

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern Work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Park Improvements to the Village of Hortonville – Memorial Square Design

1. The work under this contract includes, but is not limited to, the furnishing of all labor, materials, tools, equipment, transportation, certificates, and temporary protection necessary for or incidental to the construction of the improvements to the Village of Hortonville – Memorial Square Design.
2. The project includes, but is not limited to:
 - a. Temporary Erosion Control
 - b. Temporary Traffic Control
 - c. ADA accessible pavement through the plaza.
 - d. Site Removals
 - e. Site Excavation and Grading
 - f. Crushed Aggregate Base Course
 - g. Concrete Sidewalk
 - h. Concrete Curb and Gutter
 - i. Unclassified Excavation
 - j. Railing
 - k. Proposed Shade Sails
 - l. Site Amenities
 - m. Site Lighting and Electrical Work
 - n. Demo of Existing Electrical Service
 - o. New Electric Service
 - p. New Water Services
 - q. New Storm Sewer
 - r. Landscaping

B. Project Management, Coordination, and Meetings.

1. Contractor shall perform all coordination with Public Utilities requiring relocations or new installations.
2. Coordination with all regulatory agencies to ensure compliance is met with permit requirements
3. Contractor shall coordinate with the Owner on the requirements for the park amenities to be installed by the Owner prior to installing any concrete and/or base course to ensure the amenities once installed will meet ADA requirements.
4. Weekly progress meetings.

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SECTION 01 11 16
WORK BY OWNER

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (N/A)

1.03 DESCRIPTION OF WORK

- A. The Owner (Village of Hortonville) will perform some of the site work. The contractor shall coordinate with the Owner on items below:
1. The Contractor shall coordinate with the owner for removal of the existing "little Free Library" by owner on the project site prior to project start.
 2. The Contractor shall coordinate with the Owner for final location of furnishing and installing the trash and recycling receptacle on the site.
 3. The Owner shall furnish the bike racks and the contractor should install them on the site in accordance with the project documents.
 4. The Owner shall furnish and install the 3-Seat ADA Picnic Tables on the site.
 5. The Owner shall furnish and install the 4-Seat

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

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SECTION 01 14 00
WORK RESTRICTIONS AND PROVISIONS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, current edition.
 2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK (N/A)

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (N/A)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (N/A)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 EXAMINATIONS

- A. Contractor shall obtain complete data at the site and inspect surfaces that are to receive the work before proceeding with assembling, fitting or erecting his work under this contract. The Contractor shall notify the Engineer in writing in the case of discrepancies between existing work and drawings, and of any defects in surfaces that are to receive the Contractor's work. The Engineer will direct the remedy of applicable surfaces.
- B. Information pertaining to existing conditions that appear on the drawings is based on available records. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing or that unexpected developments may not occur. All data included was provided to assist the Contractor in the investigation of conditions. The Contractor is responsible for the interpretation of the data provided.
- C. The Contractor shall become acquainted with the location of underground service, utilities, structures, etc., which may be encountered or be affected by the Contractor's work, and shall be responsible for any damage caused by neglect to provide proper precautions or protection.
- D. Utility Locations. Contractor shall be responsible for locating and verifying all utilities on the project and also all relocations where necessary. Typically the utilities require the request for locate be made a minimum of three working days before the Contractor begins work in the area. The utilities shown on the contract drawings are approximate in location, depth, number, and type.
- E. Contractor shall verify grades, lines, levels, locations, and dimensions as shown on drawings and report any errors or inconsistencies to the Engineer before commencing work. Starting of work by the Contractor shall imply acceptance of existing conditions.

3.02 STORAGE AND HANDLING

- A. Contractor or the Contractor's authorized representative must be present to accept delivery of all equipment and material shipments. The Owner's employees will not knowingly accept, unload, or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by any representative of the Owner shall not constitute acceptance or responsibility to assume all liability for any equipment or material delivered to the job site.
- B. Any material or equipment removed from the present construction shall be the property of the Owner and disposition shall be as directed by the Owner or stockpiled at locations shown on the contract drawings. All salvaged materials shall be removed in a workmanlike manner and carefully transported to Owner's storage area. The Contractor shall coordinate the salvaging of items with the Owner.
- C. Contractor shall confine all operations, equipment, apparatus, and storage of materials to the immediate area of work to the greatest possible extent. Contractor shall ascertain, observe, and comply with all rules and regulations in effect on the project site, including, but not limited to parking and traffic regulations, use of walks, security restrictions and hours of allowable ingress and egress.
- D. The storage of materials on the grounds shall be in strict accordance with the instructions of the Owner.
 - 1. All materials affected by moisture shall be stored on platforms and protected from the weather in accordance with manufacturer recommendations.
 - 2. Should it be necessary at any time to move material storage platforms, the Contractors shall move same at the Contractor's expense, when directed by the Owner.
 - 3. Areas used for storage of materials shall be repaired and restored by the Contractor.
- E. The Owner assumes no responsibility for materials stored on the site. The Contractor shall assume full responsibility for damage due to the storage of materials.
- F. During the construction of this project, materials, storage areas, and earth stockpiles shall be located so as not to interfere with the installation of the utilities nor cause damage to existing structures or utilities.

3.03 WORK RESTRICTIONS AND PROVISIONS

- A. Notification. The Contractor shall notify the Owner and the Engineer 72 hours in advance of beginning work. Notice must also be given to the Owner and the Engineer for each subsequent day the Contractor will be working.
- B. Operation During Construction. The existing facilities shall remain completely operational during construction. The Contractor shall be responsible to see that the facilities are operating as they should. Sequence of operations or place of commencement may be determined by the Engineer as deemed to best serve the needs and convenience of the Owner, or as necessity of occasion requires.
- C. Starting of work implies acceptance of the work of others. Removal and replacement of work applied to defective surfaces, in order to correct defects, shall be done at the expense of the Contractor who applied work to defective surfaces.
- D. Access to Work. Representatives of the State and Federal Regulatory Agencies and Owner shall have access to the work and on-site records at all times.
- E. Project Log. A project log shall be maintained showing daily progress of work. Engineer and Owner shall have access to this logbook and the project schedule at all times.
- F. Existing pipes, electrical work, and all other utilities encountered, which may interfere with new work, shall be rerouted, capped, cut off, or replaced by the Contractor.
- G. Dust and Noise. Contractor shall make an effort to keep dust and noise to a minimum during construction. The dispersion of dust from construction related activities shall, until acceptance of work, be minimized by

the application of water or other acceptable materials or covers. Noise from any construction activities shall only be allowed during approved working hours. This includes preparation, organizational and clean-up work. Work hours are limited to weekdays between 7 a.m. and 7 p.m. unless specifically stated elsewhere in these specifications or approved during construction by the Owner and Engineer in writing. Only maintenance of traffic and/or erosion control activities are allowed outside of these times.

- H. Contractor shall confine equipment, apparatus, storage of materials and operations to limits by specific direction of the Owner or Engineer and shall not bring material onto the site until they are needed for the progress of the work.
- I. Cleaning. Contractor shall be responsible for all cleaning required within the technical sections of the specifications governing work under the Contractor's jurisdiction as well as for keeping all work areas, passageways, and all other areas of the premises free of rubbish, debris and scrap which may be caused by the Contractor's operations or that of the Subcontractors.
1. Remove rubbish, debris, and scrap promptly upon its accumulation and in no event later than the end of each week.
 2. Combustible waste shall be removed immediately or stored in fire resistive containers until disposed of in an approved manner.
 3. Spillage of oil, grease, or other liquids which could cause a slippery or otherwise hazardous situation or stain a finished surface, shall be cleaned up immediately.
 4. Dust, dirt, and other foreign matter shall be removed completely from all internal surfaces of all mechanical and electrical units, cabinets, ducts, pipes, etc.
 5. Dirt, soil, fingerprints, stains and the like, shall be completely removed from all exposed finished surfaces.
 6. If rubbish and debris is not removed, or surfaces cleaned as specified above, the Owner reserves the right to have said work done by others and the related cost(s) will be deducted from monies due the Contractor.
- J. Disposal of Demolished Materials. Remove from the site all debris, rubbish, and other materials resulting from demolition operations. Storage of removed materials will not be permitted on the site. If burning is allowed, the Contractor shall obtain all required permits.
- K. Mail Service.
1. Temporary relocation of mailboxes. If the Postal Carrier cannot deliver mail to the properties affected by the construction of utilities or roadway, the Contractor shall provide temporary mailboxes or shall relocate existing mailboxes to an accessible site. Contractor shall relocate mailboxes to their new location and set to proper height, as directed by an authorized representative of the US Postal Service. Mailboxes shall be reset as close to original location as possible, unless otherwise noted, while maintaining proper height and location requirements of the US Postal Service, upon restoration of regular postal service. If mailboxes, bases or posts are damaged during removal, it shall be the Contractor's responsibility to replace the damaged part prior to reinstallation. Contractor shall not be responsible for correction of existing deficient mailboxes, bases, or posts. Owner and Engineer shall be notified of such instances immediately.
 2. Final relocation of mailboxes. If the Postal Carrier can deliver mail to affected properties during construction, Contractor shall maintain reasonable access to said mailboxes. Upon completion of the project, Contractor shall relocate mailboxes to a location and height that meets the US Postal Service requirements along affected roadways.
- L. Street Signs. The Contractor shall salvage and reinstall all signs affected by construction. All signs to be removed shall be done in a workmanlike manner and carefully transported to Owner's storage area. If signs, sign bases or posts are damaged during removal, it shall be the Contractor's responsibility to replace said sign, base or post prior to reinstallation.
- M. Garbage Collection. Garbage and/or recycling collection will continue throughout the project. Contractor shall provide temporary access to garbage vehicles throughout the project area or assist with garbage collection in areas inaccessible to vehicular traffic during the project.

3.04 OPERATION AND PROTECTION

- A. Contractor shall schedule his work as to minimize the inconvenience to the Owner and residents adjacent to the project.
- B. Traffic Control. The Contractor shall meet the requirements for traffic control in accordance with the Manual on Uniform Traffic Control Devices. All structures and equipment shall be constructed, installed, and operated with guards, controls, and other devices in place.
- C. The Contractor shall provide protection as follows:
 - 1. Protection. The Contractor shall provide and maintain proper barricades, fences, signal lights, or watchmen to properly protect the work, persons, animal and property against injury. The cost of protection shall be incidental to the contract and no extra payment will be allowed therefore.
 - 2. Provide, erect, and maintain all required barricades, guard rails, temporary walkways, etc., of sufficient size and strength necessary for protection of stored material and equipment; adjacent to or within project area; adjoining property and the building(s) as well as to prevent accidents to the public and the workmen at the job site.
 - 3. Provide and maintain proper shoring and bracing for existing underground utilities encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the new work, or can be properly backfilled upon completion of new work.
 - 4. Provide protection against rain, snow, wind, ice, storms or heat so as to maintain all work, materials, apparatus, and fixtures, incorporated in the work or stored on the site, free from injury or damage. At the end of the day's work, cover all new work likely to be damaged. Remove snow and ice as necessary for safety and proper execution of the work.
 - 5. Protect the building and foundations from damage at all times from rain and groundwater. Provide all equipment and enclosures as necessary to provide this protection.
 - 6. Damaged property shall be repaired or replaced in order to return it to preconstruction conditions.
 - 7. Protect materials, work, and equipment, not normally covered by above protection, until construction proceeds to a point where the general building protection of the area where located, dispenses with the necessity therefore. Protect work outside of the building lines such as trenches and open excavations, as specified above.
 - 8. Take any and all necessary precautions to protect Owner's property as well as adjacent property, including trees, shrubs, buildings, sanitary sewers, water piping, gas piping, electric conduit or cable, etc., from any and all damage which may result due to work on this project.
 - 9. Repair work outside of property line in accordance with the requirements of the authority having jurisdiction.
 - 10. Repair any work damaged by failure to provide proper and adequate protection to its original state to the satisfaction of the Owner or remove and replace with new work at the Contractor's expense.
 - 11. Tree Protection. Trees shall be protected from damage and scarring. Do not injure trunks, branches, or roots of trees that are to remain. No trees shall be removed without the approval of the Owner. Tree branches in the way of construction operations shall be carefully pruned prior to construction. Do cutting and trimming only as approved and as directed by the Owner. Do not operate equipment or vehicles within the drip line of a tree to be preserved. Any roots exposed during construction shall be cut clean. Ripping of the roots with excavation equipment shall not be allowed.
 - 12. All survey monuments, property stakes, etc., which are encountered during the construction are to be preserved and undisturbed. The Engineer shall be notified of all such items immediately upon discovery. Failure to preserve such monuments will not be allowed and replacement shall be at the Contractor's expense.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Work restrictions and provisions shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 WORK RESTRICTIONS AND PROVISIONS

- A. Work Restrictions and Provisions, Inclusive. The cost associated with work restrictions and provisions shall be considered inclusive to payment for work related to the associated construction item, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

- A. To provide adequate budget and bonding to cover items not precisely determined prior to bidding, include in the Contract Price the costs or quantities described in this Section.
- B. Adjustment of Cost:
1. If cost or quantity is more or less than the specified allowance, Contract Price will be adjusted by Change Order, unless stated otherwise herein.
 2. Submit documentation for engineer review for the actual costs or quantities after completion of Work. Documentation shall include actual invoices or billing statements and evidence of payment.
- C. Designate in schedule of values costs and quantities required under each allowance.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.07 SPECIFIC ALLOWANCES

- A. Electric Service
1. The Contractor shall coordinate new electric services. For bidding purposes, the Contractor shall include the Electrical Allowance noted in electrical specifications section 26 05 01 in their bid. This cost shall cover items listed in the electrical specifications.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

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SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 DESCRIPTION OF WORK

A. Additive Alternate AA1 – GATEWAY FEATURE AND ELECTRICAL

1. If the owner shall choose, a Gateway Feature, Electrical connection and Electrical Outlets (2) shall be installed in the locations shown in the contract documents. Labor and materials to perform the work shall be as indicated in the project documents. The work includes coordination and installation for the Gateway Featured containing masonry, foundations, electrical and archway as specified, electrical outlet installation, and electrical connection to pre-fabricated lighting within the feature. All items shall be reviewed, measured and confirmed with the engineer and/or Village prior to ordering and installation.
 - a. Payment. All costs, labor, and materials shall be paid for the above work under this Additive Alternate under their respective bid items.

1.03 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

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SECTION 01 32 23
SURVEY AND LAYOUT DATA

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 1 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

- A. The Contractor will stake and layout all work. The Contractor shall immediately, upon entering the site for purpose of beginning work, locate general reference points and take such action as necessary to prevent their destruction. The Contractor shall layout the work and be responsible for all lines, elevations and measurements. The Contractor must exercise proper precaution to verify dimensions of the drawings before laying out work and will be held responsible for any error resulting from failure to exercise such precaution.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS

- A. Automated Machine Guidance (AMG) Control / Staking Plan

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 AUTOMATED MACHINE GUIDANCE (AMG)

- A. Contractor may utilize AMG in lieu of or in addition to conventional staking on all or part of the work. When staking is inclusive to construction, any use of AMG will be considered inclusive to associated work.
- B. All AMG work must be coordinated with the Engineer throughout the course of construction to ensure that work performed using AMG conforms to the contract tolerances and that the methods employed conform to the contractor's AMG Control/Staking Plan and accepted industry standards. The contractor will need to revert to conventional staking methods (at no additional cost to the Owner) for all or part of the work at any point during construction if AMG is producing unacceptable results. Acceptable AMG work will be up to the Engineer's discretion.
- C. AMG Control/Staking Plan - Submit a detailed AMG plan to the Engineer for review at least 5 business days before the preconstruction meeting. This plan should explain, at a minimum, how AMG technology will be integrated into the project, what bid items AMG will be associated with and which, if any, will use conventional staking, and the process for verification of tolerances. The plan shall also include:
 - 1. An explanation of how AMG Technology will be integrated into the project
 - 2. A comprehensive list of bid items associated with AMG
 - 3. A list of any items for which conventional staking will be used (either alone or in conjunction with AMG)
 - 4. The process for verification of tolerances
 - 5. The designation of a single primary contact person for AMG technology issues.
 - 6. A list/diagram of all control points intended for use on the project for verification as required.

7. A description of Contractor's quality control procedures. Include the frequency and type of checks performed to ensure that the work conforms to the contract plans.

Engineer will review the plan for conformance with contract documents. Contractor may not perform AMG work prior to receiving written approval of the AMG plan. All work using AMG shall be performed in accordance with the approved AMG plan. Contractor shall submit plan updates to Engineer throughout the project as necessary, or as directed by the Engineer.

D. AMG Geometric and Surface Information

1. Contractor is responsible for the creating and generating all surface models and any other data required to construct the project to the lines and grades shown on the Contract Drawings. At Contractor's request, Engineer may provide an AutoCad Civil3D file and and/or .XML file of the surfaces used to generate the construction plans. The Contractor shall be responsible for comparing electronic data with available hard copies and Contract Documents. Engineer shall not be held responsible for any discrepancies between the linework, surfaces, or digital data provided to the Contractor. The use of any digital files prepared by Engineer shall not in any way obviate the Contractor's responsibility for the proper checking and coordination of dimensions, details, and other information required to facilitate complete and accurate construction.
2. Develop and maintain a contractor construction model for areas of the project employing AMG. Confirm that the resulting model accurately represents the contract plans. At Engineer's request, provide the construction model to the Engineer in .XML format, or other engineer-approved format.
3. Managing and Updating Information -Notify the Engineer of any errors or discrepancies in Engineer-provided information. Engineer will determine what, if any, revisions may be required. Engineer may revise the contract drawings, if necessary, to address errors or discrepancies that the contractor identifies. If the Engineer requests, provide construction model updates to the Engineer. All Contractor costs for revisions to the surface model, linework, etc. shall be inclusive to the item constructed and no additional money will be paid to the Contractor.
4. Engineer shall contact Contractor if design changes are made after the bid if they will affect the digital model. Contractor shall make the appropriate changes to the model or work with Engineer in the field to ensure design changes are incorporated into final product. Contractor shall be solely responsible for making adjustments or changes to the model as required.
5. Construction Checks - Check the work against the plan elevation at randomly selected points on cross-sections located on the plans at the frequency the Engineer approved as a part of the AMG Control / Staking Plan. Submit the results of these random checks to the Engineer daily. Notify the Engineer immediately if a check variance exceeds the tolerances specified below. Check the work at additional points as the Engineer directs. The Engineer may conduct periodic independent checks to verify accuracy with the plans and contract documents.
6. AMG Construction Tolerances

Item	Horizontal	Vertical
Daily Calibrations	0.10 feet*	0.05 feet*
Subgrade	0.25 feet	0.10 feet
Base Aggregate	0.25 feet	0.04 feet
Curb and Gutter	0.02 feet	0.01 feet
Concrete Pavement	0.02 feet	0.01 feet

*or as directed by the engineer

7. Contractor supplemental staking and dry run required by item to assist completing work within construction tolerances:
 - a. Curb and Gutter
 - 1) Inlets shall be staked to center of inlet at back of curb and minimum 10 ft. each side of inlet at back of curb. Stakes shall provide horizontal and vertical location of structure in the field from the construction documents.
 - 2) High/low points, and grade breaks shall be staked to substantiate vertical tolerances are met. Stakes shall be a maximum of 25 feet apart.
 - 3) Intersection curb radii PC, PT, mid-point, and ramp openings shall be staked to confirm intersection details are maintained.

- 4) Additional staking as determined in the field by Engineer to avoid possible conflicts.
 - 5) Contractor to provide at least one experienced staff member to determine that work conforms to the construction documents and allowed tolerances. If at any time work performed is producing unacceptable results contractor shall immediately stop work, notify Engineer, and may be required to revert to conventional staking methods.
 - 6) Contractor to perform dry run (no concrete placed) on a portion of the work, as directed by the Engineer, to ensure that AMG technologies will complete work within the construction tolerances. Allow the engineer to check projected curb grades on the machine during the dry run.
- b. Subgrade and Base Aggregate
 - 1) Offset staking required at high/low points, PC, PT, mid-points, and maximum of 400 ft. intervals to ensure necessary accuracy of vertical and horizontal compliance with contract documents.
 - c. Culverts
 - 1) Culverts require placement of 2 benchmarks placed within 100 ft. of each location where work is to be completed to ensure contractor/engineer can verify drainage of existing ground to best fit and record accurate as-built information.
 - d. Water Main
 - 1) Water main staking shall include all bends, tee's, hydrants, valves, reducers, etc. and a maximum interval of every 100 feet along the main.
 - e. Sanitary Sewer
 - 1) Sanitary Sewer staking shall include the structures, wye's, and 25-foot and 50-foot outside the structures along the sewer main being installed.
 - f. Storm Sewer
 - 1) Storm Sewer staking shall include the manhole and inlet structures, as well as 25-foot and 50-foot outside the structures along the storm sewer being installed. Inlet type structures shall reference the "top of curb" as well as the "back of curb" (if curb and gutter is required).

3.02 CONSTRUCTION SURVEY LAYOUT REQUIREMENTS AND TOLERANCES

- A. Tolerances for staking shall be 0.02 feet horizontal and 0.01 feet vertical unless otherwise stated.

