilled sufficiently to prevent movement.
- E. All pipe laid in trenches shall have a minimum clearance of 6 inches for rigid pipe and 12 inches for flexible pipe between the outside face of the pipe and the trench wall.
- F. For flexible pipe do not disturb the installed pipe and its embedment when using movable trench boxes. If the box extends below the cover material, use methods to assure that the integrity of the embedment is maintained when the box is moved.
- G. Keep interior of the pipe clean and dry. Water shall not be allowed in the trench while pipe is being laid. When work is stopped, securely plug the end of the pipe.
- H. Joining Pipe: Assemble joints in accordance with the pipe manufacturer's instructions. Solvent cements shall meet ASTM D2564 as applicable. Make PVC solvent cement joints in accordance with ASTM D2855. Handle solvent cements in accordance with ASTM F402.
- I. Trench excavations shall be fully completed a sufficient distance in advance of the laying of the sewer, and the exposed end of all pipes shall be fully protected with a board or other approved stopper to prevent earth or other substances from entering the pipe. Not more than 100 feet of trench shall be opened in advance of pipe laying unless permitted by the Engineer.

### **3.04 Rigid Pipe Bedding and Cover**

- A. Pipe bedding and cover shall conform to Classes B or C. Unless otherwise indicated on the Drawings, use Class C.

- B. Bedding material shall be spaded or shovel sliced so that the material fills and supports the haunch area of the pipe.
- C. Cover material shall be placed and worked by hand.

**3.05 Flexible Pipe Bedding and Cover**

- A. Pipe bedding and cover shall be Class IA, IB, II or III materials unless the bedding class is indicated on the Drawings. Do not use Class II or Class III material when there is water in the trench. Use the same material for bedding and cover.
- B. Place bedding material below and around pipe to the spring line to provide side support and to prevent lateral and vertical movement of the pipe. Place Class IA and Class IB material in maximum 6-inch layers. Place and compact Class II and Class III material in maximum 6-inch layers. Work the material in and around the pipe by hand to provide uniform support.
- C. Place cover material to a level 6 inches above the top of the pipe. Place Class IA material in maximum 6-inch layers. Place and compact Class IB, Class II, and Class III materials in maximum 6-inch layers. Class IA material shall be worked by hand. Class IB material shall be compacted using hand tampers or vibratory compactors. Class II and Class III material shall be compacted using vibratory compactors. Each stage shall be compacted by hand or mechanical tamping to the percent of the maximum dry density in accordance with ASTM D698 as indicated below:

Required Density	
Material	Density
Class 1A	None
Class 1B	85%
Class II	85%
Class III	90%

**3.06 Backfilling**

- A. Backfill in accordance with the Section 31 23 33.

**3.07 Separation from Water Main**

- A. Sanitary sewer mains shall be placed at least 8 feet horizontally (center to center) from any existing or proposed water main. If, due to ledge rock conditions or physical barriers, the Engineer determines that the 8-foot horizontal separation cannot be maintained, the horizontal separation may be reduced to a minimum of 3 feet if the bottom of the water main is at least 18" above the top of the sewer.
- B. When sanitary sewer mains cross under water mains, provide a minimum separation of 12 inches from the bottom of the water main to the top of the sewer. When sanitary sewer mains cross over water mains, provide a minimum of 18 inches from the bottom of the sewer to the top of the water main.
- C. If an existing water main is encountered while laying the sanitary sewer and it is impossible to obtain the proper vertical separation, immediately inform the Engineer and reconstruct the water main for a minimum distance of 8 feet on either side of the sanitary sewer to permit centering one full length of water main over the sanitary sewer.

**3.08 Infiltration/Exfiltration Testing**

- A. Test all sewers for infiltration/exfiltration. Either the water infiltration test or the low pressure air test may be used. Provide all materials, equipment and labor necessary to conduct the tests. Include the cost of testing in the price bid for the sewer. Perform tests under the observance of the Engineer or authorized representative of the Owner.
- B. The Contractor shall furnish all of the equipment necessary for conducting the test, and all tests shall be conducted in the presence of the Engineer and/or inspector.

C. Water Infiltration Test

1. The rate of infiltration of water into the sewers including appurtenances shall not be greater than 200-gallons per day per inch per mile. Infiltration between any two adjacent manholes shall not be greater than 500-gallons per day per inch diameter per mile.