Construction Staking Tolerances

Item	Horizontal	Vertical
Slope Stakes	0.25 feet	0.10 feet
Structure Layout	0.02 feet	0.01 feet
Sanitary Sewer	0.02 feet	0.01 feet
Water Main	0.10 feet	0.03 feet
Storm Sewer	0.02 feet	0.01 feet
Pipe Culverts	0.25 feet	0.03 feet
Electrical	0.02 feet	0.01 feet
Subgrade	0.25 feet	0.10 feet
Base Aggregate	0.25 feet	0.04 feet
Curb and Gutter	0.02 feet	0.01 feet
Curb Ramps	0.02 feet	0.01 feet
Concrete Pavement	0.02 feet	0.01 feet

PART 4 MEASUREMENT AND PAYMENT

4.01 CONSTRUCTION LAYOUT

A. General. Construction Layout shall be paid for at the bid price for the work as described above in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 1.

1. Construction Layout, Lump Sum. When so provided, payment for Construction Layout shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 1.
2. Construction Layout, Inclusive. When no quantity is provided, Construction Layout shall be considered inclusive to payment for the associated work.

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing submittal information as required by the contract drawings, other specification sections and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittal Log - Section 01 33 23

1.05 SUBMITTALS

- A. As soon as possible after Notice to Proceed, submit brochures of catalog cuts and specifications for all new equipment. Submittal of product data shall comply with the requirements for Submittals.
- B. Prior to fabrication or installation, submit Submittals for review. Each submittal shall consist of the minimum number of copies as listed on the submittal log. Two will be returned to the Contractor. Should more than two copies of reviewed Submittals be necessary for Contractor's use and distribution, the Contractor shall supply additional sufficient number of Submittals for review as required.
- C. Submittals shall include layout details, schedules, setting instructions, and manufacturer's literature. Concrete reinforcing steel Submittals shall include a concrete pouring sequence for structures with vertical construction joints.
 - 1. Submittals shall be identified with the name of the project, numbered consecutively and bear the stamp of review of the Contractor as evidence that all drawings have been checked by the Contractor for accuracy and compatibility with contract requirements. Drawings not so checked and noted will be returned without being examined.
 - 2. Partial lists will not be considered; Submittals for each part of work shall be complete in one submittal.
- D. If information on previously submitted Submittals is altered, in addition to the notations made by the Engineer, the Contractor shall bring all changes to the attention of the Engineer. Corrections or changes indicated on reviewed Submittals shall not be considered an order for extra work.
- E. Submittals will not be considered reviewed unless they bear the stamp of review and signature of the Engineer. Drawings will be reviewed for general design only. Dimensions and fit of units of various parts shall be the Contractor's responsibility.
- F. Prior to work at the site, submit samples allowing reasonable time for review and testing. Submit samples in sufficient quantity (minimum of five), of adequate size showing quality, type, color range, finish and texture. Label each sample stating material, description, applicable specification sections, intended use, project name, and Contractor's name.

- G. Order no materials subject to sample review until receipt of written shop drawing review. Materials installed shall match reviewed samples. No review of samples shall be taken in itself to change or modify contract requirements beyond the expressed stipulations of the review letter.
- H. All Submittals for major equipment must be reviewed and delivery dates scheduled prior to performing any work at the site. A revised work schedule shall be submitted weekly showing corrected delivery dates.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Prior to startup of the equipment, the Contractor shall provide the Engineer with operation and maintenance manuals as listed on the submittal log. The manuals shall include the following:
 1. Supplier and manufacturer's name, address, telephone number, and local representative's name, address and telephone number. Sources of service and parts and a list of local repair services, supply houses, and potential sources for the types of repairs and equipment parts.
 2. Complete and accurate set of record drawings including drawing dimensions, schematics of hydraulics, wiring, and piping.
 3. Warranties and bonds shall be included in manual.
 4. Catalog literature complete with test data and performance data and ratings.
 5. Specify equipment function, normal operating, and limiting conditions.
 6. Assembly, installation, alignment, adjusting, and checking instructions.
 7. Operating instructions for start-up, shutdown, routine and normal operation.
 8. Emergency operating instructions indicating range and flexibility during emergencies.
 9. Detailed service information including schedule of recommended maintenance.
 10. Troubleshooting, common operating problems, problems that might occur in unit/process. List probable causes and discuss control/prevention.
 11. Detailed safety section covering the operation and maintenance of unit. Contractor shall supply a complete list of equipment service numbers, model numbers, electrical requirements, manufacturer's names, etc.
 12. The correct model number shall be designated where the literature covers more than one model.
 13. For items assembled by the Contractor, the Contractor shall write and provide duplicate operation and maintenance instructions.
 14. Data shall be folded to 8-1/2 inch x 11 inch size and placed into hard cover binders. Material shall be grouped according to specifications section and filed behind individual filing tab pages on which the following is to be typed: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, Manufacturer's Order Number.
 15. Manuals shall be delivered to the Engineer for approval prior to job completion.

1.07 PERMITS AND APPROVALS

- A. Obtain and submit copies of all permits, code inspections, and approval documents, as specified.

1.08 CONSTRUCTION SCHEDULE

- A. Submit a minimum of five copies of a schedule of operation prior to construction. The schedule shall provide for activities of the various trades and shall be sequenced to provide a minimum of interruption to the operation of existing facilities. Allow ample time for the Owner to alter operations as required by the construction of the various components of the work. Revised and updated construction schedule shall be provided throughout the construction as deemed necessary and requested by the Engineer.
- B. The construction schedule shall be supplemented by a list of Submittals, dates they will be submitted for approval and a reasonable time allowance for review.

1.09 START-UP REPORTS

- A. Where equipment startup by a factory-trained representative is required, a minimum of three copies of the start-up report shall be submitted which describe the representatives activities and installation approval.

1. Start-up report shall be a typewritten document containing descriptive information specifically identifying the piece by equipment, all tests conducted, and the results of the tests.
2. Start-up role log, with the dated signatures of those conducting and accepting all start-up instructions and tests shall be provided as part of the report.

B. Substantial completion will not be issued until all start-up reports have been submitted.

1.10 RECORD DRAWINGS

A. The Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.

1. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
2. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner.

1.11 SUBMITTAL LOG

A. A submittal log is included as Section 01 33 23 of this Project Manual, which lists the minimum required Submittals, product data, samples, and operation and maintenance manuals. Additional submittals not listed on the log may be required by the Engineer during the course of construction. All submittals to the Engineer shall include the submittal number shown on the log. The minimum number of copies to be submitted is shown on the submittal log. Any additional copies required by the Contractor may be submitted in addition to the number shown on the log.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Submittals shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 SUBMITTALS

A. Submittals, Inclusive. The cost for all submittals shall be considered inclusive to payment for work related to the respective equipment, associated construction, or utility, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES SUBMITTAL LOG																			
PROJECT:										MSA PROJECT NO: 07807040									
CONTRACTOR:																			
Spec Section #	Spec Section Title/Product	Date Rec'd	Min. # Req'd	# Submitted	Submittal/Revision #	Referred			Action					# copies to					
						To	Date Sent	Date Reviewed	Reviewed with no Comments	Reviewed with Comments as Amend and Resubmit	Rejected	Date Ret'd	Contractor	Owner	Field	File			
01 32 23	Survey and Layout Data		1																
02 01 00	Maintenance of Existing Conditions		0																
03 15 00	Concrete Accessories		2																
03 20 00	Concrete Reinforcing		2																
03 30 00	Cast-In-Place Concrete		2																
05 52 00	Handrails and Railings		1																
31 05 19.13	Geosynthetics for Earthwork		1																
31 32 19.13	Geogrid		1																
32 13 10	Concrete Sidewalk, Steps and Driveways		1																
32 16 13	Concrete Curb and Gutter		1																
32 36 00	WI Site Furnishings		4																
32 84 23	Underground Irrigation		2																
32 91 19.13	Topsoil Placement Grading		0																
32 93 00	Landscaping		1																
33 05 26.16	Tracer Wire		0																
33 10 00	Water Utilities		3																
33 41 13	Public Storm Utility Drainage Piping		2																

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SECTION 01 35 00
SPECIAL PROCEDURES

CONTENTS: Work under this section is intended to supplement and/or modify the individual specifications. This section does not relieve the Contractor from fulfilling all items in said sections. The numbers of this section are referenced to those of Specifications Divisions 01 through 33.

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00.01 SPECIFICATION EXPLANATION

- A. The Special Procedures items will supplement or supersede the standard specifications. The number preceding special provisions refers to standard specifications that are being referenced. Where reference is made to Wisconsin Department of Transportation Specifications, all conditions of said specification will apply except "Payment and Measurement."

00.02 WAGE RATES

- A. The Contractor shall pay wage rates established by the local wage scale.

00.03 BID QUANTITIES

- A. All Bid Quantities are estimated. The Contractor shall field verify all quantities and work prior to submitting a Bid. Final quantities shall be adjusted to reflect the field installed quantities. The unit price in the Bid shall not be adjusted though final quantities may vary. Lump sum prices shall not be adjusted. The Engineer's estimate of quantities as shown in the Bid is approximate and the right is reserved by the Owner to increase or decrease said quantities.

00.04 ADDITIVE BID ALTERNATES

- A. The Bid contains additive bid alternates. The alternate bids will be used to shape the project to fit the budget. The Owner reserves the right to award the Contract on the base bid and any combination of the bid alternates.

DIVISION 01 - GENERAL REQUIREMENTS

01.01 SECTION 01 14 00 – WORK RESTRICTIONS AND PROVISIONS

- A. Work completed by others is noted on the plan.
 - 1. Work outside project disturbance limits: contractor to coordinate with owner, utility owners, and contractors completing work adjacent to project disturbance limits, including for access, staging, utility connections, etc. All work outside project disturbance limits is by others.
 - 2. Payment. All costs associated with the above work shall be considered incidental to the project work.
- B. Driveways, Roadways, and Entrances. Keep driveways and entrances serving adjacent properties and adjacent roadways clear and available to the property owners, the owner's employees, and emergency/law enforcement vehicles at all times. Do not use these areas for parking or storage of materials without prior written approval of the property owner. Schedule deliveries to minimize space and time requirements for equipment on-site. At the completion of each day driveway access shall be restored unless otherwise coordinated with the Engineer, the Village, and affected landowners.

- C. Storage of Equipment and Materials. The Contractor shall contain their efforts to the construction site/project boundary. If additional space is required, the Contractor shall discuss and work out the agreements with the Village for additional areas to utilize or with private property owners outside of this contract. All areas disturbed on the site and offsite due to the construction and storage of materials/equipment shall be restored to equal or better conditions.
- D. Temporary Fencing. The Contractor shall utilize temporary fencing to protect their work areas within the plaza. The Contractor shall protect their work area and work at the end of each day by closing off the work zone. Temporary snow fencing or better may be used to enclose areas such as the launch area, excavations and active construction zones. The public shall be blocked from entering the work area and area of stored materials at all times of the day and protected from the movement of equipment and materials to and from the work areas.
1. The fencing shall be maintained each day and be intact and fully standing at all times with no holes in the fencing or gaps on the top/bottom of the fencing.
 2. Payment. All costs associated with the above work shall be considered incidental to the adjacent work of the project.
- E. Traffic Control.
1. Provide pedestrian accommodations for sidewalk bypass as necessary.
 2. Flaggers shall be used at all times when deliveries and/or equipment movements impact or occur on the adjacent streets.
 3. Traffic control devices and materials shall conform to the MUTCD and applicable State Department of Transportation specifications.
- F. Adjacent Roadway Project Coordination
1. The Contractor shall coordinate all construction activities with the adjacent roadway project to prevent conflicts and maintain proper sequencing of work.
 2. The Contractor shall:
 - a. Communicate and schedule work to minimize disruption between projects.
 - b. Cooperate with the Owner and roadway project representatives regarding site access, staging areas, and shared resources.
 - c. Protect any Owner-provided materials or equipment delivered to the site until installation is complete.
 3. The Owner will deliver any Owner-provided materials to the site; the Contractor shall ensure readiness to receive and safeguard such materials
- G. Site removals. The Contractor shall remove, salvage, or dispose of all materials as required and explained in the contract documents. Removals include, but are not limited to, concrete pavement, sawcutting, walls, utilities, and existing site amenities. The contractor shall coordinate with the Owner on removals by Owner.
1. Payment. All cost associated with the above work shall be included in the bid price for "Site Removals, LS".
- H. Exploratory Excavations. As soon as possible, the Contractor shall dig and locate the existing utility as noted on the plan as directed by the Field Engineer. The Contractor shall pothole the existing utility and the Field Engineer will note the elevations of the existing utilities, prior to the installation of the proposed utility, to determine if there are conflicts. This information may be utilized to adjust the proposed utility design in the construction documents. The exploratory excavation shall be completed a minimum of 2 weeks in advance of needing to order any utility materials and shop drawings.
1. Payment. All costs associated with verifying existing utility elevations shall be included in the unit price bid for, "Exploratory Excavation."

01.02 SECTION 01 33 00 - SUBMITTALS

- A. Site furnishing submittals shall be submitted to the OWNER for final review and approval for the following items:
 - 1. Drinking Fountain.
 - 2. Shade Sail.
 - 3. Memorial Stone.
 - 4. Flagpole.
 - 5. Gateway Feature.

DIVISION 02 - EXISTING CONDITIONS

02.01 SECTION 02 01 00 – MAINTENANCE OF EXISTING CONDITIONS

- A. Restore all areas disturbed by construction activity construction to an equal or better than pre-existing condition.
- B. Contractor shall contain operations to within the right-of-way and Village property. No work shall occur on private property.
 - 1. Payment. All costs associated with the above work shall be considered incidental to the project.
- C. All existing infrastructure and site conditions shall not be disturbed if not approved by the Owner. If they are disturbed and/or damaged, the Contractor shall repair them back to equal or better conditions.
- D. Payment. All costs associated with the above work shall be considered incidental to the overall project.

DIVISION 03 - CONCRETE

03.01 SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

- A. Concrete Surfacing. Surfacing for concrete shall be broom finished concrete along all concrete within the project limits.
- B. The concrete shall be installed as per the contract plan detail or manufacturer's recommendations.
- C. Fly Ash. Fly ash shall not be used in the concrete mix for concrete pavements. Fly ash in the concrete mix is acceptable for concrete collars at storm sewer pipe connections.
- D. The contractor shall consider the proposed concrete areas and then propose a full pad jointing plan. The plan shall be proposed to Engineer for consideration and review prior to the concrete pour for the pad at least one (1) week in advance of the pour.
- E. Payment. All costs associated with the associated items including but not limited to the labor, materials, and construction methods shall be paid for under their respective items.

DIVISION 05 - METALS

05.01 SECTION 05 52 00 HANDRAILS AND RAILINGS

- A. RAILING
 - 1. Basis of Design Model: 'Montage Majestic', Ornamental Fence with square posts
 - 2. Fabrication: Steel
 - 3. Finish: Powder coat, Black
 - 4. Size: 42-inch
- B. Manufacturer: Ameristar Assa Abloy, 1555 N Mingo Rd, Tulsa, OK 74116, USA, 1.888.333.3422, <https://www.ameristarperimeter.com/us/en/products/ornamental-fence-gates/montage/montage-residential>, or approved equal.
- C. Mounting: Surface-mount to concrete per manufacturer's specifications.
 - 1. Mounts to be installed in such a way so as to avoid placement across concrete control joints.
- D. Location: Install Railing in the locations shown within the Construction Drawings.
- E. Payment. All labor, materials, and work and work associated with the installation of the Railing shall be paid for under the unit price bid item "42-INCH RAILING, BLACK, LF".

DIVISION 26 - ELECTRICAL

26.01 SECTION 26 05 01 – PROJECT SPECIAL CONDITIONS

- A. Base Bid. All electrical service, panelboards, outlets, boxes, conduit runs, fixtures, wiring, labor and materials to install electrical work as drawn in the Construction Drawings shall be included in the Base Bid with the only exception being materials and work in Additive Alternate #1. Conduit runs for outlet locations and gateway feature included Additive Alternate #1 shall be installed and capped as part of the base bid.
- B. Additive Alternate #1 – Site Lighting. The Additive Alternate includes wiring, above-ground installation of (2) outlet boxes and service connection to the Gateway Feature. Conduit shall still be run and capped for future installation to the location shown in the Contract Drawings.
- C. Site Lighting. All the associated work, materials and labor as described in this project shall be considered under two bid items.
 - 1. Payment. All labor, materials, and work as described in this division shall be considered and paid for under the lump sum bid items, "Site Electrical" or "Electrical Allowance".

DIVISION 31 - EARTHWORK

31.01 SECTION 31 11 00 – CLEARING AND GRUBBING

- A. Contractor shall perform all clearing and grubbing activities as needed to install the plaza, shade structures, utilities, and landscaping. Contractor shall clear and grub all trees, shrubs, landscaping, and stumps within the project grading limits and the temporary construction easements as shown on the drawings and as directed by the Field Engineer. No additional trees shall be removed unless approved by the Engineer and/or Owner.
 - 1. Payment. All labor, materials, and costs for the above work to clear and grub shall be paid for under the respective bid item, "Remove Site Trees."

31.02 SECTION 31 23 13 – SUBGRADE PREPARATION

- A. Unclassified Excavation. Unclassified excavation shall include, but is not limited to, all turf, topsoil removals; base course removal; overall site grading and concrete slab grading/excavation, asphalt excavation, sidewalk grading, , site preparation, and any other items requiring shaping/grading for their installation as shown on the contract drawings. Contractor shall consider cut/fill amounts for the proposed project. Topsoil shall not exceed 6-inches in depth.
1. Payment.
 - a. All costs, labor, and materials for earthwork, grading, excess materials beyond removals section, other items listed above, and fine grading shall be included in the lump sum price bid for "Unclassified Excavation." This shall include, but not be limited to, the removal of excess material, excavation to subgrade, stripping topsoil, fill, borrow, proper compaction, removal, transport, and placement of all excess material as required.
 2. Contractor shall compute and verify all earthwork volumes.
 - a. The Contractor shall coordinate earthwork operations to maintain the intended site balance.
 - b. It is the intent that the overall site is a cut site. The Contractor shall:
 - 1) Monitor excavation and fill quantities throughout the project.
 - 2) Identify and secure a disposal site for all excess soil, including fill and topsoil, at no cost to the Owner.
 - 3) Schedule hauling and disposal activities to avoid delays and conflicts with other work.
 - c. No additional compensation will be provided for disposal of excess material.
- B. Subgrade Staking and Roll Testing. Contractor shall set "blue tops" off of reference lines established by the site staking. The Engineer will inspect and observe testing of completed subgrade as soon as possible upon notification that "blue top" grade has been achieved. Testing of subgrade shall be performed by the Contractor by means of a "Roll Test" with a loaded tri-axle dump truck or other machinery with equivalent axle weights. Tests shall be performed under the observation of the Field Engineer. Testing of final base course layer shall also be performed via a roll test as described
1. Payment. All costs associated with subgrade staking and subgrade/base roll testing shall be included in the lump sum price bid for "Unclassified Excavation."
- C. Excavation Below Subgrade (EBS) with Breaker Run and Geogrid. Breaker run shall be used to backfill EBS areas. As directed by the Field Engineer, Contractor shall excavate below subgrade to remove weak or unacceptable soils. The resulting excavation shall be filled with breaker run material and geogrid as per this specification and compacted as required. Geogrid shall be Tensar BX 1100 (or Engineer approved equal) and installed per manufacturer's recommendations. All areas to be paved in the future shall be proof rolled at subgrade and with base course down to ensure stability as needed for future paving.
1. Payment. All costs associated with excavation, grading and disposal of material from EBS areas, geogrid, breaker run placement, and compaction shall be included in the unit price bid for "Excavation Below Subgrade with Breaker Run and Geogrid".

31.03 SECTION 31 23 33 – TRENCHING AND BACKFILLING

- A. Backfill. Backfill of all trenches shall be Type II. Existing material shall be utilized for backfill unless otherwise ordered by the Engineer. Rocks over 6 inches in diameter shall not be placed within 2 feet of any sanitary sewer, storm sewer, or water main.
- B. Imported Granular Backfill. Imported granular backfill shall only be placed upon Field Engineer's request.
1. Payment. All costs related to the installation of imported granular backfill, shall be included in the unit price bid item for "Imported Granular Backfill."
- C. Embedment Material. Class B bedding utilizing granular materials shall be used for all water mains. Clean sand bedding and initial backfill, 3/8" minus imported material, shall be used for all water service lines. Embedment and initial backfill materials shall be compacted with a vibratory compactor.

- D. Compaction. Compaction of backfill within two feet of all vertical utility structures including hydrants, valve boxes, cleanouts, manholes and inlets shall be accomplished by hand operated compaction equipment in lift thicknesses of eight inches or less.

31.04 SECTION 31 25 00 – EROSION CONTROL

- A. Erosion Control. The Contractor shall install erosion control measures to prevent siltation of culvert pipes, adjacent property, and the nearby waterways. Cleaning and/or sediment removal from storm sewers, ditches, private property, or the drainage ways due to erosion from the construction site shall be the responsibility of the Contractor at no expense to the Owner. Additional measures shall be installed as necessary to prevent siltation of the culverts, private properties, and the nearby waterways. Contractor shall be responsible for the completion of WisDNR required erosion control inspections and reports. Erosion control measures shown on the plans are project minimum requirements. Additional erosion control measures shall be required per the "State of Wisconsin Department of Natural Resources Storm Water Management Technical Standards" and/or directed by the Engineer in the field. Copies of some of the standards are included in the appendices. All technical standards can be found at:
 - 1. <https://dnr.wisconsin.gov/topic/Stormwater/standards>
- B. Payment. All costs associate with furnishing, installing, maintaining, and removing erosion control measures as required on the contract drawings or Wisconsin Department of Natural Resources Construction Site Erosion and Sediment Control Technical Standards, and as required by the Field Engineer and applicable standards shall be included in the lump sum price bid for "Erosion and Sedimentation Control, LS"

DIVISION 32 - EXTERIOR IMPROVEMENTS

32.01 SECTION 32 11 23 – AGGREGATE BASE AND SUBBASE

- A. Aggregate Base Course. Contractor shall match the base thickness per the Contract Documents. The aggregate base course shall extend a minimum of 1-foot past the edge of the pavement along all of the driveways and parking lot areas. The aggregate base course shall extend 6-inches beyond the edge of the proposed sidewalk areas.
 - 1. Payment. All costs associated with compacted aggregate base course construction shall be included the respective bid item.
- B. Breaker Run. Breaker run used to fill EBS areas shall be virgin 3-inch dense graded base meeting the requirements of the Wisconsin DOT Standard Specifications.
- C. Testing. Testing of shaped base course shall be performed by means of a roll test with a loaded truck or other machinery with equivalent axle weights. The minimum gross vehicle load weight used for roll testing shall not be less than 68,000 pounds. Tests shall be performed under the observation of the Engineer and Owner.
- D. Payment.
 - 1. All costs associated with breaker run breaker placement, and compaction shall be included in the unit price bid for "Excavation Below Subgrade with Breaker Run and Geogrid".

32.02 SECTION 32 13 10 – CONCRETE SIDEWALK, STEPS, & DRIVEWAYS

- A. 5-inch Concrete Sidewalk with Base. As indicated on the plans, concrete sidewalks shall be 5-inches in thickness and receive a minimum of 6-inches of 1 ¼ -Inch Dense grade base as defined by WisDOT standard specifications current at the time of this bid.
 - 1. Surfacing shall be medium broom finish along all sidewalks/paths.
 - 2. Payment.
 - a. All costs associated with the above work, but not limited to, shall be included in the unit bid price item for. "5-inch Concrete Sidewalk with Base."

- B. 5-inch Colored Concrete Sidewalk with Base. As indicated on the plans in the octagonal plaza concrete pours, concrete sidewalks shall be 5-inches in thickness and receive a minimum of 6-inches of 1 ¼ -Inch Dense grade base as defined by WisDOT standard specifications current at the time of this bid.
 - 1. Color shall be Brickform Shale or approved alternate. Contractor shall provide 2.5-foot x 5-foot test pour for color to be approved by owner.
 - 2. Surfacing shall be medium broom finish along all sidewalks/paths.
 - 3. Payment.
 - a. All costs associated with the above work, but not limited to, shall be included in the unit bid price item for. "5-inch Colored Concrete Sidewalk with Base."
- C. Dense Graded Base for Sidewalk Areas. Contractor shall use 1 ¼-inch dense graded base course for the sidewalk areas as defined by WisDOT Standard specifications current at the time of this bid.
 - 1. Payment. All labor, materials, and costs associated with the base shall be included in the unit price bid item for respective adjacent concrete work item.

32.03 32 16 13 – CONCRETE CURB AND GUTTER

- A. Concrete Curb: Concrete Curbs shall be installed as indicated in the project documents. The curb shall consist of reinforcing steel, dowels and compacted base, which will be incorporated into the proposed 5-inch concrete pavement.
 - 1. Payment. All labor, materials, and costs for the above work to set up and install concrete curbing shall be paid for under the respective bid item, "Concrete Curb, 4-Inch."

DIVISION 33 - UTILITIES

33.01 SECTION 33 05 16.13 PRECAST CONCRETE UTILITY STRUCTURES

- A. The unit bid price for "48-INCH METER PIT MANHOLE" shall constitute full compensation for all labor, materials, equipment, and incidentals necessary to complete the work as shown on the Drawings and specified. Work includes, but is not limited to:
 - 1. Furnishing and installing the precast concrete utility structure.
 - 2. Excavation, backfill, compaction, and grading required for installation.
 - 3. All connections, jointing, and sealing to ensure watertight integrity.
 - 4. Coordination with adjacent utilities and protection of existing facilities.
 - 5. Restoration of disturbed areas to original or specified condition.
 - 6. Compliance with all applicable codes, standards, and manufacturer's recommendations.
- B. No separate payment will be made for incidental work or materials; such costs shall be included in the unit price bid for this item.
- C. Payment.
 - 1. All costs associated with the above work, but not limited to, shall be included in the unit bid price item for. "48-INCH METER PIT MANHOLE."

33.02 SECTION – 33 10 00 – WATER UTILITIES

- A. Water Service Connection. Contractor shall connect into the site stub to make the proposed water service connection. The Contractor shall dig topsoil, turf, and fill back from the existing utility connection. The Owner's Utility will provide the water meter. Contractor shall coordinate all work with Owner to make the connection.
- B. The bedding, haunching and initial backfill material shall be ¾-inch clear stone. The initial backfill (cover material) shall be installed and compacted to a minimum of 12-inches over the top of the pipe. The remaining trench backfill shall be Type II backfill (suitable native excavated material) as approved by field engineer.

- C. Record Drawings. Contractor shall keep an accurate record of installed systems and note any changes to the original contract drawings. Records shall be kept up daily and available on-site to the Engineer at all times throughout construction. Contractor shall provide the Engineer a final set of record drawings upon completion.
- D. Connect to Existing Water Service. When no other fitting is required at the connection to the existing water service, a mechanical joint long sleeve shall be used.
 - 1. Payment. All costs related to connecting to existing water service, including all labor and materials, shall be included in the unit price bid for "Connect to Capped Water Service"

33.03 SECTION 33 41 13 – PUBLIC STORM UTILITY DRAINAGE

- A. Storm Sewer Piping.
 - 1. Storm sewer piping indicated shall be HDPE piping as indicated on the plans.
 - 2. The bedding, haunching and initial backfill material shall be ¾-inch clear stone. The initial backfill (cover material) shall be installed and compacted to a minimum of 12-inches over the top of the pipe. The remaining trench backfill shall be Type II backfill (suitable native excavated material) as approved by Engineer.
 - 3. The Contractor shall dye test and/or provide the necessary inspections to determine if any encountered storm laterals are active and need to be reconnected/relayed.
 - 4. Prior to acceptance, the Contractor and field engineer shall inspect the new storm structures for this project after the construction activities are complete. The Contractor shall repair and/or completely replace any defects or issues identified by the Owner during the inspection.
 - 5. Payment. All costs related to connecting to existing storm sewer, including all labor and materials, shall be included in the unit price bid for "Connect to Existing Storm Sewer" or "Public Storm Utility Drainage Piping, HDPE, Size."
- B. Storm manhole. The contractor shall install Drainage at the rim elevations as indicated plans. See project appendix for detail references.
 - 1. Payment. All costs associate with the drain and grate shall be included in the respective unit bid price item, "Nyloplast Drain Basin, (Size)."

END OF SECTION

SECTION 02 01 00
MAINTENANCE OF EXISTING CONDITIONS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover all materials, equipment, supervision, and labor necessary for surface restoration. The various street surfaces disturbed, damaged, or destroyed during the performance of the work under this contract shall be restored and maintained as shown, specified, and directed. Included in this classification are pavement surfaces of all types, pavement bases, shoulders, and appurtenances as driveways, curb and gutter sections, sidewalks, alleys, and all other miscellaneous surfaces required but not designated under other sections of these specifications.
- B. A schedule of restoration of the pavement surfaces shall be worked out by the Contractor and approved by the Engineer. The schedule shall be adhered to unless subsequent changes are approved by the Engineer.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Cast-in-Place Concrete - Division 03
- C. Subgrade Preparation - Division 31
- D. Trenching and Backfill - Division 31
- E. Aggregate Base and Subbase - Division 32
- F. Asphaltic Concrete Pavement - Division 32

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

- A. Materials shall comply with the respective sections of Divisions 03, 31, and 32 of these specifications, as they are applicable, and those of the State of Wisconsin, Department of Transportation, Standard Specifications to the extent indicated by the reference thereto.

2.02 PAVEMENT SURFACE AND APPURTENANCES

- A. Asphaltic concrete pavement and appurtenances shall conform to the requirements specified in Asphaltic Concrete Pavement - Division 32 or as specified in Special Procedures - Division 01.
- B. Concrete pavement and appurtenances shall conform to the requirements specified in Cast-in-Place Concrete - Division 03 or as specified in Special Procedures - Division 01.

PART 3 EXECUTION

3.01 GENERAL

- A. Workmanship shall comply with the respective sections of Divisions 03, 31, and 32 of these specifications, as they are applicable, and those of the State of Wisconsin, Department of Transportation, Standard Specifications to the extent indicated by the reference thereto.

3.02 TEMPORARY RESTORATION

- A. Upon completion of backfilling, the pavement surface damaged or destroyed shall be temporarily restored by the Contractor.
 - 1. The pavement shall be temporarily restored by placing on a prepared subgrade a base consisting of crushed gravel or crushed stone. The base shall have a minimum thickness of 8 inches plus the thickness of the permanent type of pavement to be replaced, or greater thickness if necessary to conform to the thickness of the base disturbed or removed, and shall be placed at the proper line and grade.
 - 2. Temporary pavement shall be maintained in a suitable and safe condition for traffic until the permanent pavement is laid.
- B. Type I backfill shall be used under all paved streets, paved roads, driveways, sidewalks and curb and gutter sections.
- C. Curbs, where possible, shall be temporarily reset in their place as a part of the temporary restoration. Damaged or destroyed sidewalks shall be temporarily restored by placing a 3-inch layer of granular base material, or other approved material.

3.03 PERMANENT RESTORATION

- A. Preparation for pavement and appurtenance replacements may proceed after trenches have been compacted in accordance with Trenching and Backfill - Division 31. Level and grade, fill, or re-excavate as necessary. Neatly trim any adjacent permanent pavement by a sawcut joint prior to pavement replacement.
 - 1. Base material shall be in accordance with Aggregate Base Course - Division 32 and to a depth of 8 inches or as specified in Special Procedures - Division 01.
 - 2. Asphaltic concrete pavement shall be in accordance with Asphaltic Concrete Pavement - Division 32 and to a depth of 3 inches or as specified in Special Procedures - Division 01.
 - 3. Concrete pavement and appurtenances shall be in accordance with Cast-in-Place Concrete - Division 03 and shall be to a depth of 8 inches or as specified in Special Procedures - Division 01. Concrete pavement reinforcement shall be equal to or exceeding that existing.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Maintenance of existing conditions shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 MAINTENANCE OF EXISTING CONDITIONS

- A. Maintenance of Existing Conditions, Lump Sum. When so provided, payment for maintenance of existing conditions shall be made at the contract lump sum price bid.
- B. Maintenance of Existing Conditions, Inclusive. When no quantity is provided, maintenance of existing conditions shall be considered inclusive to payment for work associated.

END OF SECTION

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SECTION 02 42 00
REMOVAL, SALVAGE AND ABANDONMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 1 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall include removals and abandonments of existing improvements as specified herein and marked in the field.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (NONE)

PART 3 EXECUTION

3.01 REMOVE CURB & GUTTER

- A. Remove curb and gutter at existing joint or sawcut straight joint to aid in removal.
- B. If curb and gutter is tied to concrete pavement, sawcut tie bars prior to removal.

3.02 REMOVE CONCRETE

- A. Remove concrete driveway, sidewalk and steps at existing joint and/or sawcut straight joint to aid in removal.
- B. Remove railings, if any.

3.03 REMOVE ASPHALTIC PAVEMENT

- A. Remove asphaltic roadway (including asphaltic curbs, if any), driveway and trail. Sawcut straight joint to aid in removal.

3.04 REMOVE PIPE

- A. Verify that all connections to/from the pipe have been disconnected and redirected to new facilities.
- B. Remove pipes and culverts, including endwalls, valves and any other appurtenant items.
- C. Backfill trench in accordance with Section 31 23 33.

3.05 REMOVE STRUCTURE

- A. Verify that all connects to/from the structure have been disconnected and redirected to new facilities.
- B. Remove total structure including casting, unless salvage casting is specified.
- C. Backfill trench in accordance with Section 31 23 33.

3.06 REMOVE HYDRANT

- A. Remove hydrant, valves and lead pipe.
- B. Install mechanical plug in existing tee after hydrant has been removed if watermain is not also slated for immediate removal or abandonment. Mechanical plug shall be in accordance with Section 33 10 00.
- C. Backfill trench in accordance with Section 31 23 33.

3.07 REMOVE RETAINING WALL

- A. Remove retaining wall, tie backs, anchorages, foundation, drain tile and any other appurtenant items.
- B. Avoid damage to adjacent structures including remaining sections of wall not scheduled for removal.
- C. Temporarily support soil retained by wall until grading and/or new wall is complete.

3.08 SALVAGE ASPHALTIC PAVEMENT AND BASE

- A. Salvage asphaltic pavement and base in accordance with WisDOT Standard Specification 325 except:
 - 1. Salvage any underlying crushed aggregate base.
 - 2. Pulverize asphaltic pavement to until at least 97% will pass the 2-inch sieve.
 - 3. Pickup, load, haul and stockpile material at a location directed by the Engineer.
 - 4. Salvaged material shall become Owner's property unless indicated otherwise in the Bid Schedule or Special Procedures – Division 01.

3.09 SALVAGE CULVERT

- A. Salvage culverts and apron endwalls in a manner that will prevent damage. Remove any sediment from within the culvert.
- B. Pickup, load, haul and stockpile at a location directed by the Engineer.
- C. Salvaged material shall become Owner's property unless indicated otherwise in the Bid Schedule or Special Procedures – Division 01.
- D. Backfill trench in accordance with Section 31 23 33.

3.10 SALVAGE CASTING

- A. Salvage casting and lid in a manner that will prevent damage. Remove any concrete or asphaltic pavement stuck to the casting and lid.
- B. Pickup, load, haul and stockpile at a location directed by the Engineer.
- C. Salvaged material shall become Owner's property unless indicated otherwise in the Bid Schedule or Special Procedures – Division 01.

3.11 SALVAGE HYDRANT

- A. Salvage hydrant and valve in a manner that will prevent damage.
- B. Remove lead pipe.
- C. Install mechanical plug in existing tee after hydrant has been removed if watermain is not also slated for immediate removal or abandonment. Mechanical plug shall be in accordance with Section 33 10 00.
- D. Pickup, load, haul and stockpile at a location directed by the Engineer.
- E. Salvaged material shall become Owner's property unless indicated otherwise in the Bid Schedule or Special Procedures – Division 01.
- F. Backfill trench in accordance with Section 31 23 33.

3.12 SAWCUT

- A. Asphaltic pavement sawcuts shall be cut a minimum of 2 inches deep.
- B. Concrete sawcuts shall be a minimum depth of one-third the concrete thickness.
- C. Contractor shall endeavor to minimize dust.
- D. Sludge from sawing shall not be allowed to flow onto, or be deposited on, any live traffic lane. If sludge from sawing is deposited onto adjacent concrete surfaces that will remain after the completion of the project, it shall be promptly removed to avoid staining.

3.13 ABANDON PIPE

- A. Verify that all connections to/from the pipe have been disconnected and redirected to new facilities.
- B. For watermains, close all valves, remove all valve boxes and hydrants.
- C. For sanitary sewers and storm sewers, remove all structures and apron endwalls in their entirety.
- D. Seal all pipe ends with concrete for a distance of 1 foot plus the diameter of the pipe.
- E. For all pipes greater than 8 inches in diameter:
 1. Provide fill and vent tubes through the end seals discussed above.
 2. Fill pipes with blown silica sand or flowable concrete.
 3. Seal fill and vent tubes as stated above after filling operations are complete.
- F. All trenches shall be backfilled in accordance with Section 31 23 33.

3.14 OTHER REMOVALS

- A. Includes all removals and salvaged items within the project area not specifically designated as a contract bid item in the bid form.
- B. Includes existing utilities designated for replacement and/or abandonment as part of the project.
- C. Shall be performed in accordance with the requirements of Section 204, State of Wisconsin, Department of Transportation, Standard Specifications.
- D. Where new pipe or structures are laid in the same location or below, the removal of any existing pipe or structures shall be incidental to the construction of the new system.

3.15 DISPOSAL

- A. All removed materials not designated for salvage, shall be removed from the project site and abandoned in accordance with all applicable laws and regulations. The Contractor is responsible for providing all necessary erosion control measures at disposal sites. No materials shall be deposited in wetland areas.
- B. Contractor is encouraged to recycle as much material as is practical.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Removals and abandonments shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

4.02 REMOVALS

- A. Remove Curb and Gutter, Lineal Foot. Measurement for remove curb and gutter shall be per lineal foot of curb removed as measured along the face of curb. Payment shall be made at the contract unit price as measured above for removal and disposal of curb and gutter.
- B. Remove Concrete, Square Yard. Measurement for remove concrete shall be per square yard of concrete removed. Payment shall be made at the contract unit price as measured above for removal and disposal of concrete.
- C. Remove Asphalt Pavement, Square Yard. Measurement for remove asphalt pavement shall be per square yard of asphalt removed. Payment shall be made at the contract unit price as measured above for removal and disposal of asphalt.
- D. Remove Pipe, Lineal Foot. Measurement for remove pipe shall be per lineal foot of pipe or culverts removed as measured along the centerline of the pipe to the center of adjacent structures and/or the end of endwalls. No measurement shall be made for removal of pipes when a new pipe or structure is installed in the same trench. Payment shall be made at the contract unit price as measured above for removal and disposal of pipe, endwalls, valves and any other appurtenant items.
- E. Remove Structure, Each. Measurement for remove structure shall be per each structure removed. No measurement shall be made for removal of structures when a new pipe or structure is installed in the same trench. Payment shall be made at the contract unit price as measured above for removal and disposal of structures and any other appurtenant items.
- F. Remove Hydrant, Each. Measurement for remove hydrant shall be per each hydrant removed. No measurement shall be made for removal of hydrants when a new pipe or hydrant is installed in the same trench. Payment shall be made at the contract unit price as measured above for removal and disposal of hydrant, valve, lead and any other appurtenant items and plugging existing tee.
- G. Remove Retaining Wall, Lineal Foot. Measurement for remove retaining wall shall be per lineal foot of retaining wall removed as measured along the face of the retaining wall at its base. Payment shall be made at the contract unit price as measured above for removal and disposal of retaining wall, tie backs, anchorages, foundation, drain tile and any other appurtenant items and providing temporary soil support.
- H. Other Removals, Inclusive. No separate measurement and payment will be made for other removals. All costs shall be inclusive to other items of work within this section or other related sections.

4.03 SALVAGE

- A. Salvage Asphalt Pavement and Base, Square Yard. Measurement for salvage asphaltic pavement and base shall be per square yard. Payment shall be made at the contract unit price as measured above for pulverizing, pickup, loading, hauling and stockpiling salvaged asphaltic pavement and base.

- B. Salvage Culvert, Lineal Foot. Measurement for salvage culvert shall be per lineal foot of culverts salvaged as measured along the centerline of the pipe to the center of adjacent structures and/or the end of endwalls. Payment shall be made at the contract unit price as measured above for salvaging, loading, hauling and stockpiling of culverts.
- C. Salvage Casting, Each. Measurement for salvage casting shall be per each casting salvaged. Payment shall be made at the contract unit price as measured above for salvaging, cleaning, loading, hauling and stockpiling casting.
- D. Salvage Hydrant, Each. Measurement for salvage hydrant shall be per each hydrant salvaged. Payment shall be made at the contract unit price as measured above for salvaging, loading, hauling and stockpiling hydrant and valve, removing and disposing of lead and any other appurtenant items and plugging existing tee.

4.04 SAWCUT

- A. Sawcut, Lineal Foot. Measurement for sawcut of asphalt and concrete shall be per lineal foot. Payment shall be made at the contract unit price as measured above for sawcut.

4.05 ABANDONMENT

- A. Abandon Pipe, Lineal Foot. Measurement for abandon pipe shall be per lineal foot of abandoned pipes of greater than 6 inches in diameter. No measurement will be made for abandoned pipes of 6 inches in diameter or less. Payment shall be made at the contract unit price as measured above for abandonment of pipes by way of sealing and filling.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. American Concrete Institute (ACI), Annual Book of ACI Standards:
 - a. ACI 308R – Guide to Curing Concrete, Current Edition.
 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
 - a. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete, Current Edition.
 - b. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions, Current Edition.
 - c. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Current Edition.
 - d. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation, Current Edition.
 - e. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete, Current Edition.
 - f. ASTM C882 - Standard Test Method for Bond Strength for Epoxy-Resin Systems Used with Concrete by Slant Shear, Current Edition.
 - g. ASTM C884 - Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay, Current Edition.
 - h. ASTM D6 – Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds, Current Edition.
 - i. ASTM D297 – Standard Test Methods for Rubber Products - Chemical Analysis, Current Edition.
 - j. ASTM D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type), Current Edition.
 - k. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), Current Edition.
 - l. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction, Current Edition.
 - m. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover, Current Edition.
 - n. ASTM E1643-98 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - o. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 3. Canadian General Standards Board (CGSB) Standards:
 - a. CGSB 41-GP-35M - Performance Standards for Poly Vinyl Chloride (PVC) Waterstops, Types I and III, Current Edition.
 4. Federal Specification TTS 227 and TTS 230, Current Edition.
 5. U.S. Army Corps of Engineers (USACOE), Specifications and Standards:
 - a. USACOE CRD-C572 - Specification for Poly Vinyl Chloride (PVC) Waterstop, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing and installing concrete accessories as shown on the contract drawings and specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Structural Cast-In-Place Concrete Forming - Division 03
- C. Cast-in-Place Concrete - Division 03

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to the rate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 WATERSTOP

- A. Polyvinyl Chloride PVC Waterstop.
 - 1. Ribbed Centerbulb, for non-moving joints: 4-inch long, minimum 3/16-inch thick with 1/8-inch ribs, 3/8-inch outside diameter centerbulb and shall comply with U.S. Corps of Engineers Specification CRD-C572.
 - a. Greenstreak 701 by Sika Corporation
 - b. Or equal
 - 2. Split Flange Type: 6-inch long, minimum 3/8-inch thick with 3/16-inch thick split ends, 5/8-inch outside diameter centerbulb,
 - a. Greenstreak 724 by Sika Corporation
 - b. Or equal
 - 3. Retrofit Waterstop: L-shaped PVC waterstop with 3-inch long legs, ribbed on one leg. Stainless batten bar with steel epoxy anchor bolt.
 - a. Greenstreak 655 with epoxy 7300 by Sika Corporation
 - b. Or equal
- B. Gasket Waterstop: Strip-applied non-swelling mastic waterstop for non-moving joints, 3/4-inch by 1-inch wide unless noted otherwise.
 - 1. Lockstop with Lockstop Primer by Sika Corporation
- C. Additional Waterstop at Tanks with Waterproofing Admixture: Use at all joints in water-retaining structures with waterproofing admixture (see Section 03 30 00).
 - 1. General: Crystalline, cementitious, non-toxic chemical treatment for the water-proofing and protection of concrete.
 - 2. Product: Use same product provided as admixture in concrete mix – see Section 03 30 00.
 - 3. Concentration: Concentrated slurry coat, concentration as recommended by manufacturer.