Allowable Limits of Infiltration  
200 Gal/Day/In.-Diam/Mile

Diameter of Sewer (Inches)	Infiltration Per 100' Per Hr. (Gallons)
4"	0.63
6"	0.95
8"	1.26
10"	1.58
12"	1.90
15"	2.37
18"	2.84
48" I.D. MH	0.08 Gal/Vf/Hr

2. Tests for infiltration/exfiltration shall be conducted in a manner approved by and under the direction of the Engineer and shall be performed with a minimum positive head of 2 feet.

D. Low Pressure Test

1. Conduct test in accordance with ASTM F1417.
2. Procedure:
  - a. Clean and flush line to be tested.
  - b. Determine test time for the section of line to be tested using Table 1.
  - c. Plug all openings in test section.
  - d. Add air until the internal pressure of the line is raised to 4.0 psi. Allow air pressure to stabilize (usually 2-5 minutes). Maintain a minimum pressure of 3.5 psi.
  - e. When pressure is stabilized, reduce pressure to the starting pressure of 3.5 PSI. If the pressure drops more than 1.0 PSI during the minimum test time indicated in Table 1, the line is presumed to have failed.
  - f. For larger pipe, the Engineer may, at his discretion, use the minimum test times for a 0.5 psi pressure drop indicated in Table 2.
  - g. If the test section is below the groundwater level, determine the height of groundwater above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the spring line of the pipe, increase the test pressure by 0.43 psi.

Table 1 - Minimum Specified Time Required for a 1.0 PSI Pressure Drop for Size and Length of Pipe Indicated

Pipe Diam. in.	Minimum Time, min:s	Length For Minimum Time, ft.	Time For Longer Length	Specified Time for Length (L) Shown, min:s						
				100'	150'	200'	250'	300'	350'	400'
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36
18	17:00	133	7.694 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10

Table 2 - Minimum Specified Time Required for a 0.5 PSI Pressure Drop for Size and Length of Pipe Indicated

Pipe Diam. in.	Minimum Time, min:s	Length For Minimum Time, ft.	Time For Longer Length	Specified Time for Length (L) Shown, min:s						
				100'	150'	200'	250'	300'	350'	400'
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:29
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35

### 3.09 TV Inspection

- A. TV inspection shall be used in lieu of air testing for sewer replacement projects that have live lateral connections connected to the new sewer main. If there is no bid item for the TV inspection, the cost of the inspection is incidental to the sewer construction.
- B. TV inspection may be required on all sewer mains. If TV inspection is required it will be noted on the Drawings or elsewhere in the Bidding Documents. If there is no bid item for the TV inspection, the cost of the inspection is incidental to the sewer construction.
- C. The Engineer reserves the right to require TV inspection if there is reason to believe that there has been settlement of the pipe.
- D. Required TV inspection shall be performed after construction of the sewer main has been completed. Any defects found shall be repaired. Two copies of the TV report shall be submitted to the Engineer with a copy of the VCR tapes. The report shall include a summary of all defects and the location of all laterals.

### 3.10 Deflection Testing

- A. Deflection tests shall be performed on all PVC mainline sewer pipe.
- B. The test will be performed with a rigid ball or mandrel without mechanical pulling devices. The testing device must pass freely through the pipe without the use of excessive force. Any line which does not pass the testing device will not be accepted until the faulty pipe is replaced and the line re-tested.
- C. If deflection testing is done within 30 days after backfilling, deflection may not exceed 5%. If deflection testing is done more than 30 days after backfilling, deflection shall not exceed 7.5%. See following table for mandrel dimensions for ASTM D3034 and ASTM F679, SDR-35 PVC pipe.

Mandrel Dimensions for SDR-35 PVC Pipe			
Nominal Size In.	Base Inside Diameter*	7 ½% Mandrel	5% Mandrel
8	7.665	7.09	7.28
10	9.653	8.84	9.08
12	11.361	10.51	10.79
15	13.898	12.86	13.20
18	16.976	15.70	16.13
21	20.004	18.50	19.00
24	22.480	20.80	21.36
27	25.327	23.44	24.06

\* As per ASTM D3034 and F679

- D. The costs of all deflection testing shall be included in the unit price bid for that section of sewer. No additional payment will be allowed for testing or re-testing of sewer.