2.02 EXPANSION AND CONTRACTION JOINT FILLER

- A. Preformed Bituminous. Bituminous expansion and contraction joint filler shall be preformed bituminous strips which complies with ASTM D994.
- B. Preformed Sponge Rubber. Sponge rubber expansion and contraction joint filler shall be preformed which complies with ASTM D1752.
- C. Preformed Cork. Cork expansion and contraction joint filler shall be preformed which complies with ASTM D1752.

- D. Thermal Isolation Joint Material (Rigid Insulation). Polystyrene insulation, ASTM C578, Type X, extruded cellular type, 5 year aged R-value of 5.0 minimum at 75°F water absorption in accordance with ASTM C272 of 0.3 percent by volume maximum, minimum 15 psi compressive strength, 0.5 inch thick.
- E. Board Insulation. Contractor to choose from one of the following:
 - 1. Polystyrene insulation: ASTM C578, Type X, extruded cellular type, 5-year aged R-value of 5.0 minimum at 75°F, water absorption in accordance with ASTM C272 of 0.3 percent by volume maximum, minimum 15 psi compressive strength, 0.5-inch thick, square edges.
 - a. Owens Corning Foamular Insulating Sheathing
 - b. Or equal
 - 2. Polyisocyanurate insulation: ASTM C1289 Type 1, closed-cell polyisocyanurate foam core bonded to foil facing on each side, R-value of 6 per inch, 0.05 perm water vapor permeable, water vapor absorption of 0.1%; less than 25 flame spread index, less than 450 smoke developed index, 16 psi compressive strength, 40 psi flexural strength.
 - a. Dow Thermax Sheathing
 - b. Johns Mansville AP Foil Faced Polyiso Board
 - c. Sika Rmax Pro Select Polyiso Insulation Board
 - d. Or equal.
 - 3. EPDM Rubber insulation: ASTM C534 Type I and II, ASTM D1056, flexible, closed-cell EPDM-rubber based elastomeric, tube and sheet, UV resistant, indoor/outdoor, mold and fungal growth resistant. k Value: 0.245 at 75 degrees F (ASTM C518/C117). Water Absorption (weight %): 0.2% (ASTM C209). Water Vapor Permeability: 0.03 perm (ASTM E96). Flame Spread/Smoke Developed Ratings: 25/50.
 - a. Aerocel by Aeroflex
 - b. Or equal.
- F. Removable Plastic Expansion Joint Cap: Plastic joint cap, board width by 1/2-inch deep.
 - 1. Snap-Cap by W.R. Meadows.
 - 2. Geenstreak Expansion Board Cap by Sika Corporation.

2.03 BOND BREAKER

- A. Cast-in-Place Concrete Flatwork. Asphalt impregnated felts, 15 pound.
- B. Cast-in-Place Concrete Formwork. Non-staining liquid product which imparts a waterproof film to prevent adhesion of concrete and will not leave a paint-impeding coating on the face of the concrete.

2.04 VAPOR BARRIER

- A. Under Slab Vapor Barrier: 15 mil reinforced high-density multi-layer laminated polyethylene film for under slab application.
 - 1. Must meet the following minimum properties:
 - a. Barrier shall meet or exceed all requirements of ASTM E1745 Classes A, B and C.
 - b. Water Vapor Permeance (ASTM F1249): 0.038 perms
 - 2. Products:
 - a. Stego Wrap Vapor Barrier (15-mil) by Stego Industries
 - b. Griffolyn Type-65 by Reef Industries
 - c. Or equal
- B. Seam Tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide. Tape or Mastic by vapor barrier manufacturer.
- C. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

2.05 WATERPROOF SHEET MATERIAL FOR CURING

- A. Provide one of the following, complying with ASTM C171: waterproof paper, polyethylene film or polyethylene-coated burlap.
- B. Use only materials which are resistant to decay when tested in accordance with ASTM E154, as follows:
 - 1. Polyethylene sheet not less than 6 mils thick; or
 - 2. Water resistant barrier paper consisting of heavy papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side.

2.06 CONCRETE REPAIR COMPOUND

- A. Concrete repair compound shall be as required for the installation as manufactured, Master Builders Solutions, or equal.

2.07 PIPE SLEEVES, ANCHOR BOLTS AND CAST IRON GROOVES

- A. Shall be furnished, installed, and anchored solid in their final location.

2.08 CURING AND SEALING COMPOUND - INTERIOR

- A. Membrane-forming curing compound shall meet the moisture retention requirements of ASTM C309, Type 1.
 - 1. MasterKure CC 200WB by Master Builders Solutions.
 - 2. Sealtight CS-309-25 Curing and Sealing Compound by W.R. Meadows, Inc.
 - 3. Eucocure VOX by Euclid Chemical Co.
 - 4. Or equal.
- B. Products shall be compatible with surface finish. Where flooring manufacturer allows, use water-based dissipating type.

2.09 CURING COMPOUND - EXTERIOR

- A. Curing compound for use on standard exterior concrete shall comply with ASTM C309, Type 2; resin, white pigmented.
- B. Curing compound for use on colored exterior concrete shall comply with ASTM C309, Type 1, and shall be compatible with concrete coloring method and surface finish.

2.10 PLATE DOWEL SYSTEM

- A. Two-component concrete slab-on-grade construction joint dowel system consisting of plastic sleeves and 3/8 inch thick steel plates meeting ASTM A36. Plates to be set in a dowel form constructed of molded high density ABS plastic.
 - 1. Diamond Dowel System by PNA Construction Technologies.
 - 2. Speed Plate by Sika.
 - 3. T28 Superior Plate Dowel by Dayton Superior.
 - 4. Or equal.

2.11 DAMPPROOFING MEMBRANE

- A. Acceptable Manufacturers:
 - 1. W.R. Meadows, Inc.
 - 2. Master Builder Solutions by BASF
 - 3. Substitutions: per Section 01 60 00.
- B. Dampproofing:
 - 1. Sealmastic Asphalt Emulsion Dampproofing by W.R. Meadows, Inc.
 - 2. MasterSeal 614 by BASF

2.12 PIPE BOLLARD CAPS

- A. Pipe bollard caps: Precast concrete pipe bollard caps, 5000 psi fiber reinforced concrete with a cast in place anchor, diameter to match the steel pipe diameter: Top Gard concrete bollard caps by TopGard LLC 1125 Brookside Ave, Indianapolis, IN, www.topgardcap.com.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories where shown on contract drawings and as specified herein.
- B. Place bond breaker at junctures of slabs-on-grade with vertical walls.
- C. Expansion and Contraction Joint Filler: Install at locations noted on the drawings calling for expansion / contraction joint materials.
- D. Thermal Isolation Joint Material (Rigid Insulation): Install at the inside perimeter of the exterior wall foundation between the foundation wall and the concrete slab on grade. Place the snap cap on top of the insulation.
- E. Seal all exposed surfaces of expansion and contraction joints with joint sealer (3/4 inch deep and hold 1/8 inch below surface of concrete).
- F. All splices on PVC waterstops shall be field welded using an indirect heating element. Concrete shall be thoroughly vibrated around the waterstop to avoid honeycombs and to ensure complete embedment of the ribbed flanges.
- G. Apply concentrated slurry coat to surface of joints in water-retaining structures with water-proofing admixture. Clean joint as required by manufacturer. Apply slurry coat full width of second pour intersection. Apply per manufacturer's instructions for areas not subject to hydrostatic pressure.
- H. Install under-slab vapor barrier at locations shown on Drawings in accordance with manufacturer's instructions and ASTM E1643-98. Unroll vapor barrier with the longest dimension parallel with the direction of the pour. Seal vapor barrier to foundation walls behind perimeter expansion joint, unless shown otherwise on Drawings. Vapor barrier shall be continuous inside building foundation, unless noted otherwise. Overlap joints 6-inches and seal with manufacturer's tape. Seal all penetrations (including pipes) with manufacturer's pipe boot. No penetrations of the vapor barrier are allowed except for reinforcing and permanent utilities. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6-inches and taping all four sides with tape.
- I. Concrete Structural Repair Compound: Apply first coat of repair mortar with a stiff bristle brush to apply a scrub coat working the mortar into the honeycomb areas, then use a trowel to completely fill the honeycomb areas and trowel smooth the mortar to flush it out with the face of the concrete.
- J. Plate Dowel System: Install plate dowel system at concrete slab-on-grade construction joints per manufacturer's instructions. See Drawings for dowel spacing and slab depth positioning requirements.
- K. Dampproofing:
 - 1. Do not apply dampproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to dampproofing manufacturer.
 - 2. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
 - 3. Prime surfaces in accordance with manufacturer's instructions.
 - 4. Apply mastic to seal penetrations tie bar penetrations in substrate in accordance with manufacturer's instructions. Extend mastic in minimum 3-inch diameter around penetration. Apply two (2) coats, continuous and uniform. Do not apply where finished surface will be exposed.
 - 5. Protect membrane from damage.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Concrete accessories shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CONCRETE ACCESSORIES

- A. Concrete Accessories, Inclusive. When no quantity is provided, concrete accessories shall be considered inclusive to payment for work associated with cast-in-place concrete.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. American Concrete Institute (ACI) Specifications and Standards:
 - a. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures, Current Edition.
 - b. ACI 318 - Building Code Requirements for Structural Concrete and Commentary, Current Edition.
 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
 - a. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement, Current Edition.
 - b. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement, Current Edition.
 - c. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Current Edition.
 - d. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete, Current Edition.
 3. American Welding Society (AWS), Specifications and Standards:
 - a. AWS D12.1 - Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction, Current Edition.
 4. American Association of State Highway Transportation Officials (AASHTO), Specifications and Standards:
 - a. AASHTO M182 - Specification for Burlap Cloth Made from Jute or Kenaf, Current Edition
 5. Concrete Reinforcing Steel Institute (CRSI) Specifications and Standards:
 - a. CRSI - Manual of Standard Practice, Current Edition.
 - b. CRSI - Recommended Practice for Placing Reinforcing Bars, Current Edition.
 - c. CRSI - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature, Current Edition.
 - d. CRSI - Recommended Practice for Reinforcing Bar Splices, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing and installing concrete reinforcing as shown on the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Concrete Accessories - Division 03
- C. Cast-in-Place Concrete - Division 03

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specification. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
 - 1. Submit detailed reinforcing drawings prepared in accordance with ACI 315, including bar schedule with bar marks and bends indicated.
 - 2. Comply with CRSI Manual of Standard Practice showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete.
 - 3. Verify dimensions and make proper allowance for fitting together work of other trades.
- B. Submit a certification attesting that reinforcing steel meets the requirements of ASTM A615, including Supplementary Requirements S1, and that welded steel wire fabric meets the requirements of ASTM A185.
 - 1. Submit certified copies of mill reports, tensile and bend tests for reinforcing steel on projects where the quantity of reinforcing exceeds 15 tons.
 - 2. For information only, submit manufacturer's data and instruction for proprietary items, including reinforcement and accessories.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 REINFORCEMENT

- A. Steel Bar Reinforcement. Main reinforcing and stirrups; ASTM A615, Grade 60.
- B. Welded Wire Fabric. Welded wire fabric, flat sheets, ASTM A1064, 6x6-W2.9xW2.9, unless otherwise specified or indicated on the contract drawings.
- C. Steel Tie Wire. Steel tie wire, ASTM A82, plain, cold-drawn, 16 gauge or heavier.
- D. Supports For Reinforcement. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place complying with CRSI Manual of Standard Practice. For slabs on grade where base material will not support chairs, use supports with sand plates or horizontal runners to locate mesh properly in slab. Provide hot-dipped galvanized or plastic-coated accessories in contact with forms for sight exposed concrete; stainless steel accessories for sandblasted or bushhammered concrete.

PART 3 EXECUTION

3.01 FABRICATION

- A. Fabricate and place to shapes and dimensions indicated or required to carry out intent of contract drawings and these specifications.
- B. Bends for stirrups and ties shall be made around a pin having a diameter not less than four times the diameter of reinforcing bar. Bends for other bars shall be made around a pin having a diameter not less than six times diameter of bar, except that for bars larger than 1 inch, pin shall be not less than eight times diameter of bar.
 - 1. Perform cutting and bending in the shop; bend and cut steel cold. Heating of reinforcement will not be permitted. Do not bend or straighten bars in a manner that will injure the material.
 - 2. Field bending of bars shall not be allowed without the Engineer's approval.
- C. Tagging shall be with metal, linen, or rope fiber tags filled in with machine or waterproof ink. Paper tags shall not be allowed.
- D. Reinforcing bars shall conform accurately to the dimensions shown on the contract drawings.

3.02 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. For reinforcing steel fabricated on-site, shop from the mill in bundles, limited to one size and length, tagged with a waterproof tag showing the name of the mill, heat number, grade and size of the bars and identifying number.
- B. For reinforcing steel fabricated off-site, deliver in bundles identified as to structure and shop drawing number. Identify each individual bar with a waterproof tag showing the grade, size and bar mark from the approved bar schedule.
- C. Protect reinforcing steel and wire fabric from damage and from dirt, oil grease, other foreign matter, and rust-causing condition. Do not store reinforcement in direct contact with the ground.

3.03 CLEANING

- A. Before placing and before pouring concrete, all reinforcement shall be thoroughly cleaned of all oil, dirt, loose mill scale, loose rust, or foreign matter that will destroy or reduce bond.

3.04 PLACING REINFORCEMENT

- A. Placement. Metal reinforcement shall be accurately placed in accordance with approved Submittals and adequately secured in position by concrete or metal chairs or spacers. Nails shall not be driven into forms to support reinforcement nor shall wire ties come in contact with forms.
- B. Splicing. Lap at splices shall be sufficient to transfer stress between bars by bond and shear.
 - 1. Furnish reinforcing bars in full lengths as indicated on the contract drawings and approved Submittals.
 - 2. Do not splice bars unless indicated on the contract drawings or approved by the Engineer in writing. When authorized, make splices in accordance with ACI 318; perform welding in accordance with AWS D12.1.
 - 3. Splices generally shall be avoided at points of maximum stress. Minimum splice lap for stressed bars shall be forty times bar diameter.
- C. Offsets in longitudinal bars at change of cross section shall be placed in region of lateral support. Slope of inclined portion of offset shall not be more than one in six and, in tied columns, ties shall be spaced not over 3 inches on centers for a distance of 1 foot below actual point of offset.
- D. Embedded Items. The Contractor shall provide for the installation of all items embedded in the concrete, such as coil rod inserts, anchor bolts, dowels, etc., as shown on the contract drawings or as provided for in other Divisions of these specifications.
 - 1. All dowel bars shall be tied securely in place before pouring concrete.
 - 2. Provide for clearances with appurtenant materials and devices.
- E. Drilled and Grouted or Epoxy Dowel Installation. Existing concrete which will be incorporated into new work and requiring integration with new concrete will be doweled as indicated on the contract drawings and as follows:
 - 1. Drill hole in existing concrete of size that is 3/4 inch larger in diameter than diameter of dowel bar. Incline the hole in the concrete such that the non-shrink grouting or epoxy will be retained in the hole.
 - 2. Fill hole with non-shrink grouting or epoxy.
 - 3. Immediately place dowel bar into hole.
 - 4. Allow grout or epoxy to take initial set before disturbing dowel bar.
- F. Steel Reinforcing Fabric. Reinforce as detailed on the contract drawings; and where not indicated, reinforce with wire fabric, place 2 inches from the top of the slab.
 - 1. Flat sheets shall be used whenever available. Wire fabric shall lap 6 inches on side joints and 12 inches on end joints. Properly secure with annealed wire. Fabric shall be raised and secured in the correct location using permanent supports. Raising the fabric by hook during placement of concrete shall NOT be permitted.

2. Alternately, in tight quarters and around appurtenances and openings, lap mesh reinforcement not less than one mesh space plus 2 inches, and tie.
- G. Concrete Cover. The minimum cover of concrete for all reinforcement shall conform to the dimensions indicated on the contract drawings, which indicate the clear distance from the edge and end of the reinforcement to the face of the concrete surface. Provide clearance and spacing indicated on the contract drawings and approved Submittals, where so indicated.
1. Where no clearances are indicated, the thickness of the concrete cover over reinforcement shall be as follows:
 - a. Concrete cast against and permanently exposed to earth - 3 inches;
 - b. Formed concrete exposed to earth or weather - 2 inches;
 - c. Formed concrete not exposed to earth or weather - 1-1/2 inches;
 - d. Slabs not exposed to earth or weather - 1 inch.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Concrete reinforcing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CONCRETE REINFORCING

- A. Concrete Reinforcing, Inclusive. When no quantity is provided, concrete reinforcing shall be considered inclusive to payment for work associated with cast-in-place concrete.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work covered under this section shall cover furnishing all materials, equipment and labor required to construct all cast-in-place concrete as shown on the contract drawings and as specified.

1.02 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Concrete Quality Control - Division 01
- D. Structural Cast-in-Place Concrete Forming - Division 03
- E. Concrete Accessories - Division 03
- F. Concrete Reinforcing - Division 03

1.03 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.04 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Concrete Institute (ACI), Annual Book of ACI Standards:
 - a. ACI 117/177R - Standard Specification for Tolerances for Concrete Construction and Materials and Commentary, Current Edition.
 - b. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, Current Edition.
 - c. ACI 209.1R - Report on Factors Affecting Shrinkage and Creep of Hardened Concrete, Current Edition.
 - d. ACI 301 - Specification for Structural Concrete, Current Edition.
 - e. ACI 302.1R - Guide for Concrete Floor and Slab Construction, Current Edition.
 - f. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete, Current Edition.
 - g. ACI 305R - Hot Weather Concreting, Current Edition.
 - h. ACI 306 - Standard Specification for Cold Weather Concreting, Current Edition.
 - i. ACI 308R - Guide to Curing Concrete, Current Edition.
 - j. ACI 309R - Guide for Consolidation of Concrete, Current Edition.
 - k. ACI 311.4R - Guide for Concrete Inspection, Current Edition.
 - l. ACI 318/318R - Building Code Requirements for Structural Concrete and Commentary, Current Edition.
 - m. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures, Current Edition.
 - n. ACI 530/530.1/530R/530.1R - Building Code Requirements for Commentary for Masonry Structures and Specification for Masonry Structures and Related Commentaries, Current Edition.
 - o. ACI ASCC MNL-5 - The Contractor's Guide to Quality Concrete Construction, Current Edition.

- p. ACI CP-10/PACK - Craftsman Study Package for ACI Certification of Concrete Flatwork Technician/Finisher, Current Edition.
 - q. ACI MCP - ACI Manual of Concrete Practice, Parts 1 through 7, and Index, Current Edition.
 - r. ACI SCM-24 - Concrete Repair Basics, Current Edition.
 - s. ACI SP15 - Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with Selected ACI Reference, Current Edition.
 - t. ACI SP-71 - ASTM Standards in ACI 318, Current Edition.
2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
- a. ASTM C33 - Standard Specification for Concrete Aggregates, Current Edition.
 - b. ASTM C70 - Standard Test Method for Surface Moisture in Fine Aggregate, Current Edition.
 - c. ASTM C94 - Standard Specification for Ready-Mixed Concrete, Current Edition.
 - d. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or [50 mm] Cube Specimens), Current Edition.
 - e. ASTM C125 - Standard Terminology Relating to Concrete and Concrete Aggregates, Current Edition.
 - f. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate, Current Edition.
 - g. ASTM C128 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate, Current Edition.
 - h. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, Current Edition.
 - i. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete, Current Edition.
 - j. ASTM C150 - Standard Specification for Portland Cement, Current Edition.
 - k. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete, Current Edition.
 - l. ASTM C191 - Standard Test Methods for Time Setting of Hydraulic Cement by Vicat Needle, Current Edition.
 - m. ASTM C219 - Standard Terminology Relating to Hydraulic Cement, Current Edition.
 - n. ASTM C226 - Standard Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement, Current Edition.
 - o. ASTM C233 - Standard Test Method for Air-Entraining Admixtures in Concrete, Current Edition.
 - p. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete, Current Edition.
 - q. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for use as a Mineral Admixture in Portland-Cement Concrete, Current Edition.
 - r. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete, Current Edition.
 - s. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, Current Edition.
 - t. ASTM C566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying, Current Edition.
 - u. ASTM C595 - Standard Specification for Blended Hydraulic Cement, Current Edition.
 - v. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete, Current Edition.
 - w. ASTM C688 - Standard Specification for Functional Additions for Use in Hydraulic Cements, Current Edition.
 - x. ASTM C989 - Standard Specification for Slag Cement for Use in Cement and Mortars, current edition.
3. Portland Cement Association (PCA) Standards and Specifications:
- a. PCA - Design and Control of Concrete Mixtures, Current Edition.