### **3.11 Final Sewer Cleaning**

- A. Prior to final acceptance the sewer main shall be jet-vacuumed. Unless the Engineer indicates a different time, the sewer cleaning shall be performed after the asphalt pavement has been placed. If not listed as a separate bid item, the cleaning is incidental to the sanitary sewer construction.

### **3.12 Service Laterals**

- A. Fittings shall be wyes on sewers less than 12-inch diameter. On sewers 12-inch diameter or larger, tees may be used.
- B. For sewer replacement projects with existing service laterals, wyes or tees shall be 6-inch unless the Contractor field verifies that the existing lateral is 4-inch from the main to the building. For 4-inch laterals, a 6x4 reducer will be required.
- C. All wyes and tees without laterals and the ends of all service laterals shall be sealed with solvent cemented caps.
- D. Unless otherwise indicated, all laterals shall extend to the property line.
- E. The depth or elevation of the lateral at the property line may be set by the Engineer. If not set by the Engineer, verify lateral depths with the Engineer when the depths at the property line are less than eight feet or more than ten feet deep.
- F. The lateral shall be laid with a minimum slope of 1/8" per foot and a maximum slope of 1/2" per foot. Risers laid at 45 degrees shall be used to keep the pipe within the maximum slope limit.
- G. Sewer and Water Lateral Separation
  - 1. Sewer laterals shall have a minimum center-to-center horizontal separation from water service laterals 2-inch diameter and smaller of 30 inches. Separation may be less than 30 inches if the bottom of the water lateral is at least 12 inches above the sewer lateral.
  - 2. Sewer laterals shall have a minimum center-to-center horizontal separation from water service laterals 2-1/2 diameter and larger of 8 feet.
- H. The sewer lateral shall be laid no closer than 8 feet to a well.

### **3.13 Tracer Wire**

- A. Furnish and install tracer wire for PVC sewer laterals in accordance with Section 33 05 26.

### **3.14 As-Built Measurements**

- A. Provide as-built measurements clearly marked on a clean copy of the Construction Drawings. These as-built measurements are incidental to the Work. Include measurements for all laterals including distance from downstream manhole to wye or tee, length of lateral, height of riser, invert elevations of manholes, and invert elevation of lateral.

END OF SECTION

**SECTION 33 39 13**  
**SEWER MANHOLES**

**PART 1 - GENERAL**

**1.01 Section Includes**

- A. Precast concrete manholes for sanitary and storm sewer construction.
- B. Cast-in-place concrete manholes shall be provided only when indicated on the Drawings.

**1.02 References**

- A. ASTM A48 - Gray Iron Castings.
- B. ASTM C94 - Specification for Ready-Mixed Concrete.
- C. ASTM C270 - Mortar for Unit Masonry.
- D. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- E. ASTM 877 - Standard Specifications for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections.
- F. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- G. ASTM C990 - Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- H. AASHTO M198 - Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

**1.03 Quality Control**

- A. Manhole section will be rejected for any of the following reasons:
  - 1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
  - 2. Surface defects indicating honey-combed or open texture that would adversely affect the function of the manhole.
  - 3. The planes of the ends of the manhole sections are not perpendicular to their longitudinal axis, within the limits of the variation given in paragraphs 12.3 and 12.4 of ASTM C478.
  - 4. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.
  - 5. Any continuous crack having a length of 12 inches or more, regardless of position in the section of wall.
  - 6. Lift holes that extend through wall.
  - 7. Drop across flowline not as specified.
- B. Concrete adjusting rings will be rejected if they contain cracks that extend more than one-half the thickness of the ring.

**PART 2 - PRODUCTS**

**2.01 Manholes**

- A. Precast concrete, ASTM C478.
  - 1. Standard manhole shall have a 48-inch inside diameter, eccentric cone and 24-inch diameter opening, unless indicated otherwise on the Drawings.
  - 2. Provide slab tops when manholes are too shallow for cone section. Slab tops shall be of the in-bell design.
  - 3. Lift holes extending through barrel wall are not allowed.

- C. Steps: ½ inch diameter, Grade 60 steel rod covered with polypropylene plastic; PS1, M.A. Industries, Inc. ML-10, American Step Company; or equal.
- D. Pipe Connections:
  - 1. Sanitary Sewer: Flexible, watertight, rubber connector; Kor-N-Seal, NPC, Inc.; PSX, Press-Seal Gasket Corp; or equal.
  - 2. Storm Sewer: Mortared.