1.05 DEFINITIONS

- A. Exposed or Exposed to View: Portion of the structure that can be observed by the "public" during normal operation.

1. Normal Operation: For tanks, this means when the tank is filled with liquid to the projected design average operating liquid level.
- B. Public: Persons allowed on-site and within buildings by the Owner.
- C. Liquid-Retaining Structure: A structure intended to hold and contain liquid in various stages of treatment. These structures are designed to be watertight to prevent leakage. Examples include: storage tanks; clarifiers; aeration tanks; digesters; chemical containment.
- D. Severe Exposure: Conditions where concrete is subjected to aggressive environments that can significantly impact its durability, such as chemical attacks from substances like acids, alkalis, or other corrosive chemicals.

1.06 SUBMITTALS

- A. Submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specification. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. Concrete Design Mix
 1. Prior to the start of placing of concrete, submit the design mix for each class of concrete, indicating that the concrete constituents and proportions will result in a concrete mix meeting the physical requirements for each class of concrete specified.
 2. Submit with the design mix, laboratory strength test reports and manufacturer's certificates attesting the conformance of constituents with these specifications.
 3. Do not vary the proportions of the constituents or source of material of the approved mix without submitting corresponding test result documentation to the Engineer for review and approval.
 4. Design mix shall indicate proportions of cement, aggregate and water, and names and proportions of admixtures and air-entraining agents.
 5. Laboratory strength test reports shall contain strength data for the required number of tests as specified in ACI 318 (for non-water retaining concrete) or ACI 350 (for water-retaining concrete) design specifications. If existing data for the required number of tests is not available, then ACI 318/350 allows for alternate data or trial mixture results to be submitted for approval. Provide certification that the design mix complies with all ACI and ASTM requirements.
- C. Concrete Installation Submittals
 1. Submit proposed plans and methods for cold/hot weather concrete placement procedures.
 2. Submit proposed curing and concrete jointing plans that indicate locations of construction joints and control joints for concrete walls and slabs.

1.07 MEETINGS

- A. Prior to submitting design mixtures and rebar shop drawings, contractor shall hold a meeting to review detailed requirements for preparing final concrete design mixes and expectations regarding shop drawing quality, to establish procedures for placing, finishing, curing, and protecting concrete to meet required quality under anticipated conditions, to review construction drawing details, and to review proposed construction and control joint locations and layouts. Representatives of each entity directly involved with the cast-in-place concrete shall attend, including the following:
 1. Contractor's superintendent
 2. Architect of Record or representative
 3. Structural Engineer of Record or representative
 4. MSA's Resident Project Representative (RPR)
 5. Testing laboratory responsible for field quality control
 6. Ready-mix concrete supplier
 7. Concrete subcontractor
 8. Special concrete finish subcontractor

- B. Pre-installation concrete meetings shall be held seasonally:
 - 1. Pre-Installation Concrete Meeting – Fall
 - a. Review of cold weather concrete placement procedures, curing methods, and protocols.
 - 2. Pre-Installation Concrete Meeting – Spring
 - a. Review of hot weather concrete placement procedures, curing methods, and protocols.
 - 3.

1.08 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 CEMENTITIOUS MATERIALS

- A. Cement
 - 1. Cement shall be Portland Cement ASTM C150 Type I or IA or ASTM C595 Class IL, except as otherwise noted or approved.
 - a. Type III cement shall only be used for Class L concrete, or when approved by the Engineer.
 - b. ASTM C150 Type I or IA, Type II, and Type III, and ASTM C595 blended cement types IL, IP, and IS shall be used for exterior flatwork as approved by the Engineer.
 - 2. A singular brand and manufacturer of cement shall be used for the entire work.
- B. Fly Ash and Slag
 - 1. Cement Substitutions:
 - a. Contractor may use fly ash or ground granulated blast furnace slag (GGBFS) as a substitute for a portion of Portland cement in the structural concrete. The maximum allowable substitution rates shall be as follows:
 - 1) Fly Ash: 20%
 - 2) GGBFS: 30%
 - 3) Total Mineral Admixture: 30%
 - 2. Fly Ash:
 - a. Fly ash shall conform to ASTM C618 Class C.
 - b. A singular source of fly ash shall be used for the entire work.
 - 3. Slag:
 - a. Slag shall be ground granulated blast furnace slag (GGBFS) conforming to ASTM C989.

2.02 AGGREGATE

- A. Aggregate shall consist of clean, hard durable sand, gravel, crushed gravel or crushed rock.
- B. Aggregate shall conform to the requirements of ASTM C33. Fine and coarse aggregate shall meet ASTM C33 grading requirements. Coarse aggregates shall be graded in accordance with ASTM gradations as follows:
 - 1. 3/4 inch maximum coarse aggregate - ASTM No. 67
 - 2. 1-1/2 inch maximum coarse aggregate - ASTM No. 467
- C. Maximum aggregate size shall be as defined in the Concrete Schedule, or where not defined in the Concrete Schedule, as defined by dimensional constraints for cast-in-place concrete as follows:
 - 1. Not larger than one-fifth of the narrowest dimension between sides of the forms;
 - 2. Not larger than one-third the thickness of the slab;
 - 3. Not larger than three-fourths of the minimum clear spacing between individual reinforcing bars or wire, bundles of bars, or prestressing tendons or ducts.

2.03 MIXING WATER

- A. Mixing water shall be natural or treated water, clean and free from injurious amount of oil, acid, alkali, chlorides and sulfates, other common salts, organic matter or other deleterious substances.

- B. Mixing water shall yield cement paste complying with the requirements ASTM C109 and ASTM C191.

2.04 ADMIXTURES

- A. All admixtures are subject to the written approval of the Engineer and shall be used in strict accordance with the manufacturer's recommendations.
1. Air-Entraining Admixture
 - a. All concrete exposed to weather and freeze-thaw cycles shall be air-entrained, unless otherwise specified.
 - b. Air-Entraining admixture shall conform to ASTM C260.
 - c. Air-Entrainment shall be as indicated for each class as in the Concrete Schedule.
 2. Water-Reducing, Set-Controlling Admixtures
 - a. Water-Reducing, Set-Controlling admixtures shall conform to ASTM C494, Type A for water-reducing, Type C for accelerating, Type D for water-reducing and retarding, and Type E for water-reducing and accelerating. Type F for water reducing, high range, and Type G for water reducing, high range and retarding.
- B. Crystalline Water-Proofing Admixture
1. Where: Water-proofing admixture is typically required in concrete mix for all concrete walls, floor slabs, and top slabs in water retaining structures. See Table 2 Concrete Schedule Uses and Properties.
 2. General: Admixture shall be crystalline, cementitious, non-toxic chemical treatment for the water-proofing and protection of concrete.
 3. Product:
 - a. Xypex Admix C-500, C-1000 or C-2000 as manufactured by Xypex Chemical Corporation, 13731 Mayfield Place, Richmond, BC, Canada, V6V 2G9; 800-961-4477 or 604-273-5264; fax 604-270-0451; enquiry@xypex.com; www.xypex.com
 - b. MasterLife 300D as manufactured by Master Builders Solutions Admixtures, LLC, 23700 Chagrin Boulevard, Beachwood, OH 44122; 800-628-9990; master-builders-solutions.com.
 - c. Penetron Admix SB as manufactured by Penetron USA, Inc., 45 Research Way, Suite 203, East Setauket, NY 11733; 631-941-9700; info@penetron.com; www.penetron.com
 - d. Substitutions: None.
 4. Dosing:
 - a. Rate as required by manufacturer.
 - b. Admixture must be added in accordance with the manufacturer's recommendations. Thorough blending of the admixture throughout the concrete mix is essential for correct performance and care should be taken to ensure a homogeneous mixture is obtained.
- C. Admixtures containing calcium chloride or soluble chloride shall not be used.

2.05 SYNTHETIC FIBER REINFORCEMENT

- A. Manufacturer:
1. The FORTA Corporation, 100 Forta Drive, Grove City, PA, 800.245.036, www.forta-ferro.com.
- B. Product: FORTA-FERRO
1. Fiber lengths are greater than 2.0 inches.
 2. Before mixing, fibers are collated by twisting with an initial bundle aspect ratio less than 20.
 3. Pre-mixing, macro monofilament fibers are bundled and have an aspect ratio of 80.
 4. Post mixing, fibers are dispersed and have an aspect ratio of 80 or greater.
 5. Fibers are made of copolymer virgin materials that are inert.
 6. Fibers are sized to be flexible and not stiff to ensure fibers 'lay down' and are easy to finish.
- C. Batching and Mixing
1. After all or a portion of the concrete has been loaded into the truck or mixer, add fiber reinforcement by mixer ready dispersible bags at the prescribed dosage with the drum turning.
 2. After fibers have been added, add water-reducing admixture (polycarboxylate superplasticizer).

3. Follow ACI procedures to mix 5 minutes once all ingredients are in the drum.

PART 3 EXECUTION

3.01 COORDINATION

- A. Examine the drawings and specifications for work of other sections or other contractors and coordinate such work with the requirements of this Section; make provisions for installation of such items as sleeves, pipes, conduits, inserts and hangers in a manner that will not impair or weaken concrete construction. Verify that preinstallation meetings have occurred per requirements of Part 1.

3.02 READI-MIX CONCRETE

- A. Acceptability and Use. Readymix concrete shall be designed on the basis of strength, durability, impermeability, and exposure condition, as required for the intended use of the structure by methods specified in ACI 211.1 and ACI 318. All readymix concrete shall comply with the water-cement ratio for each specific class of concrete as specified in the Concrete Schedule. Concrete design mix, complete with sample test results shall be submitted to the Engineer for approval prior to placing any concrete.
 1. Failure to Meet Strength Requirements. Failure to meet strength requirements shall be as defined in Concrete Quality Control- Division 01 of these specifications.
 2. Watertight Concrete. All concrete exposed to earth or water shall be watertight, shall have a water-cement ratio as specified, and shall be air-entrained as specified in the Concrete Schedule.
 - a. Provide damp-proofing membrane as indicated on the contract drawings.
 3. Waterproof Concrete. All concrete for water retaining structures shall be waterproof, shall have a water-cement ratio as specified, and shall be air-entrained as specified in the Concrete Schedule.
 - a. Install waterstops as indicated on the contract drawings.
- B. Mix Proportioning. Mix proportioning shall be the responsibility of the Contractor and shall be submitted for review and approval by the Engineer, in accordance with these specifications.
 1. Select proportions for concrete to obtain the quality requirements for the class of concrete as specified in the Concrete Schedule. Contractor, at their expense, shall have an approved independent laboratory prepare design mixes for each specified concrete class.
 2. Slump. Slump for class of concrete shall be as specified in the Concrete Schedule. The Contractor shall at their expense, make field slump tests in accordance with ASTM C143 and Concrete Quality Control-Division 01 of these specifications.
 3. Adjustment to Concrete Mixes. Design mix adjustments may be requested by the Contractor when characteristics of materials, conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised design mixes and strength results shall be submitted and approved before using in the work. No change in contract price will be allowed for these changes.
 4. Addition of Water to the Batch. Addition of water to the batch delivered to the site shall be in strict accordance with ASTM C94. This shall be the Contractor's responsibility and by their direction, following consultation with the Engineer.
 - a. Addition of water to the batch shall be one time only. Total gallons of water added to the batch shall be recorded on the load ticket, which shall be supplied to the Engineer prior to that delivery truck leaving the site. If water is permitted to be added to mixed concrete upon arrival at the job, an additional mixing of 30 revolutions of the drum shall be required.
 - b. Contractor shall adjust the water-cement ratio of the batch to the corresponding value based on the addition of water to the batch and shall submit this information to the Engineer with adjusted strength data for the final batch proportion.
 - c. At no time shall the addition of water cause the water-cement ratio specified in the concrete class schedule to be exceeded.

3.03 GENERAL

- A. Unless otherwise specified, conform to ACI 304, 305, and 306 for concrete installation requirements such as preparation, mixing, conveying, depositing, curing, and cold and hot weather requirements; consolidate concrete in accordance with ACI 309.

- B. Concrete not placed within 90 minutes or 300 revolutions, whichever occurs first, after the first mixing of the cement and aggregates will be rejected.
- C. Contractor shall indicate on record set of Drawings at site, for review prior to installation, a pouring program for concrete work showing unit of operation, method of pouring, installation of construction/control joints, expansion joints and all necessary work.
- D. Proper grade marker or stakes shall be used by Contractor to establish grades for ramps, platforms, sidewalks, slopes to drains, inlets, etc.
- E. Trenches, forms, conveying equipment shall be prepared to receive concrete in accordance with ACI 304.
- F. Place concrete footings upon undistributed clean surfaces, free from frost, ice, mud and water; when foundation is on dry soil or pervious material, lay waterproof sheathing paper over earth surfaces to receive concrete.
- G. Rock surfaces upon which concrete is to be placed, make level, clean, free from all objectionable coatings, water, mud, debris, loose semi-detached or unsound fragments; level surfaces to receive sand cushion placed to minimum thickness of 2 inches.
- H. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature and mechanical injury; maintain with minimum moisture loss and relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.
- I. All freshly cast concrete shall be protected from damaging effects of the elements freezing, rapid drop in temperature and loss of moisture and from future construction operations.

3.04 PREPARATION OF EQUIPMENT AND PLACE OF DEPOSIT

- A. Before placement, clean equipment for mixing and transporting the concrete; remove debris and ice from all surfaces upon which concrete is placed; clean reinforcement of dirt, loose rust, and mill scale, or other coatings.
- B. Remove water from all areas before depositing concrete; before depositing new concrete on or against concrete that has set, thoroughly roughen; clean existing surfaces of laitance, foreign matter or loose particles; retighten forms; slush existing surfaces with neat cement grout coat; place new concrete before grout has attained initial set; give horizontal construction joints grout brush coat of cement, fine aggregate, in same proportions as concrete to be placed.
- C. Thoroughly wet the stone base on which slabs are to be placed where no vapor barrier is indicated.
- D. Check compaction of fill and proper grade for slabs-on-grade. Check screeds and exercise care to prevent disturbing screeds during placement. Provide for construction joints in slabs-on-grade at 20 feet maximum in each direction unless shown otherwise on the contract drawings. Place expansion joint material at junctures of slabs-on-grade with vertical walls and as otherwise shown.
- E. Remove debris, excess form oil, and water from formwork; avoid washing newly deposited concrete.

3.05 MIXING

- A. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 and ACI 304. The production facilities shall comply with the requirements of the National Ready Mixed Concrete Association Certification Plan as regards materials storage and handling, batching equipment, central mixer, truck mixers, agitators, non-agitating units, ticketing system, etc.
- B. Do not over-mix; do not use concrete which is retained in mixers so long as to require additional water in excess of design mix water to permit satisfactory placing; retempering of mix is not permitted.

- C. Concrete shall be delivered to the site of the work and the mixed concrete discharged completely within 1-1/2 hours after water has been added to cement. In hot weather, or under conditions contributing to quick stiffening of concrete, this time may be reduced by the Engineer.
- D. Concrete delivered shall arrive at the site having a temperature not less than 50 Degrees F nor greater than 85 Degrees F, unless otherwise permitted by the Engineer.

3.06 CONVEYING

- A. Convey concrete from the mixer to the final deposit by methods that will prevent segregation or loss of materials.
- B. Use of aluminum conveyances is not permitted.

3.07 CONCRETE PLACEMENT

- A. Place concrete, including drops greater than 60 inches using recommended practices in accordance with ACI 304 and ACI 318. Once pouring operation commences, it shall be carried out as a continuous operation until a section is completed.
- B. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing; do not use vibrators to move concrete horizontally within the forms.
- C. Do not use retempered concrete or concrete contaminated by foreign material.
- D. Plan and conduct concrete placement to ensure that the concrete is kept plastic and that the concrete is free of cold joints.
- E. Where there is a time delay greater than 45-minutes between adjacent concrete placement, a bulkhead construction joint, complete with waterstops where required, must be installed.
- F. Do not commence placing when the sun, heat, wind or limitations of facilities provided prevent proper finishing or curing.
- G. Discontinue concreting when the descending natural air temperature falls lower than 40 Degrees Fahrenheit unless preparations are made and in place to heat or insulate concrete in accordance with the cold weather concreting requirements of this specification.
- H. Concrete for walls shall be deposited in approximately horizontal layers not to exceed 18 inches in height to avoid segregation due to rehandling and flowing.
- I. Concrete shall not be placed or poured in water. Water level shall be removed or lowered in a manner approved by Engineer. Excess water shall not be permitted. Powdering a mixture of cement to absorb excess water shall not be permitted.
- J. Concrete shall be placed before initial set has occurred. Placing should be carried on in such manner that the concrete in the form is still plastic and can be integrated with fresh concrete.
- K. Contractor shall notify Engineer of concrete pouring schedule one day in advance of pour to allow for inspection of reinforcing and forms.
- L. Bottom dump buckets may be used for transporting mixed concrete to the desired location. Particular care shall be taken to avoid jarring or bumping as this may cause segregation.
- M. Where chutes are used to transport concrete, they shall be of metal or wood with metal lining and should have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials.

The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the form.

- N. Elephant trunks and/or tremies shall be used in walls and columns to prevent free fall of the concrete and to allow the concrete to be placed through the cage of reinforcing steel.
- O. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity. Loss of slump in pumping shall not exceed 1-1/2 inches.

3.08 CONSOLIDATION

- A. Each concrete layer placed shall be compacted by mechanical internal vibrating equipment supplemented by hand spading, rodding, or tamping.
- B. The period of concrete vibration shall not be less than two seconds nor more than five seconds at any one point.
- C. Consolidate concrete thoroughly as it is placed in order to secure a dense mass; work concrete well around the reinforcement and embedded items and into the corners of the forms.
- D. Use internal vibrators inserted vertically over the entire area of the placement; form vibrators not permitted; internal vibrators shall maintain a minimum of 5000 impulses when submerged in concrete.
- E. Vibrate until voids are eliminated, coarse aggregate is suspended in mortar, and entrapped air bubbles begin to rise to the surface; concrete should move back into the space vacated by the vibrator; vibration duration shall be limited only to the time necessary to produce consolidation without causing segregation.
- F. Space vibrator insertions such that the area visibly affected by the vibrator overlaps the adjacent just-vibrated area by a few inches.
- G. Penetrate at least 6 inches into previously placed layers in order to bond between layers and avoid cold joints.
- H. Take care not to over-vibrate air entrained concrete; place vibrator to eliminate honeycombing but avoid excess vibrating that bleeds all entrapped air from the mix.
- I. Do not use vibrators to transport concrete.

3.09 JOINTS

- A. Construct expansion, control, and isolation joints only where indicated on the drawings or at additional locations approved by the Engineer (and as shown on the Standard Details).
- B. Where the placing of concrete is discontinued, clean off laitance and other objectionable material to a sufficient depth to expose sound concrete as soon as concrete is firm enough to retain its form; smooth the top surface of concrete adjacent to the forms with a trowel to minimize visible joints on exposed faces.
- C. Immediately upon completion of the work of placing concrete, remove accumulations splashed upon the reinforcement and the surfaces of the forms; perform this removal before concrete takes its initial set; clean reinforcing steel carefully to prevent damage to the concrete steel bond.
- D. Do not halt work within 18 inches of the top of any face.
- E. For bonded horizontal joint construction, roughen the surface and expose the aggregate; clean the surface thoroughly by wet sandblasting, by cutting with high-pressure water jet or by other approved methods; perform cleaning after the concrete has hardened to prevent raveling of the surface below the desired depth.

- F. Construction and contraction joints shall be constructed with interfaces roughened to 1/4-inch amplitude, cleaned and laitance removed.
- G. Before bonding concrete is placed, clean the surface of loose or soft particles or other objectionable materials and keep wet for a minimum period of 12 hours.
- H. Cover the cleaned and saturated surface with a coating of neat cement grout and deposit new concrete before the grout has attained its initial set.

3.10 CURING

- A. Concrete shall be wet cured by immersion of moisture-retaining covers in conformance with ACI 308 or shall receive curing compound in accordance with ACI 309.
- B. Water curing is the preferred method of protection for curing concrete; cover exposed surfaces with a saturated material (burlap or cotton mats) and keep wet continuously with a soil soaker hose for 7 curing days for all concrete except high early strength concrete; leave covering in place, without wetting, for an additional 3 days.
- C. A curing day is defined as 24-hour day when the concrete surfaces are kept moist and the uniform temperature of the concrete mass is between 55 Degrees Fahrenheit and 75 Degrees Fahrenheit.
- D. Curing shall start as soon as free surface water disappears after finishing. Where forms are not removed immediately, curing shall be accomplished in a manner acceptable to the Engineer.
- E. Curing compounds may not be used on surfaces that are to receive additional concrete, paint or tile, unless approved by the manufacturer for such use.
- F. Curing and sealing compound shall not be applied to steel reinforcing anchors, water stops, construction joints, or surfaces to be bonded to other concrete.
- G. When using a curing compound, keep surfaces moist after the forms are removed. Preferred sequence: Remove forms in accordance with 03 11 13 Structural Cast-In-Place Concrete Forming of this specification; apply curing compound according to manufacturer's recommendations (if manufacture allows pre-finishing application); repair form tie holes; finish surface. Alternate sequence (if manufacturer does not allow pre-finishing application): Remove forms in accordance with 03 11 13 Structural Cast-In-Place Concrete Forming of this specification; repair form tie holes; finish surface; apply curing compound according to manufacturer's recommendations.
- H. Slabs: Immediately following slab finishing, begin water curing before the surface becomes dry or apply liquid membrane-forming curing compound.
 - 1. For exposed slabs with synthetic fiber reinforcement (fiber mesh), the exposed fibers shall be melted or burned off with a heat source prior to applying the curing compound.
- I. Vertical Surfaces: When the forms are removed entirely, spray the surface with water and allow it to reach a uniformly damp appearance with no free water on the surface; apply curing compound or begin water curing.
- J. For curing concrete under hot weather conditions, see Hot Weather Requirements in this section.
- K. For curing concrete under cold weather conditions, see Cold Weather Requirements in this section.

3.11 CONCRETE SLAB FINISHING

- A. Complete screeding and darbying slabs before excess moisture or bleeding water is present on the surface.

- B. Do not begin subsequent finishing operations until surface water has disappeared and the concrete will sustain foot pressure with only approximately 1/4 inch indentation.
- C. Refer to Concrete Schedule, included in this specification section, for finish type at each location, defined as follows:
 - 1. Smooth Float Finish: (Type S1)
 - a. Consolidate concrete with a power-driven disc-type float or a combination floating-troweling machine with metal float shoes attached.
 - b. Machines which have a water attachment for wetting the concrete during the finishing operation are prohibited.
 - c. Check and level surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge. Cut down high spots and fill low spots; immediately after re-leveling, refloat surface to a uniform, smooth, granular texture.
 - d. Where slab drainage is indicated, take care to maintain accurate slopes for drainage.
 - 2. Steel Troweled Finish: (Type S2)
 - a. Produce a Smooth Float Finish S1.
 - b. After float finishing, steel trowel surface as specified in Concrete Schedule to increase the compaction of fines and to provide maximum density and wear resistance.
 - c. Steel Troweled Finish: Screed and bull float or darby. Give preliminary float finish, true, even and free from depressions; float surface with hand or machine floats; compact surface with not less than 2 thorough and complete steel troweling operations.
 - d. Tolerance on finished steel troweled floors in no instance shall exceed 1/8 inch in 10'-0" on surface; where floor drains occur, slope floors to drains.
 - e. Buffing: After concrete floors have been properly cured, buff thoroughly to remove soluble salt incrustation or other foreign substances.
 - 3. Integral Finishes: (Type S3)
 - a. Use for slabs where some material other than concrete will be the final wearing surface.
 - b. Screeded Finish - Place screed blocks at frequent intervals and strike off to surface elevations desired; unless otherwise indicated, use on base slabs upon which grout finish, regular mortar bed ceramic tile, sand cushion terrazzo or similar type wearing surface is applied.
 - 4. Broom Finish: (Type S4)
 - a. Produce Smooth Float Finish S1.
 - b. Draw stiff broom over surface, to obtain non-slip finish.
 - 1) At Sidewalks, produce a medium-coarse broom finish.
 - 2) At all other areas produce a fine broom finish.
 - c. For slabs with synthetic fiber (fiber mesh) reinforcement, broom in one direction only, with a consistent sweeping motion to align the fibers with the broom texture.
 - 5. Abrasive Aggregate Non-slip Finish: (Type S5)
 - a. Screed and float concrete to the required finish level with no coarse aggregate visible.
 - b. Uniformly sprinkle abrasive aggregate over the floated surface at a rate of not less than 1/4-pound per square foot.
 - c. Steel trowel surface to a smooth even finish, uniform in texture and appearance and free from blemishes, including trowel marks.
 - d. Immediately after curing remove cement coating covering the abrasive aggregate by steel brushing, rubbing with an abrasive stone or sandblasting to expose abrasive particles.
 - 6. Hardener Floor Treatment: (Type S6)
 - a. Hardener shall be installed in strict accordance with manufacturer's printed instructions; experienced workmen shall apply hardener at a minimum of 45 pounds per 100 square feet.

3.12 CONCRETE SIDEWALKS

- A. Concrete sidewalk construction shall be as specified in Concrete Sidewalks, Steps, and Driveways - Division 32 of these specifications.

3.13 CONCRETE CURB AND GUTTER

- A. Concrete curb and gutter construction shall be as specified in Concrete Curb and Gutter - Division 32 of these specifications.

3.14 CONCRETE WHEEL BUMPER BLOCKS

- A. Shall be reinforced precast concrete, minimum 4000 psi, with air entrainment; maximum height 6 inches; install where indicated on Drawings.

3.15 CONCRETE SPLASH BLOCKS

- A. Reinforced precast concrete splash blocks formed of 4000 psi concrete with air entrained concrete; shall be 2 inches thick x 1'-0" wide x 2'-6" long; front shall be turned up 4 inches for 6 inches overall height; upper corners of turned up lip shall be cut off at 45 Degree angle; wire mesh reinforcing turned up in front lip.

3.16 CONCRETE FILL FOR COMPOSITE FLOOR DECK

- A. Fill over composite floor deck shall be lightweight aggregate concrete; no admixtures containing chloride salts or other deleterious materials shall be used; lightweight concrete shall not exceed 100 pcf weight.

3.17 PERIMETER INSULATION

- A. Install perimeter insulation at building foundation wall and under floor slab as shown on the contract drawings.

3.18 HOT WEATHER REQUIREMENTS

- A. Comply with ACI 305R unless otherwise specified herein below.
- B. Hot weather conditions are deemed to exist when the temperature in the forms is 75 Degrees Fahrenheit or above, or a combination of high air temperature, low relative humidity and wind velocity impair the quality of fresh or hardened concrete; take protective measures for mixing, transporting and placing concrete in accordance with ACI 305R.
- C. The temperature of the concrete at the place of discharge may not exceed 85 Degrees Fahrenheit.
 - 1. If ice is used to lower temperature, place crushed, shaved or chipped ice directly into the mixer as part or all of the mixing water; mix until ice is completely melted.
 - 2. Record the concrete temperature at the time of discharge.
- D. Do not add water that will cause the proportions to exceed the maximum water-cement ratio shown in Table I.
 - 1. Notify the Engineer before adding any water to the concrete mix.
 - 2. Record the amount of water added to the concrete at the jobsite.
- E. Discharge concrete within 45 minutes or 100 revolutions, whichever occurs first, after the first mixing of cement and aggregates.
- F. Placing and Curing:
 - 1. Place concrete promptly upon arrival.
 - 2. Provide at least one standby vibrator for each 3 vibrators in use.
 - 3. Protect concrete from direct sunlight; keep forms covered and moist by means of water sprinkling or the application of continuously wetted burlap or cotton mats for a minimum of 24 hours. Windbreaks and/or sunshades shall be provided as directed by the Engineer.
 - 4. When forms are removed, provide wet cover to the newly exposed surfaces to avoid exposure to hot sun and wind.
 - 5. Continue specified water curing methods for 10 days; leave covering in place 4 additional days; do not permit alternate wetting and drying cycles.

6. For slabs on grade, beam and deck concrete, and other horizontal placements protect the surface between finishing operations using one or more of the following methods:
 - a. Careful use of a fog nozzle.
 - b. Spreading and removing polyethylene sheeting between finishing operations.
 - c. Application of mono-molecular film after the strike-off.
- G. During extremes in weather, floor slabs shall not be cast unless the slab is protected by a roof and other suitable protective measures are provided. After curing has been completed, the floor shall be exposed to the air for 48 hours prior to allowing traffic on the floors.

3.19 COLD WEATHER REQUIREMENTS

- A. Comply with ACI 306.1 (R2002) unless otherwise specified herein below.
- B. Cold weather is defined any time when the daily temperature is 40 Degrees Fahrenheit or lower during placement and the protection period. If at any time during the progress of the work, the temperature drops below 40 Degrees F., the Contractor shall make suitable provisions to protect the concrete by use of insulation materials such as blankets, mats, etc., and equipment for providing artificial heat.
- C. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelope. Combustion gases shall not be allowed in any temporary enclosure and building envelope.
- D. Protect concrete surfaces from freezing for at least 24 hours after placement.
- E. All surfaces in contact with newly-placed concrete including formwork, reinforcement and subgrade must be above 35 Degrees Fahrenheit.
- F. Use preparation methods capable of producing concrete with a temperature not more than 85 Degrees Fahrenheit, and not less than 55 Degrees Fahrenheit, at the time of placement.
- G. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, within the specified temperatures. (Do not heat water in excess of 140 Degrees Fahrenheit.)
- H. Concrete shall have a temperature of not less than 55 Degrees Fahrenheit when placed; mix concrete at a temperature between:
 1. 60 Degrees Fahrenheit and 70 Degrees Fahrenheit when outside air temperature is above 30 Degrees Fahrenheit.
 2. 65 Degrees Fahrenheit and 75 Degrees Fahrenheit when outside air temperature is between 0 Degrees Fahrenheit and 30 Degrees Fahrenheit.
 3. 70 Degrees Fahrenheit and 80 Degrees Fahrenheit when outside air temperature is below 0 Degrees Fahrenheit.
- I. Follow concrete placement with tarpaulins or other readily movable coverings, so only a few feet of concrete is exposed to the outside air at any time.
- J. Maintain the temperature and moisture conditions specified in all parts of the newly placed concrete by covering, insulating, housing or heating; arrange for protection methods in advance of placement.
- K. Maintain concrete at a temperature of not less than 55 Degrees Fahrenheit nor more than 70 Degrees Fahrenheit for a period of 3 days after placement.
- L. A thermometer accurate to plus or minus 2 Degrees F shall be placed under the curing blanket. Additional insulation shall be supplied as required to maintain the temperature above 55 Degrees F.

- M. After the curing period, the temperature of the exposed surface shall not be permitted to drop faster than 30 Degrees F in 24 hours.
- N. Do not remove forms during the initial protection period.
- O. Protect insulation against wetting that will impair its insulating value using moisture-proof cover material; keep insulation in close contact with concrete.
- P. Construct enclosure to withstand wind and snow loads and be reasonably airtight; provide sufficient space between the concrete and enclosure to permit free circulation of heated air.
- Q. Use vented heaters; do not permit heaters to heat or dry concrete locally. Unvented salamanders or other heaters which produce carbon dioxide as by-products shall not be permitted within enclosures or inside buildings. If heaters are used, precautions shall be taken to prevent drying of the slab through the use of water jackets or other suitable methods.
- R. Maintain relative humidity above 40% within heated enclosures before construction supports are removed.
- S. Monitor temperature to ensure concrete is kept within specified limits recording time and concrete temperature every 8 hours.
- T. Assure concrete has developed necessary strength before removing forms; provide additional test cylinders with the same protection as the structure they represent to verify concrete strength before construction supports are removed.
- U. If water curing is used, terminate at least 12-hours before end of temperature protection period. Permit concrete to dry.
- V. After the required protection period gradually reduce the concrete temperature within an enclosure or insulation at a rate not to exceed 20 Degrees Fahrenheit per day until the outside temperature has been reached.
- W. Apply membrane forming curing compound to concrete surfaces during the first period of above-freezing temperatures after forms are stripped and before air temperature rises to 50 Degrees Fahrenheit; apply membrane forming curing compound to slabs as soon as finishing operations are completed, except where live steam curing is used.

3.20 DELIVERY TICKETS

- A. With each load of concrete delivered to the job there shall be furnished by the ready-mixed concrete producer duplicate delivery tickets, one for the Contractor and one for the Engineer. Delivery tickets shall provide the following information:
 1. Date and serial number of ticket;
 2. Name of ready-mixed concrete plant;
 3. Job location;
 4. Contractor;
 5. Type and brand name of cement;
 6. Mix number or specified cement content in bags per cubic yard of concrete;
 7. Truck number;
 8. Time dispatched stamped by a time clock;
 9. Amount of concrete in load in cubic yards;
 10. Admixtures in concrete, if any;
 11. Maximum size of aggregate;
 12. Water added at job, if any;
 13. Slump of concrete ordered

TABLE 1
CONCRETE CLASS SCHEDULE

Parameter Value	Compressive Strength (PSI) 28-Day	Water-Cement Ratio Maximum	Air Content Range (%) Minimum-Maximum	Slump Range (Inches) Minimum-Maximum	Coarse Aggregate (Inches) Maximum
Class A	4,000	0.5	1 to 2	2 to 4	3/4
Class B	4,000	0.5	1 to 2	2 to 4	1-1/2
Class C	4,000	0.5	5 to 7	2 to 4	3/4
Class D	4,000	0.5	4 to 6	2 to 4	1-1/2
Class E (Interior)	3,000	0.5	1 to 2	2 to 4	3/4
Class F (Exterior)	3,000	0.5	5 to 7	2 to 4	1-1/2
Class G	2,000	0.67	1 to 2	4 to 6	1-1/2
Class H	5,000	0.45	1 to 2	2 to 4	3/4
Class I	5,000	0.45	1 to 2	2 to 4	1-1/2
Class J	5,000	0.45	5 to 7	2 to 4	3/4
Class K (Exterior)	5,000	0.45	4 to 6	2 to 4	1-1/2
Class L	3,000 psi @24 hours	0.40	5 to 7 4 to 6	2 to 4 2 to 4	3/4 1-1/2

TABLE 2
CONCRETE SCHEDULE
USES AND PROPERTIES

Use	Finish	Class and Considerations
Standard Concrete (not including liquid-retaining or severe exposure structures)		
Foundations, walls, and footings, (Buried and non-exposed)	W1	Class A
	W1	Class B
Foundations and walls (Exterior and exposed)	S2 Top, W5 Sides	Class C
	S2 Top, W5 Sides	Class D
Exterior exposed retaining walls	S2 Top, W5 Sides	Class C
	S2 Top, W5 Sides	Class D
Slabs and floors, (Exterior)	S4 Top, W5 Sides	Class C
	S4 Top, W5 Sides	Class D
Slabs and floors, (Interior)	S2Top, W5 Sides	Class A
	S2 Top, W5 Sides	Class B
Beams, joists, bond beams, Spandrels, lintels, and columns	W5	Class A
Topping for precast decking, (Interior)	S2 or S4, Top W5 Sides	Class E
Topping for precast decking, (Exterior)	S2 or S4, Top W5 Sides	Class F
Equipment pads and bases	S2 Top, W5 Sides	Class E (Interior)
	S2 Top, W5 Sides	Class F (Exterior)
Curbing, sidewalk, endwalls, stairs, driveways and ramps	S4 Top, W5 Sides	Class C
	S4 Top, W5 Sides	Class D
Manhole bases and benches	Special Construction	Class E
Pavement base, cradles and inlet walls	Special Construction	Class E
		Class F
Mass and fill	None	Class G
Traffic areas requiring early access or use	Special Construction	Class L

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Cast-in-place concrete shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CAST-IN-PLACE CONCRETE

- A. Cast-in-Place Concrete, Lump Sum. When so provided, payment for cast-in-place concrete shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
- B. Cast-in-Place Concrete, Inclusive. When no quantity is provided, cast-in-place concrete shall be considered inclusive to payment for work associated with the related structure, utility, or improvement.

END OF SECTION

SECTION 05 52 00
HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. The Aluminum Association (AA), Specifications and Standards:
 - a. AA Sections 6 and 7 - Aluminum Construction Manual, Specifications for Aluminum Structures, Current Edition.
 - 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
 - a. ASTM B136 - Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum, Current Edition.
 - b. ASTM B137 - Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum, Current Edition.
 - c. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate, Current Edition.
 - d. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes, Current Edition.
 - e. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire, Current Edition.
 - f. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes, Current Edition.
 - g. ASTM B308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles, Current Edition.
 - h. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube, Current Edition.
 - i. ASTM B457 - Standard Test Method for Measurement of Impedance of Anodic Coatings on Aluminum, Current Edition.
 - j. ASTM B580 - Standard Specification for Anodic Oxide Coatings on Aluminum, Current Edition.
 - 3. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing and installing all handrails and toe plates at all locations shown on contract drawings and specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Metal Fastenings - Division 05
- D. Metal Fabrications - Division 05

1.05 SUBMITTALS

- A. Contractor shall submit such shop drawings and/or catalog cuts required for the construction and installation of the materials and all components. These drawings shall be accurate in every detail and shall contain all information necessary to relate the materials to the specifications. Submittals shall include test data showing railings comply with OSHA requirements.
- B. Submittals shall indicate the intended materials arrangement, dimensions, major support requirements, plot area and all intricate or detailed construction requirements. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 MATERIALS

- A. Handrails and railings shall be 1-1/2 inch round, 6063 anodized aluminum alloy, Schedule 40 pipe size. Use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding.
- B. Post members shall be one continuous piece and spaced not more than 6 feet on center.
- C. Toe boards to be 1/4 inch x 4 inch high aluminum plate.
- D. Handrail and connection shall be designed to resist a 200 pound load applied at any point on the handrail system per OSHA requirements.

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

- A. Take field measurements prior to preparation of shop drawings and fabrication, where possible, without delay to job progress. Allow for trimming and fitting wherever taking field measurements before fabrications.
- B. Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of miscellaneous metal work. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay. See Concrete - Division 03 and Masonry - Division 4 of these specifications for installation of inserts and anchorage devices.
- C. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation.

3.02 FABRICATION

- A. Where details are not shown, top of top rail shall be 42 inches above floor or 36 inches above stair treads measured vertically at the stair riser line.
- B. Fit and shop assemble components in largest practical sizes, for delivery to site.
- C. Fabricate components with joints tightly fitted and secured.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Railings shall have mechanical connections consisting of internal plugs with stainless steel screws or rivets. Railings shall be mechanically fastened to the building structure.

- F. Continuously seal joined pieces by continuous welds.
- G. Form exposed work true to line and level with accurate angles and surfaces and straight, true edges. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown on the contract drawings. Form bent-metal corners to the smallest radius possible without causing grain separation of otherwise impairing the work. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline.
- H. Accurately form components, to each other and to building structure.
- I. Toe boards to be attached to railings with stainless steel bolts. Joints shall be provided as necessary to allow for expansion and contraction of toe board.
- J. Fabrication of structural aluminum shall meet the requirements of Sections 6 and 7 of the Aluminum Construction Manual, "Specifications for Aluminum Structures", The Aluminum Association.

3.03 INSTALLATION

- A. Perform cutting, welding and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack. Fit exposed connections accurately together to form tight hairline joints.
- B. Do not weld, cut or abrade the surfaces of units which have been coated or finished after fabrication, and are intended for field connections.
- C. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.
- D. Space posts not more than 6 feet on centers, unless otherwise shown on the contract drawings. Plumb posts in each direction. Secure posts and rail ends to building construction as shown on drawings.
- E. Expansion joints shall be installed at 24 feet maximum centers.

PART 4 MEASUREMENT AND PAYMENT

4.01 HANDRAILS AND RAILINGS

- A. General. Handrails and railings shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
 - 1. Handrails and Railings, Lump Sum. When so provided, payment for handrails and railings shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
 - 2. Handrails and Railings, Inclusive. When no quantity is provided, handrails and railings shall be considered inclusive to payment for work associated with related construction.

END OF SECTION

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SECTION 26 05 00
ELECTRICAL CONTRACT REQUIREMENTS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

1. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work under this Section.

1.02 APPLICABLE PUBLICATIONS

- A. Publications, standards and listing requirements called out in the Sections of this Division of Labor shall form a part of these specifications as if contained herein.
- B. The requirements of the Contract Documents, including the General Conditions, and Supplementary Conditions, and Division 01 - General Requirements, apply to this section except as modified herein.

1.03 DESCRIPTION OF WORK

A. Sections included:

1. Section 26 05 00 - ELECTRICAL CONTRACT REQUIREMENTS
2. Section 26 05 01 - PROJECT SPECIAL CONDITIONS
3. Section 26 05 19 - WIRE AND CABLE
4. Section 26 05 26 - GROUNDING
5. Section 26 05 29 - SUPPORTING DEVICES
6. Section 26 05 34 - RACEWAYS
7. Section 26 05 35 - ELECTRICAL BOXES
8. Section 26 05 53 - ELECTRICAL IDENTIFICATION
9. Section 26 24 16 - PANELBOARDS
10. Section 26 27 26 - WIRING DEVICES
11. Section 26 56 29 - EXTERIOR LIGHTING FIXTURES

B. Work Included:

1. The work covered by this Division of the specifications includes the furnishing of all labor, materials, tools, equipment, permits, certificates and temporary protection necessary for or incidental to executing and completing the electrical work, and work on related systems.
2. All work shall be as specified and indicated on the drawings unless specifically excepted on the drawings or herein.
3. Read all other Divisions of the Specifications which are applicable to this work, including the General Conditions section applicable to all bidders.
4. The Electrical Contract Requirements section is a supplement to and not a replacement for the project General Conditions section.
5. In cases of conflict with information in the General Conditions, the more stringent of the contract requirements shall be considered applicable.
6. Prior to submitting bid, call to the attention of the Electrical Engineer any material or apparatus believed to be inadequate or any necessary items or work omitted.
7. Address any questions regarding the interpretation of the plans and/or specifications at least 12 days before the bid opening.
8. The Electrical Engineer reserves the right to interpret his own specifications and plans after bids are received, and to demand that the installation conform to his intent.
9. Failure to become acquainted with existing conditions at the site shall in no way relieve the responsibility for making installation in conformance with plans and specifications without additional cost to the owner.