## 2.02 Castings

- A. Cast iron, ASTM A48, Class 35B.
- B. Manufacturer: Neenah Foundry Co. or equal.
- C. Sanitary Sewer Manhole: Non-rocking design, concealed pick holes and neoprene O-ring gasket, unless otherwise indicated in the Contract Documents.
- D. Storm Sewer Manhole: Provide frames, solid lids, and grates as indicated in the Contract Documents.

## 2.03 Manhole Seals

- A. Joint Sealant: Pre-formed, butyl rubber, AASHTO M198 or ASTM C990; Kent Seal, Hamilton Kent; EZ-Stik, Press-Seal Gasket Corp.; ConSeal; or equal.
- B. Exterior Joint Sealant: A rubberized external sealing collar with metal bands meeting ASTM C877, Type II; MacWrap by MarMac Manufacturing Co. or equal.
- C. Interior Manhole Chimney Seal:
  - 3. A flexible interior seal designed to prevent leakage of water throughout a 25-year design life. The seal shall remain flexible throughout the design life, allow repeated vertical movements of the frame of not less than two inches and/or repeated horizontal movement of not less than one-half inch.
  - 4. Flexible Sleeve: Extruded or molded from a high grade rubber conforming to ASTM C923. The sleeve shall be either double or triple pleated with a minimum unexpanded vertical height of eight inches and a minimum thickness of 3/16 inches.
  - 5. Expansion Bands: 16-gauge stainless steel conforming to ASTM A240, Type 304, with a minimum width of 1-3/4 inches. Provide a positive locking mechanism. All screws, nuts, or bolts shall be stainless steel.
  - 6. Manufacturer: Cretex Specialty Products, Waukesha, WI; NCP FlexRib Seals, C.P. Technologies & Service, Elkhorn, WI; or equal.

## 2.04 Adjusting Rings

- A. Precast concrete, uniform in dimension, with smooth surfaces.
- B. Rectangular adjusting rings shall be complete rectangles. L-shaped rings are not acceptable.
- C. Cracked or otherwise damaged rings shall not be used.

## 2.05 Accessory Materials

- A. Concrete: ASTM C94; 3,000 psi at 28 days, 3 to 4-inch slump, maximum aggregate size of 1-1/2 inch.
- B. Mortar: ASTM C270, Type M.

- C. Hard, durable particles of crushed stone or gravel, substantially free from shale or lumps of clay or loam, meeting the following gradation:

Sieve Size	Percent Passing by Weight
2-inch	100
1-1/2 -inch	90-100
1-inch	20-55
3/4-inch	0-15
1/2-inch	0-5

### **PART 3 - EXECUTION**

#### **3.01 General**

- A. Provide 4 to 6 inches of precast concrete adjusting rings, unless otherwise indicated.
- B. Protect concrete and mortar from freezing.
- C. Limit the manhole excavation to the size required for installation. Provide bracing and sheathing as necessary.
- D. Provide 6 inches of crushed stone under the manhole base.
- E. Install manhole plumb.

#### **3.02 Joint Sealing**

- A. Seal joints with butyl rubber rope.
- B. When the manhole joints are below the groundwater elevation, the manhole joints shall be sealed on both the edges of the joint with butyl rubber rope and an external joint seal.

#### **3.03 Flow Channel and Bench**

- A. Provide a U-shaped flow channel, depth equal to two-thirds the diameter of incoming and outgoing pipe but not less than 6". The channel shall be steel troweled to a smooth finish and be a continuation of the pipe.
- B. No horizontal surfaces shall be left on the inside of the manhole floor. The bench shall have a minimum slope of 2" from the side of the manhole to the channel. The surface shall be troweled to a smooth but non-slip finish.
- C. Precast channels and benches are preferred.

#### **3.04 Steps**

- A. Locate steps over outgoing pipe.
- B. Place steps in vertical alignment, equally spaced at 16" C-C with the top step not more than 24" from the top of the casting.

#### **3.05 Setting Frames and Rings**

- A. Set frame and cover at the required elevation.
- B. In paved areas set manhole rim one-half inch below finish grade. Set the tops of the manholes to the same slope as the surrounding pavement.
- C. Prior to setting the manhole frame casting, clean surface of manhole chimney section and cast iron frame of all foreign materials and moisture
- D. Set frames and adjusting rings on full beds of mortar. Cut the mortar flush with the interior and exterior of the manhole.

- E. Protect frame from traffic until the mortar has hardened sufficiently to support traffic loads.
- F. Final adjustment of frames shall be done after curb and gutter has been constructed, the base course has been placed, and the finished pavement elevation and slope is known.

### **3.06 Installation of Interior Manhole Chimney Seal**

- A. Remove all loose and protruding mortar that may interfere with the seal's performance. If masonry surface is rough, sloped or irregular and would not provide an effective seal, repair with non-shrink mortar.
- B. Wire brush manhole frame to remove any loose rust or scale and repair any imperfections by grinding smooth or filling with mortar.
- C. Install seal in accordance with the manufacturer's instructions.
- D. Seal shall extend from casting to manhole section, covering the entire ring section.
- E. Install the interior manhole seal at the time of the final frame adjustment.

### **3.07 Outside Drop**

- A. Provide an outside drop pipe for any pipe whose invert is more than 2 feet above the manhole invert.
- B. The invert of the drop pipe shall enter the manhole at the elevation indicated on the Drawings or at the spring line of the outgoing sewer if no elevation is provided.
- C. The drop pipe shall be strapped to the manhole and encased in concrete or the drop may be cast integral to the manhole barrel section.

END OF SECTION

## SECTION 33 41 13

### STORM SEWER CONSTRUCTION

#### PART 1 - GENERAL

##### 1.01 Section Includes

- A. Construction of storm sewer.
- B. Construction of storm manholes and inlets.

##### 1.02 Related Sections

- A. Section 31 23 33 - Utility Excavation, Backfill and Compaction.
- B. Section 33 39 13 - Sewer Manholes.

##### 1.03 References

- A. ASTM A48 - Standard Specification for Gray Iron Castings.
- B. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- C. ASTM A760 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
- D. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- E. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- F. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- G. ASTM C443 - - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- H. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- I. ASTM C506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.
- J. ASTM C507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
- K. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- L. ASTM A929 - Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.
- M. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- N. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- O. ASTM F2736 - Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe.
- P. ACI 304 - Recommended Practice for Measuring, Transporting, and Placing Concrete.
- Q. ACI 347 - Recommended Practice for Concrete Formwork.

##### 1.04 Submittals

- A. Submit product data for pipe and accessories.

- B. Submit bedding gradation if requested.
- C. Submit as-built measurements.

**PART 2 - PRODUCTS**

**2.01 Pipe**

- A. Reinforced Concrete
  - 1. Pipe: ASTM C76, ASTM C506, or ASTM C507. Provide Class III unless otherwise indicated on the Drawings or in the Specifications.
  - 2. Joints
    - a. Circular Pipe: Tongue and groove with rubber gaskets, ASTM C443.
    - b. Elliptical and Arch Pipe: Tongue and groove with cold plastic sewer joint compound or tongue and groove with external sealing collar, MacWrap or equal.
- B. Corrugated Steel (Use only when indicated on Drawings)
  - 1. Galvanized Pipe:
    - a. Material: Galvanized steel coil, ASTM A929.
    - b. Pipe: Manufactured in accordance with ASTM A760, Type I or II.
  - 2. Aluminized Pipe:
    - a. Material: Aluminized Type 2 steel coil, ASTM A929.
    - b. Pipe: Manufactured in accordance with ASTM A760, Type I or II.
  - 3. Joints: Matching bond connectors.
  - 4. Minimum Pipe Gauge:

Minimum Pipe Gauge			
Pipe Diameter	2-2/3" x 1/2" Corrugations	Pipe Diameter	3" x 1" Corrugations
6"	18	60" - 90"	16
8" - 24"	16	96" - 102"	14
30" - 36"	14	108" - 114"	12
42" - 54"	12	120"	10
60" - 72"	10		
78" - 98"	8		

- C. Corrugated Polyethylene (Use only when indicated on Drawings.)
  - 1. Smooth interior, with annular exterior corrugations meeting requirements of ASTM F2736.
  - 2. Joints: Gasketed integral bell and spigot meeting requirements of ASTM F2736. Joints shall be watertight in accordance with ASTM D3212. Gaskets shall meet the requirements of ASTM F477.
  - 3. Fittings: Polyethylene fittings meeting requirements of ASTM F2736.
  - 4. Acceptable Manufacturers: ADS N-12 HP or equal.