C. Examination of Plans, Specifications and Site:

1. Before submitting a bid, the bidder shall familiarize himself with all features of the building and site which may affect the execution of his work.
2. No extra payment will be allowed for the failure to obtain this information.
3. If there are omissions or errors in the plans or specifications, they shall be clarified with the architect prior to submitting bid.
4. For all remodeling projects, a site visit to the premises, for the purpose of the noting of all existing conditions which may affect work is required.
5. Knowledge of all existing conditions, which may affect work in a renovation project, shall be included in the preparation of bid.
6. Lack of information on existing conditions shall not be allowed for a valid cause for additional compensation.

D. Codes, Permits, and Inspection Fees

1. All work and materials shall conform in every respect to the current rules and requirements of the National Fire Protection Association, National and State Electrical Codes, Local Codes and Ordinances, Local Utility Regulations and OSHA.
2. Give to the proper authorities all required notices relating to the project, obtain all official permits and licenses required, pay all fees incidental thereto, deliver upon completion of the work and without cost to the Owner all required certificates of inspection and approval.

1.04 RELATED WORK ELSEWHERE

- A. Applicable provisions of Division 01: General Conditions shall govern work in this section.
- B. All other Divisions of the Specifications which are applicable to or interface with work in Division 01.
- C. Division 26 contractor to furnish and install all boxes, conduit and 120 volt connections per plans and specifications.

1.05 SHOP DRAWINGS

- A. Submit shop drawings in accordance with Division 01.
- B. Submit shop drawings following Section specific Shop drawing submittal guidelines.

1.06 OPERATION & MAINTENANCE MANUALS

- A. Submit operation and maintenance manuals in accordance with Division 01.
- B. Submit operation and maintenance manuals following Section specific shop drawing submittal guidelines.

1.07 QUALITY ASSURANCE

- A. Provide quality assurance in accordance with Division 01.
- B. All materials, equipment and parts are to be new, undamaged and unused of current manufacture.
- C. Acknowledges acquaintance with the plans and specifications and their respective requirements.
- D. Guarantee that the electrical system has been installed strictly in accordance with the electrical plans and specifications using only the best of materials available, installed in a substantial manner by experienced labor.
- E. Various components of the electrical system shall be placed in service prior to completion date as instructed by Owner. This shall not change the guarantee period which shall be one year after acceptance by Owner.

- F. Replace and/or repair any items failing from causes of faulty workmanship, materials or design without cost to Owner at any time within one year from date of final acceptance.

1.08 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. It is the intent of these specifications that all the necessary material, apparatus, and devices to complete the installation as specified herein, except such parts as are specifically excepted, shall be provided.
- B. If an item is either shown on the plan or called for in these specifications, it shall be considered sufficient of said item in this contract.
- C. All sizes given are as minimum.
- D. Material and labor shall be first class and workmanlike and to the satisfaction of the Electrical Engineer and shall be subject to inspection test and approval at all times from commencement until acceptance of completed work.
- E. Manufacturers shall be responsible for providing material listed by U.L. or other approved agencies, and all governing codes and ordinances.
- F. All material must bear U.L. and/or other approved labels where possible.
- G. Items specified by catalog number or brand name and approval of shop drawings will not relieve the manufacturer of this responsibility.

2.03 MATERIALS: ALTERNATE MATERIALS

- A. Where materials, equipment apparatus, or other products are specified by manufacturer, brand name, and type of catalog number such designation is to establish standards of desired quality and style and shall be the basis of the bid.
- B. Substitutions shall not be made unless there are "equals" listed in the specifications or on the plan.
- C. Substitutions may be bid as alternates.

- D. Burden of proof that materials are equal shall be upon bidder requesting their use; therefore, bidder shall furnish, with their request for approval all supporting data.
- E. Assume responsibility for substituted material and state name of manufacturer, type or brand or equipment and addition to or deduction from base bid.
- F. Materials and equipment must meet all requirements as to type, quality, function, appearance and physical dimensions shown.
- G. Assume responsibility for any costs to other Divisions as a result of the use of alternate materials.
- H. Submit supporting data to Architect/Electrical Engineer within 15 days after the bid date.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Equipment Submittal Drawings
 1. Within 45 days after a notice to proceed and prior to ordering equipment, furnish to the Electrical Engineer submittal drawings for review (see section 26 05 04).
 2. Review of any submittal drawings does not waive any condition of the specifications unless specifically noted thereon.
 3. No fabrication or ordering of equipment shall be started until reviewed drawings are returned.

3.02 FIELD MEASUREMENTS

- A. Job Drawings
 1. Maintain, at the job site, one (1) complete set of up-to-date plans and written specifications, complete with all addenda items.
 2. This complete plan and specification set shall be reserved for all field markings to show minor revisions and detailed construction notes.
 3. These marked plans shall be returned to the Electrical Engineer prior to contract completion and final payment.
 4. Assist the Electrical Engineer in transferring applicable field notes to the project drawings for record purposes.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Material on Site and Storage
 1. Maintain proper care and storage of material and equipment on site.
 2. Any material damaged by rust corrosion, warping, breakage, finish damage, etc. shall be replaced by the Contractor to the satisfaction of the Engineer.

3.04 INSTALLATION

- A. Field Change Orders
 1. No revisions to the contract price shall be allowed unless such revisions have been authorized in writing by both Owner and the change order submitter.
 2. All work completed prior to completion of a written contract change order will not be compensated for by the Owner.
 3. Any work item that is proposed to perform, on the basis of a proposed contract adder, must be announced in advance such that time is available for the Architect, Owner and the Electrical Engineer to determine if a change in contract price is allowable.
- B. Change Orders
 1. Change orders may be requested as a part of this project.

2. Assume the following in regards to change orders:
 - a. Work and equipment associated with change orders shall be installed per the specified equipment on this project.
 - b. All change orders shall be accounted for on as-built drawings.
 - c. Change order additions to special systems where riser diagrams have been furnished, shall be included as a part of the riser diagram.
 - d. A break down of all costs associated with the change order is required.
 - e. The cost breakdown shall be as follows:
 - 1) Itemized list of all materials.
 - 2) Materials shall be priced at Best Column in a national pricing service book.
 - 3) Cost for subcontractor services.
 - 4) Subcontractor services shall be shown as actual costs from subcontractor.
 - 5) Material mark-up.
 - 6) Maximum allowed is 8%.
 - 7) Number of hours of labor at standard charge out rate.
 - 8) Total change order cost.
 3. If equipment or materials are deducted as a part of this change order, credit shall also be shown on change order.
- C. Installation: General
1. Equipment Access & Location.
 - a. All equipment, junction and pull boxes, and accessories shall be installed to permit access to equipment for maintenance.
 - b. Provide and set in place all required sleeves, inserts, forms, etc. and coordinate this work with all other divisions of work.
 2. Cutting and patching.
 - a. Beams or columns shall not be pierced without permission of the Architect and then only as directed.
 - b. All new or existing work cut or damaged shall be patched and restored to its original condition.
 - c. Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished and left in the condition existing prior to commencement of work.
 3. Excavation and backfill.
 - a. Backfilling of all trenches beneath concrete floor and stair slabs within building shall be accomplished with gravel fill and shall be specially compacted to same density as surrounding area.
 - b. Lines passing under foundation walls shall have a minimum of 1 1/2 inch clearance.
 - c. Care shall be taken to insure no disturbance of bearing soil under foundations.
 4. Attachments and supports.
 - a. Be responsible for proper fittings and support for each item of equipment and materials installed under Division 26.
 - b. Be responsible for the proper application, installation and location of all necessary and required inserts, supports and anchor bolts.
 - c. Where same are to be installed by other Divisions of work, supply same to the contractor in whose work they occur with instructions for placement and proper installation.
 - d. Establish the method and nature and select accessories necessary for proper support appropriate to item and point of attachment with due consideration given to ambient/environmental conditions and service duty.
 - e. Attachments, supporting devices and accessories shall be specifically designed for the application, suitable for the duty imposed in service and acceptable to the Architect.
 - f. Attachments shall be made to structural components of the structure in such manner not to jeopardize the integrity of the structure and otherwise consistent with trade practices.
 - g. Generally, anchors shall be concrete insert type in poured concrete and drilled expansion type in precast concrete.
 - h. Powder actuated anchors shall not be used in concrete work.
 - i. Exterior conduit mounting channel shall be stainless steel.

j. All sleeves to be furnished and installed by Division 26.

D. Installation: Electrical Service

1. Provide new single phase, three wire electric service as shown and noted on the contract drawings.

E. Installation: Temporary Electric Distribution ("Temporary Electric Construction Power" as noted in 26 05 01 (2.04))

1. Provide 1 120/240, 100 amp, single phase temporary electric service. All power consumption costs will be paid for by: Owner.
2. Assume that the electrical services are to be distributed in locations throughout the building site.
3. Be responsible for all costs associated with installing electric service, removing the electric service and temporary power distribution after permanent power has been installed in the facility.
4. Temporary power requirements other than those specified, shall be furnished by the Division of work requiring the same.
5. Temporary power requirements other than the specified, shall be furnished by the Division of work requiring the same.
6. Installation of the temporary power system is to begin upon notification by the Architect and shall be installed and routed in manner acceptable to the Architect and the various trades so as not to interfere with construction of the project.
7. The temporary power system should be adequate for the construction of this project and in accord with OSHA Requirements for Construction Projects.
8. The temporary power system shall include fused main disconnect switch, panelboards, branch circuits, outlets, lamps and the maintenance thereof.
9. Furnish 2 general purpose, 20 ampere, 120 volt, single phase, grounding type receptacle outlets.
10. The maximum length of a 20 ampere, 120 volt power circuit shall not be greater than 200' from panelboard to farthest outlet.
11. All single phase receptacle outlet circuits shall have approved ground fault circuit interrupter protection or other OSHA approved protection systems.
12. Electric Utility Temporary Service fees shall be included in bid.

F. Installation: Trial Usage of Electrical Systems

1. The Electrical Engineer has the privilege of the trial usage of electrical systems or parts thereof for the purpose of testing under load the new installation and learning the operational procedures.
2. The trial usage shall be continued for a length of time as deemed reasonable by the Electrical Engineer and all related costs shall be included in the bid, with the exception of the electrical power cost which will be paid by the Owner.
3. The operations shall be carried out only with the express knowledge and under supervision of the responsible sub-trade who shall not waive any responsibility because of trial usage.
4. While trial usage will be kept to a minimum, it shall not be construed as acceptance by the Electrical Engineer.

G. Installation: Cooperation/Coordination

1. Coordinate and cooperate with other Divisions of work and Owner by scheduling and installing work to facilitate the construction progresses and the Owners use of the building.
2. Any deviation from contract plans shall be approved by the Electrical Engineer before proceeding.
3. Study the plans of other trade divisions of work and to fit work into the work of others in a coordinated manner.
4. Lay out work and be responsible for measurements.
5. Check facilities provided by others which require electrical connections and provide outlets suitably located for them.
6. Take such measurements as may be necessary to assure approved fitting and proper installation of his work and all other work depending thereon.
7. Cooperate with other contractors to avoid complications between the installation of electrical equipment and equipment installed by others.

- H. Installation: Finish and Painting
1. Equipment and materials such as transformers, panels and switches, shall be furnished with the manufacturer's standard finishes, consisting of a prime coat and baked enamel finish coat, unless otherwise noted.
 2. Roof mounted equipment and other exterior materials including support hardware shall have a factory or field applied prime coat and finish coat of color selected by the Owner's Representative.
 3. In general painting will be done by other trades. Assume responsibility to coordinate work with the painters so that all equipment is installed prior to painting.
 4. Assume responsibility for additional expense required to paint support channels, panel trims, flush junction box covers, fixture hangers and other electrical devices not in place prior to normal routine painting.
 5. An undamaged finish is required on all equipment.
 6. If finish becomes rusted, corroded, scratched, or flaked during storage or installation, be responsible for refinishing the equipment to the satisfaction of the Architect.
 7. Finish painting on the job site is not required by the electrical contractor, except where noted.
 8. Refer to other areas of this Division 26 for painting of equipment furnished by the Division 26.
 9. Where painting is required to be done by the electrical contractor, the painting shall be done in accordance with the painting portion of the general specification.
- I. Installation: Damage to Other Work
1. Assume responsibility for all damages resulting from the execution of work under Section 26 05 00.
 2. Assume responsibility to adequately protect Division 26 work at all times.
 3. All damages resulting from their operations shall be repaired, or the damaged portions replaced by the party originally performing the work (to the entire satisfaction of the Architect), and all cost thereof shall be borne by those responsible for the damage.
- J. Installation: Clean-Up
1. At all times, keep the premises free from excessive accumulation of waste materials or rubbish resulting from work, including tools, scaffolding, and surplus materials and leave work room or it's equivalent, clean.
 2. In case of dispute, the Architect may order the removal of such rubbish and charge the cost to the responsible Division of work as determined by the Architect.
 3. At the time of final clean-up, all fixtures and equipment shall be thoroughly cleaned and left in proper conditions for their intended use.
- K. Installation: Drawing Schedules and Details
1. The electrical drawings include a number of standard and job specific details.
 2. These details may or may not be specifically referenced on the drawings and in the specification.
 3. Assume that even if the detail is not specifically referenced, that it shall apply to this project. (As an example, if a detail is shown for the exterior mounted receptacles, but the detail is not referenced from the plan sheets, the contractor shall assume that all exterior mounted receptacles shall be installed per the detail.)
 4. Details and schedules are shown as a means to aid the electrical contractor and are not meant to be all inclusive of all devices.
 5. Assume responsibility for making takeoff of equipment required, (i.e., additional circuit breakers, motor connections, etc.) and ancillary equipment and appurtenances for a complete connection or circuit.
 6. Verify all sizes of electrical equipment with shop drawings and nameplate rating of the equipment it serves.
- L. Installation: Coordination Drawings
1. Prepare coordination drawings to a scale of $\frac{1}{4}'' = 1'-0''$ or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components.

2. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including, (but not limited to) the following:
3. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
 - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Fire-rated wall and floor penetrations.
 - d. Equipment connections and support details.
 - e. Sizes and location of required concrete pads and bases.
4. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
5. Locations include, but are not limited to, electrical rooms and other specialty electrical and communication rooms where equipment is being provided.

M. Installation: Bid Drawings

1. It must be understood that electrical drawings and details bid drawings are diagrammatic.
2. Electrical drawings and details bid drawings are not intended to be shop drawings.
3. It is expected that it may be necessary to move conduit, outlets and/or equipment in some cases to get coordinated installation and such changes are considered a part of the Contract obligation without cost to the Owner.
4. No outlets or equipment shall be located where the usefulness and/or operation will be affected by the work of other trades, door swing, counter, equipment, etc.

N. Installation: Contract Termination Requirements

1. Furnish Owner with service manuals for all items furnished under this Contract.
2. Service manuals shall be complete with drawings, diagrams, operations and installation instructions and parts lists.

3.05 OWNER TRAINING

- A. Provide as outlined in each specification section requiring owner training.

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

SECTION 26 05 01
PROJECT SPECIAL CONDITIONS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. This specification covers those conditions that are particular to this project. This section further explains and outlines other portions of these specifications.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 UTILITIES

- A. Electrical Utilities.
 - 1. Alliant Energy
 - a. Contact number: 800-255-4268
 - b. Contact website: <http://www.alliantenergy.com>
- B. Telephone Utility
 - 1. None requested – not part of E.C. work.
- C. Cable Television Utility
 - 1. None requested – not part of E.C. work.

2.03 MULTI-POLE CIRCUITS

- A. Multi-pole circuits are not allowed for single-phase line to neutral loads.

2.04 ALLOWANCES

- A. For all equipment and labor allowances, assume the following:
 - 1. All handling costs, profit margin, overhead, and taxes are assumed to be included in the contract, and thus the allowance cost is the actual contractor cost. If the allowance amount indicated is more than the actual cost, deduct this cost from the allowance amount, and the balance shall be deducted from the electrical contract by change order. In similar fashion, any costs above that shown on the allowance, shall be reimbursed to the contractor at his cost and will be added to the contract by change order.
 - 2. For those items which require material and labor, the material and labor will be priced per the change order method listed in specification section 26 05 00.

3. Provide an allowance for the following Temporary Electric power from utility that also includes the contractor backboard described as follows: Provide temporary electric service to include meter socket and Outdoor rated Panelboard equal to Square D NQO NEMA 3R - 100A/2P, 120/240v, single phase panel with minimum (12) 120 volt circuits available). Allowance is to cover cost of providing temporary construction panel power/distribution as outlined elsewhere in the Specifications. This fee should cover the amount of the materials, labor and equipment related to Temporary Electric Construction Power. It is not meant to cover:
 - a. Energy usage.
 4. For those allowances for utility fees, the electrical contract will be adjusted up or down by change order by the amount listed for the change order, less the actual cost of the utility fee. No additional compensation for mark-ups or handling will be allowed by the contractor. Any such costs for this shall be included in the bid.
- B. The following allowances shall be included in the contract:
1. Temporary Electric Metered Service/backboard with Panelboard for Construction Power Allowance: \$3,500. This is a separate Base Bid cost item that must be added to Electrical Base Bid total price.
 2. Permanent Utility Lateral Service Drop Allowance: \$7,500. The actual permanent meter socket and electrical panel/ backboard assembly as referenced on the electrical plans is a separate cost from this allowance but still must be added to Electrical Base Bid total price.
- C. For all allowances listed, assume that all handling costs, taxes and installation are in addition to the allowance shown. The allowance amount shown is intended to cover contractor materials, equipment, labor costs related to providing Temporary Electric Construction Power extended from existing site electrical service.

2.05 ALTERNATES

- A. No Electrical Alternates.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
 - 1. NFPA 70 – National Electrical Code.
 - 2. ANSI/TIA/EIA-568-B.2.
- B. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
- C. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
- D. Underwriters Laboratories, Inc. (UL).

1.03 DESCRIPTION OF WORK

- A. Furnish and install a complete and operable wire and cable system as indicated on the drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Division 26 Electrical

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATION & MAINTENANCE MANUALS (NONE)

1.07 WARRANTY

- A. Wire and cable shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.

- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. Approved manufacturer:
 - 1. Contractor's option.
- B. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 WIRE AND CABLE – GENERAL PURPOSE (600V)

- A. General:
 - 1. THWN or THHN general purpose building wire insulated with polyvinyl chloride (PVC) and covered with protective sheath of nylon intended for lighting and power circuits at 600 volts or less, in residential, commercial, and industrial buildings.
 - 2. The wire shall be suitable for 90°C maximum continuous conductor temperature in dry locations and 75°C in wet locations and listed by Underwriters Laboratories for use in accordance with Article 310 of the National Electrical Code.
- B. Conductors:
 - 1. Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.
- C. Insulation:
 - 1. Each conductor shall be insulated with PVC and sheathed with nylon complying with the requirements of UL Standard 83 for Types THHN or THWN and UL Standard 1063 for Type MTW and CSA C22.2 No. 75 for T90 Nylon.
 - 2. Types THWN or THHN shall comply with the optional Gasoline and Oil Resistance rating of UL Standard 83. The insulation shall also comply with UL requirements for 105°C Appliance Wiring Material.
 - 3. The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL Standard 83 for THWN or THHN. The minimum thickness at any point, of the PVC insulation, shall be not less than 90 percent of the specified average thickness.
 - 4. The minimum thickness at any point of the nylon sheath shall be as specified in UL Standard 83 for Types THWN or THHN.
 - 5. The PVC insulation shall be applied tightly to the conductor and shall be free-stripping.
- D. Identification:
 - 1. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations, and optional ratings. The wire shall also be identified as C (UL) Type T90 Nylon or TWN 75, FT1.
- E. Tests:
 - 1. Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistance listing; as Type MTW to UL Standard 1063 (stranded items); as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN75.
- F. Usage:
 - 1. General use power wiring, minimum size No. 12 AWG.
 - 2. General use control wiring, minimum size No. 14 AWG.

2.04 WIRE AND CABLE – UNDERGROUND (600V)

- A. General:

1. USE-2 or RHH, cross linked polyethylene insulated cables for use in circuits not exceeding 600 volts. Cables listed by UL as Type USE-2 and recognized for underground use in wet locations at a maximum continuous conductor temperature of 90°C in accordance with Article 338 of the National Electric Code.
 2. UL listed as Type RHH or RHW-2 for general purpose wiring applications at maximum continuous conductor temperature of 90°C in dry locations (RHH) or 90°C in wet or dry locations (RHW-2).
 3. Installed in air, conduit, or other recognized raceways in accordance with Article 310 of the National Electric Code.
- B. Conductors:
1. Conductors shall be Class B stranded annealed uncoated copper per UL Standard 854 and 44.
 2. A suitable separator over the conductor may be used at the option of the manufacturer.
- C. Insulation:
1. Each conductor shall be insulated by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, and type designations.
- D. Tests:
1. Wire shall be tested in accordance with the requirements of UL Standard 8654 for Type USE-2, UL Standard 44 for Types RHW-2 or RHH.
- E. Usage:
1. Underground power wiring, minimum size No. 12 AWG.