**2.02 End Sections**

- A. Manufacturer's standard product.
- B. Provide concrete for concrete pipe and corrugated metal for steel pipe or polyethylene pipe.

**2.03 Pipe Bedding and Cover**

- A. Bedding and Cover:
  - 1. Class IA - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5

2. Class IB - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1/2"	100
3/8"	85 - 100
No. 4	10 - 30
No. 200	0 - 5

3. Class II - Coarse-grained soils free from organic matter, trash, debris, and frozen material with 100% passing the 1-1/2" sieve and less than 5% passing the No. 200 sieve. Generally including sands, gravels, and sand-gravel mixtures with little or no fines. ASTM D2487 Soil Types GW, GP, SW and SP are included in this class. Excavated material may be used if it meets the above material requirements.
4. Class III - Coarse-grained soils with fines free from organic matter, trash, debris, and frozen material with 100% passing the 1-1/2" sieve and 12% - 50% passing the No. 200 sieve. Generally includes silty or clayey sands, gravels, or sand-gravel mixtures. ASTM D2487 Soils Types GM, GC, SM and SC, are included in this class. Excavated material may be used if it meets the above material requirements.

## 2.04 Manholes and Inlets

### A. General

1. Precast concrete manholes and inlets shall meet requirements of Section 33 39 13. with the exceptions noted.
2. Interior manhole seals are not required.
3. Pipe connection may be mortar.
4. Concealed pick hole covers are not required.

### B. Cast-In-Place Concrete

1. Ready-mixed concrete meeting requirements of ASTM C94; 3000 psi 28-day strength, 3 to 4-inch slump, maximum aggregate size of 1-1/2 inch and air entrainment of 7 percent.
2. Reinforcing steel: ASTM A615, Grade 60.

- ### C. Crushed Stone: Hard durable particles of crushed stone or gravel substantially free from shale or lumps of clay or loam meeting the following gradation:

Sieve Size	% Passing By Weight
2"	100
1-1/2"	90 - 100
1"	20 - 55
3/4"	0 - 15
1/2"	0 - 5

## PART 3 - EXECUTION

### 3.01 Handling of Material

- A. All materials shall be handled with care to avoid damage. No material shall be dropped.
- B. All defective material shall be removed from the job site.
- C. Contractor is responsible for arranging suitable sites for material storage.

### 3.02 Lines and Grade

- A. All pipe shall be laid to the lines and grades shown on the drawings or given by the Engineer.
- B. The use of a laser beam for maintaining line and grade is required unless other methods are approved by the Engineer.
- C. A person qualified to operate the equipment shall be present when the laser is in use.

### 3.03 Laying Pipe

- A. Lay pipe uniformly to line and grade so that the finished sewer presents a uniform bore. Noticeable variations from true alignment and grade will be sufficient cause for rejection of the work.
- B. Commence at the lowest point and proceed to the upper end. Lay pipe with bell-end pointing up-grade.
- C. For reinforced concrete pipe provide a minimum of six inches between the pipe wall and the trench wall. For polyethylene and corrugated steel pipe, provide a minimum distance between the pipe wall and the trench wall of 2.5 times the pipe diameter for poor or expansive soils and a minimum of 12 inches for all other soils.
- D. Rest each pipe on the full length of its barrel.
- E. Do not lay the next pipe until the previous pipe is backfilled sufficiently to prevent movement during joining.
- F. For flexible pipe do not disturb the installed pipe and its embedment when using movable trench boxes. If the box extends below the cover material, use methods to assure that the integrity of the embedment is maintained when the box is moved.
- G. Keep water out of the pipe. Do not let water rise into or around the pipe until the trench is filled at least one foot above the pipe.
- H. When work is stopped for any reason, securely plug the end of the pipe.
- I. Jointing: Assemble joints in accordance with the pipe manufacturer's instructions.
- J. Do not drive over flexible pipe unless there is a minimum of 24 inches of cover material over the pipe.

### 3.04 Rigid Pipe Bedding - RCP

- A. Pipe bedding and cover shall be Class IA, Class IB, Class II, or Class III. If pipe is in groundwater, bedding and cover shall be Class IA or IB. Use the same material for bedding and cover.
- B. Place bedding material below and around pipe to the spring line to provide side support and to prevent lateral and vertical movement of the pipe. Place material in 6-inch maximum layers. Work the material in and around the pipe by hand to provide uniform support.
- C. Place cover material to a level 6 inches above the top of the pipe.

### 3.05 Pipe Bedding - Polyethylene and Corrugated Steel

- A. Pipe bedding and cover shall be Class IA or Class IB. If pipe is in groundwater, use Class IB.
- B. Place bedding material below and around pipe to the spring line to provide side support and to prevent lateral and vertical movement of the pipe. Place Class IA and Class IB material in 6-inch maximum layers. Work the material in and around the pipe by hand to provide uniform support.
- C. Place cover material to a level 12 inches above the top of the pipe. Place Class IA and Class IB material in maximum 6-inch layers. Class IA material shall be worked by hand. Class IB material shall be compacted using hand tampers or vibratory compactors. Each stage shall be compacted by hand or mechanical tamping to the percent of the maximum dry density in accordance with ASTM D698 indicated below:

Material	Density
Class IA	None
Class IB	85%

- D. Do not use a hydrohammer with less than 4 feet of cover over the pipe.

### **3.06 Manhole and Inlet Construction**

- A. Cast-In-Place: Cast-in-place manholes and inlets shall be constructed as shown on the Drawings. If cast-in-place manholes are not shown and the Contractor desires to provide them in lieu of precast concrete, Shop Drawings prepared by a qualified Engineer must be submitted for approval.
- B. Construction
  - 1. Provide two to four inches of precast adjusting rings unless otherwise indicated.
  - 2. Manholes that are constructed when temperature is below 35°F shall be protected from freezing.
  - 3. Limit the manhole excavation to the size required to install the manhole. Provide bracing and sheathing as necessary.
  - 4. Provide six inches of crushed stone under the manhole base.
  - 5. Inverts shall be the same size as the diameter of the largest adjoining pipe. Shape inverts in accordance with the Standard Drawings. Provide a smooth finish.
  - 6. Provide tongue and groove joints sealed with butyl rubber rope for reinforced concrete barrel sections.
  - 7. Construct cast-in-place structures in accordance with ACI 304 and ACI 347.
  - 8. Frames and Covers: Provide frames and covers in the size and type indicated on the Drawings. Set rims of manholes and inlets at finish grade elevation. In paved areas set the rims one-half inch below the pavement surface. Set the rim to match the slope of adjacent paving. Perform final rim adjustment after base course has been placed.
  - 9. Frame/Adjusting Ring Joints: Provide a mortar joint for manholes and field inlets. Dry stack adjusting rings on curb inlets and mortar casting to top ring at time of curb construction.
  - 10. Provide steps for manholes and circular inlets 4-foot diameter or larger. Place steps in vertical alignment, equally spaced at 16" on-center with top step not more than 24 inches from top of casting.

### **3.07 End Sections**

- A. Provide flared end sections on all inlet and outlet ends of storm sewer that do not terminate within a manhole or inlet. Provide prefabricated grates on all end sections for pipes larger than 12-inch diameter. Provide riprap at discharge end as indicated on the drawings.

### **3.08 Separation from Water Main**

- A. Storm sewer mains shall be placed at least 8 feet horizontally (center to center) from any existing or proposed water main. If, due to ledge rock conditions or physical barriers, the Engineer determines that the 8-foot horizontal separation cannot be maintained. The horizontal separation may be reduced to a minimum of 3 feet if the bottom of the water main is at least 18" above the top of the sewer.
- B. The vertical separation for storm sewer mains crossing under water mains shall be such that the elevation from the top of the sewer to the bottom of the water main is at least 6". The vertical separation for storm sewer mains crossing over water mains shall be such that the elevation from the bottom of the sewer to the top of the water main is at least 18".
- C. If an existing water main is encountered while laying the storm sewer and it is impossible to obtain the proper vertical separation, immediately inform the Engineer. Reconstruct the water main for a minimum distance of 8 feet on either side of the storm sewer to permit centering one full length of water main over the storm sewer.

### **3.09 As-Built Measurements**

- A. Provide as-built measurements clearly marked on a clean copy of the Contract Drawings. Tie location of bends and all connections not terminating with a manhole or inlet to ground features to clearly locate the buried construction. As-built measurements are incidental to the Work.

END OF SECTION