2.05 WIRING CONNECTORS

- A. Polaris Type Mechanical Connectors:
1. 8 AWG and larger wire for all motor connections.
- B. Spring Wire Connectors:
1. 10 AWG and smaller wire.
- C. Compression Connectors (T&B Sta-Kon or equal):
1. Control wiring.
 2. For those devices that are not rated to accept stranded wire.
- D. Cord Connectors. All cord connectors should be Kellums type using wire mesh cord restraint.
- E. Provide watertight Crouse-Hinds or equal cord grips in appropriate areas.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wire is in compliance with specifications.
- B. Verify that interior of building has been protected from weather.
- C. Verify that mechanical work likely to damage wire and cable has been completed.
- D. Inspect wire for physical damage and proper connection.
- E. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- F. Verify continuity of each conductor.

3.02 FIELD MEASUREMENTS

- A. Field verify all measurements. Do not base on contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of work.
- C. Adjust system to satisfy field requirements.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.
- B. Maintain original quality and condition of wire while it is in storage.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
- B. Pre-Installation:
 - 1. Verify that interior of building has been protected from weather.
 - 2. Verify that mechanical work likely to damage wire has been completed.
 - 3. Completely and thoroughly swab raceway prior to installation.
 - 4. Verify that field measurements are as shown on drawings.
 - 5. Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.
 - 6. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
 - 7. Determine required separation between cable and other work.
 - 8. Determine cable routing to avoid interference with other work.
- C. Conductor Sizing:
 - 1. Conductor sizes are based on copper.
 - 2. Use conductor not smaller than No.12 AWG for power and lighting circuits.
 - 3. Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
 - 4. Where circuit wiring length exceeds 100 feet, increase wire size as needed to maintain a maximum voltage drop of three percent.
 - 5. Use conductor not smaller than No.14 AWG for control circuits.
 - 6. Wire and cable size shall be increased from size indicated or required by code to meet the following voltage drop requirements:
 - a. 3% drop for branch circuits.
 - b. 5% drop for motor circuits.
- D. Wire Pulling:
 - 1. Pull all conductors into raceway at same time.
 - 2. No.4 AWG and larger wire and power cables shall be lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets. Follow cable manufacturer's specifications regarding use of lubricant.
 - 3. The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.
- E. Splices and Terminations:

1. Splices and terminations shall not be made within raceways.
2. Clean conductor surfaces before splicing or terminating.
3. Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.
4. Wire nuts, "ScotchLocks", and similar devices may be used to splice 120V power circuits.
5. Control, communication, and data transmission wire and cable shall not be spliced.
6. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels or support for the ceiling suspension system per NEC.
7. Neatly train and lace wiring inside boxes, equipment, and panelboards.
8. Clean conductor surfaces before installing lugs and connectors.
9. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
10. Use Polaris type mechanical connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
11. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

F. Wire Marking:

1. The ends of each conductor shall be marked with circuit number, motor number, wire or terminal number.
2. Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink sleeve. Markers shall be shrunk around the wire to provide a tight, non-slip bond with a compatible heat gun.
3. Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322

G. Color Coding:

1. Color coding shall be as follows:

a.		120/240
b.		System
c.	Phase A	Black
d.	Phase B	Red
e.	Neutral	White
f.	Ground	Green

H. Ground Wire Color Coding

1. Provide green insulated ground wire for #8 and smaller. #6 wire shall have green band per code.

I. Control Panels:

1. Control panel wiring. Wiring within control cabinets shall be stranded type MTW.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

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SECTION 26 05 26
GROUNDING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to current Underwriters Laboratories (UL) Specifications and Standards.
- C. Conform to National Electrical Contractors Association (NECA) "Standards of Installation".
- D. Product specific standards and requirements are included in product specifications.

1.03 DESCRIPTION OF WORK

- A. Furnish and install a complete and operable grounding and bonding system as indicated on drawings and specified herein.
- B. Ground and bond all equipment required per all applicable codes whether or not specifically shown on drawings.
- C. Bond together system neutrals, service equipment enclosures, exposed non current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATION & MAINTENANCE MANUALS (NONE)

1.07 QUALITY ASSURANCE

- A. Provide quality assurance in accordance with Division 1.
- B. The following shall be submitted in addition to those items listed above:
- C. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms. Additional grounding electrodes shall be used to satisfy ground resistance requirements where required by earth conditions.

1.08 WARRANTY

- A. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. Submit a written warranty executed by the installer indicating ground test was completed.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).
- B. Provide a complete and fully functional grounding system using materials and equipment of types, sizes, and rating as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturer's standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions. Provide all accessories necessary for a fully functioning system.

2.03 GROUND RODS

- A. Material: Copper-clad steel.
- B. Diameter: 3/4" minimum.
- C. Length: 10' minimum.
- D. Use one or more ground rods to obtain the minimum specified ground resistance. This applies to manholes, padmount switches, transformers, service entrances, and all other equipment requiring a supplemental grounding electrode. Minimum of three ground rods shall be used to ground the service entrance as indicated on plans.

2.04 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.
- B. Split bolt connector types are not allowed.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.05 COMPRESSION CONNECTORS

- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size, and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.06 EXOTHERMIC CONNECTIONS

- A. Select the appropriate kit for specific types, sizes, and combinations of conductors and other items to be connected. Field personnel shall be trained in execution of welds.

2.07 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Size as shown on drawings, specifications, or required by NFPA 70, whichever is larger.
- C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, in specifications, or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.02 FIELD MEASUREMENTS

- A. Field verify exact routing of all backbone cable.
- B. Adjust grounding system installation to satisfy field requirements.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.

3.04 INSTALLATION

- A. General:
 - 1. Provide a separate, insulated equipment grounding conductor in all raceways.
 - 2. Supplementary Grounding Electrode:
 - a. Use driven ground rod on exterior of building.
 - b. Install ground rod in suitable recessed well; fill with gravel after connection is made.
 - c. Effectively ground metal frame of the building.
 - d. Install grounding conductor to footing rebar per NEC.
 - 3. Receptacle grounding:
 - a. For all receptacle circuits, provide separate green ground wire in raceway system.

- b. Standard receptacles may be used and green wire shall be directly connected to receptacle or to pigtail.
- c. Provide #12 pigtail to ground all metal boxes.
- d. Stranded wire twisted on ground terminal on device is not allowed.

B. Ground Rod Installation

- 1. Install ground rods to be 10'6" deep.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

SECTION 26 05 29
SUPPORTING DEVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to current American National Standards Institute (ANSI) standards.
- C. Conform to current American National Standards Institute ANSI B31.1 standards.
- D. Conform to National Electrical Contractors Association (NECA) "Standards of Installation".

1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable support devices as required.
- B. Metal supporting devices shall be zinc galvanized or cadmium plated steel or malleable iron.
- C. Equipment and materials shall be supported with devices designed for such purpose. Wire or plastic ty-raps not acceptable.
- D. Where so specified on the drawings, provide stainless steel, PVC covered, or hot dipped galvanized.
- E. Refer to drawings or other portions of the specifications for particular pieces of equipment which may require more stringent equipment specifications than listed in this specification.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATION & MAINTENANCE MANUALS (NONE)

1.07 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 LIGHTING FIXTURE SUPPORT

- A. Provide items such as stems, hickies, bar hangers, and clips required to securely attach fixtures to ceilings or walls.
- B. Provide spacers or stabilizers to eliminate fixture instability.
- C. Provide auxiliary supports so fixtures can be drawn up tightly, tilted or rotated, and not affected by vibrations.

2.04 SUPPORTING STRUCTURES

- A. Rack supports of galvanized steel channel sections with adequate feet to allow secure mounting. Weld sections, do not use bolts.

2.05 MOUNTING EQUIPMENT

- A. Mount per plan details.

2.06 CONDUIT SUPPORTS

- A. 1- hole galvanized steel straps for EMT, 2-hole galvanized steel straps for all other conduits. Do not use perforated hanger iron. This applies only to service rack. Shelter shall have all conduit stubbed concealed into vertical column bases and all wiring shall be run within shelter structure members with no exposed conduit. Electrical Contractor shall coordinate all required wire access points (removable access hand holes in structure and integral boxes) and wire pull opening paths throughout the structure with structural shelter manufacturer to allow for complete concealment of all wiring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify locations prior to rough in.
- B. Verify mounting details

3.02 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.

- B. Accept equipment on site. Inspect for damage.
- C. Protect equipment from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not use powder actuated anchors.
- D. Obtain permission from Architect before drilling or cutting structural members.
- E. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present a neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts. This applies only to service equipment rack structure.
- F. Install surface mounted cabinets and panelboards with minimum of four anchor points.
- G. Degrease and clean surfaces to receive nameplates and labels.
- H. Install nameplate and label parallel to equipment lines.
- I. Secure nameplates to equipment fronts using screws if so specified on drawings.
- J. Anchors:
 - 1. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and transfer of loading and stresses to connected equipment.
 - 2. Installation methods shall be in conformity with manufacturer's recommendations for maximum holding power.
- K. Conduit Supports
 - 1. Support conduit as follows:
 - a. Vertical Surfaces: Galvanized, heavy-duty, sheet steel straps; back straps provided for exposed conduit.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

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SECTION 26 05 34
RACEWAYS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to current National Electrical Manufacturers Association (NEMA) Standards.
- C. Conform to current Underwriters Laboratories (UL) Specifications and Standards.
- D. Conform to current American National Standards Institute (ANSI) standards.
- E. Conform to National Electrical Contractors Association (NECA) "Standards of Installation".
- F. Product specific standards and requirements are included in Product Specifications.

1.03 DESCRIPTION OF WORK

- A. Furnish and install a complete and operable conduit/raceway system as indicated on the drawings and as specified herein.
- B. All wire shall be in conduit or surface raceway. All conduits in finished areas shall be concealed. In unfinished areas, such as utility and mechanical rooms, the contractor shall conceal the branch wiring such as receptacles and light switches.
- C. Where conduit passes through areas of differing temperatures, such as into or out of cool-rooms, freezers, unheated and heated spaces, buildings, provide listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- D. Materials Included:
 - 1. Metal conduit.
 - 2. Liquidtight flexible metal conduit.
 - 3. Electrical metallic tubing.
 - 4. Nonmetallic conduit.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATION & MAINTENANCE MANUALS (NONE)

1.07 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.

- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 CONDUIT GENERAL REQUIREMENTS

- A. Minimum Size: 1/2 inch.
- B. Conduit types not listed below are prohibited.
- C. Rigid heavy wall galvanized steel conduits:
 - 1. Are to be used in the following locations:
 - a. Outdoors.
 - b. Underground, unless PVC is shown on drawings or called out in other portions of this specification.
 - c. In and under ALL concrete slabs, except for where PVC is allowed as stated in nonmetallic conduit portion of this specification.
 - d. In sizes 2-1/2" and larger, where the conduit is exposed and where it is installed between the floor and 8' AFF. Above this height EMT conduit may be used.
 - e. In areas having moisture, dust or gases.
 - f. Exposed conditions where such mechanical protection is required.
 - 2. Manufacturer: CONTRACTOR option.
 - 3. Conduit:
 - a. Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
 - b. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.
 - c. Top-coated with a compatible organic layer to inhibit white rust and increase corrosion resistance.
 - d. Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.
 - 4. Conduit Bodies:
 - a. Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.
 - b. Tapered, threaded hubs with integral bushing.
 - c. Stainless steel hardware.

- d. Cover constructed of same material with solid gasket.
 - 5. Fittings:
 - a. Ferrous metal construction electro-galvanized inside and out.
 - b. Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.
- D. Liquid Tight Flexible Conduit:
- 1. Requirements same as for flexible conduit (exception – can be used outdoors if required on service equipment rack).
 - 2. Use in areas where environment is damp or could become damp or wet.
 - 3. To contain an equipment grounding conductor with phase conductors. Bond grounding conductor to equipment served and nearest conduit system junction box.
 - 4. Manufacturer: CONTRACTOR option.
 - 5. Usage:
 - a. Use in conjunction with galvanized rigid metal conduit.
 - b. Use in conjunction with PVC coated galvanized rigid metal conduit.
 - 6. Conduit:
 - a. Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.
 - b. Jacket shall be positively locked to core to prevent sleeving.
 - c. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.
 - 7. Fittings:
 - a. Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.
 - b. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
 - c. All fittings shall be liquid tight.
- E. Nonmetallic Conduit (PVC):
- 1. Where indicated on drawings.
 - 2. Where PVC conduit penetrates floor, it must be installed per conduit installation detail.
 - 3. Manufacturer:
 - a. Carlon.
 - b. Or equal.
 - 4. Conduit:
 - a. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
 - b. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-2.
 - c. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections, which could mar conductors or cables.
 - d. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
 - 5. Conduit Bodies:
 - a. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
 - b. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.
 - c. Stainless steel hardware.
 - d. Cover constructed of same material with solid gasket.
 - 6. Fittings:
 - a. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.

- b. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

2.04 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Intermediate Metal Conduit (IMC): Rigid steel.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit all steel fittings.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1 with insulated throats.

2.06 NONMETALLIC CONDUIT

- A. Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify routing and termination locations of conduit prior to rough in.
- B. Verify conduit routing. Routing as shown on Drawings is in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 FIELD MEASUREMENTS

- A. Field verify all measurements. Do not base conduit rough-in or equipment locations on dimensions obtained from the contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.
- C. Adjust conduit system installation to satisfy field requirements.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

3.04 INSTALLATION

- A. General:

1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 2. Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
 3. Install conduit in accordance with NECA "Standard of Installation."
 4. Install nonmetallic conduit in accordance with manufacturer's instructions.
 5. Arrange supports to prevent misalignment during wiring installation.
 6. Support conduit using coated steel or malleable iron straps, lay in adjustable hangers, clevis hangers, and split hangers.
 7. Fasten conduit supports to building structure and surface under provisions of Section 26 05 29.
 8. Arrange conduit to maintain headroom and present neat appearance.
 9. Route conduit in and under slab from point to point.
 10. Do not cross conduits in slab.
 11. Maintain adequate clearance between conduit and piping.
 12. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
 13. Cut conduit square using saw or pipecutter; de burr cut ends.
 14. Bring conduit to shoulder of fittings; fasten securely.
 15. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cleaner and cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
 16. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
 17. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Hydraulic one-shot bender may be used to fabricate factory elbows.
 18. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
 19. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
 20. Provide suitable pull string in each empty conduit, except sleeves and nipples.
 21. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- B. Ground and bond conduit under provisions of Section 26 05 26.
- C. Identify conduit under provisions of Section 26 05 53.
1. Surface raceway shall be installed to run parallel of all existing surfaces.
 2. Exterior cable and conduit installation.
 - a. Layout in trench may be started at either end unless the drawings indicate that it is to pitch for drainage. In which case the layout should be started at the lowest end. The cable and conduit shall be pitched 1" per 100 feet.
 - b. Include all excavation and backfill.
 - c. Cable and conduit shall be a minimum of 30" deep.
 - d. Cable and conduit shall be laid in a 6" sand bed and covered with another 6" of sand before backfilling with earth.
 - e. Provide Brady identotape 12" above all buried conduits and cables.
 - f. Provide #12 pull wire in all empty or spare conduits.
 - g. Restore existing surface back to its original condition.
 - h. For all excavation, maintain erosion protection per Federal, State, and municipal requirements. All work associated with erosion control for excavation shall be done as per Federal, State and municipal requirements, as well as any plans, meetings, and other special conditions.
 - i. For all trenching that is under paved surfaces, backfill with structural material. Material shall be tamped in layers up to the point of the surface paving material.
 3. For on-grade slabs, the conduit may be run in or under the slab. Verify with concrete installation prior to running conduits in slab to determine if that conduit coordinates with the slab reinforcing.

D. Service Entrance Conduit

1. All joints and couplings of buried service entrance conduits shall be taped and coated with an electrical insulating and sealing compound to make them watertight.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

SECTION 26 05 35
ELECTRICAL BOXES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to current National Electrical Manufacturers Association (NEMA) Standards.
- C. Conform to current Underwriters Laboratories (UL) Specifications and Standards.
- D. Conform to National Electrical Contractors Association (NECA) "Standards of Installation".

1.03 DESCRIPTION OF WORK

- A. Furnish and install boxes as indicated on drawings and specified herein.
- B. The intent of this section is to limit the use of sheet steel boxes to small circuit wiring in dry locations for installations of outlets, switches, exhaust fans, lights, unit heaters, small overhead door units, small power outlets, and limiting the general circuit capacity of 50 amps or less.
- C. Outlets, switches, controls and etc., installed on machinery or processes shall be served with FS and NEMA 12 type boxes.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATION & MAINTENANCE MANUALS (NONE)

1.07 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA)

Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.

- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 BOXES

- A. Pull boxes and junction boxes: Metal construction, conforming to National Electrical Code, with screw on or hinged cover.
- B. Flush mounted pull boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.
- C. Small surface type junction boxes to be used in dry locations only for general purpose lighting and outlets
- D. Junction and Splice Boxes:
 1. Screw covers, galvanized after fabrication and not less than code dimensions.
 2. Entry openings in boxes shall be made with knock-out punch tool or hole saws.
 3. Burning of entry openings with a torch will not be acceptable.
 4. Paint exposed ferrous surfaces, 2 coats rust resisting paint.
- E. Raised covers to have square cut corners.
- F. Box extensions will not be allowed.
- G. Through the wall type outlet boxes not allowed.
- H. Junction boxes and pull boxes shall not have knockouts. Enclosure type, material, and dimensions shall be as indicated on the drawings and as stated in these specifications. Where no type or size is indicated for junction boxes and pull boxes, they shall be one size larger than required by NEC.
- I. For exterior outlets, such as receptacles, boxes for light fixtures and switches. Cast aluminum weatherproof box shall be provided for all outdoor applications including Photocell mounting on Service equipment rack.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify routing and termination locations of conduit prior to rough in.

3.02 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.
- B. Mounting heights:
 1. As shown on drawings and details.
 2. Coordinate exact heights with specific manufacturer's recommendations.
 3. All mounting heights of keypads and pushbuttons to be ADA compliant.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.
- B. Maintain original quality and condition of equipment while it is in storage.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Support boxes independently of conduit.
- E. Use cast aluminum outlet box at locations exposed to the weather and wet locations at Service equipment rack only. Boxes at structure shall be integral and provided by structure manufacturer.
- F. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
 - 1. Other Locations: Use surface mounted cast metal box.
- G. Grounding
 - 1. All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier's recommendations.
- H. Interface with Other Products
 - 1. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

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SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to National Electrical Contractors Association (NECA) "Standards of Installation".

1.03 DESCRIPTION OF WORK

- A. Furnish and install complete labeling as specified herein.
- B. All major pieces of electrical equipment shall have engraved labels indicating their functions. This shall include the following:
 - 1. All panelboards and disconnects shall have engraved labels indicating their functions.
 - 2. Provide all spare keys and tags as indicated for keyed switches.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical.

1.05 SHOP DRAWINGS (NONE)

1.06 OPERATIONS & MAINTENANCE MANUALS (NONE)

1.07 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 ENGRAVED LABELS

- A. Where the words "provide engraved label" appears on the drawings or in the specifications, it shall mean that the label shall be an engraved 3-layer phenolic label with black letters on white material, unless other colors are called out on the drawings or details.
- B. The label size shall be a minimum of 3/4" high and be 3" long. Labels may be attached with double backed adhesive tape unless indicated otherwise.
- C. Where references are made on the drawings to provide engraved labels, engraved nameplate or engraved plates, these should be engraved phenolic labels.

2.04 ENGRAVED PLATES

- A. Where references are made to engraved plates, this shall mean that the normal device plate shall have an engraving on it with black letters so as to indicate what this switch or device is used for.

2.05 BRANCH CIRCUIT OUTLETS: LABELING

- A. Each branch circuit outlet, receptacles, lighting, and any other device requiring 120/208/240/277 or 480 volt power, the contractor shall:
 - 1. Provide circuit, written in pencil or non-washable ink, inside of outlet box in an area that can be easily viewed when removing outlet faceplate.
 - 2. Write circuit number in ink on device between receptacles under plate.
 - 3. Optional: Provide typed label (not dyno label) for each circuit attached to device plate.
 - 4. Label each junction box outlet cover in non-washable marker as to circuit number routed through junction box.

2.06 PANELBOARDS: LABELING

- A. Panelboard Directory:
 - 1. Prepare and affix a typewritten directory to the inside cover of each panelboard indicating loads controlled by each circuit.
 - 2. Each distribution and lighting panelboard shall be equipped with a typewritten directory accurately indicating rooms and/or equipment being served.
 - 3. Assume that originally directories will have to be developed based on the room numbers on the project drawings.
 - 4. Near project completion, all directories will have to be changed to reflect actual room numbers as designated by the building occupant.
 - 5. Include the cost of doing the original handwritten directory and revisions to the directory based on occupant room numbers.

2.07 MISCELLANEOUS

- A. Branch circuits
 - 1. On branch circuits, use shall be made of all standard wire insulation colors available.
 - 2. Where wires of different systems junction in a common box, each cable shall be grouped with its own system and identified using tags or identification strips.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify surfaces are cleaned and ready to receive labels.
- B. Verify labels are correct.
- C. Verify that labels are installed as specified, level and plumb.

3.02 FIELD MEASUREMENTS (NONE)

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.

3.04 INSTALLATION

- A. General:
 - 1. Degrease and clean surface prior to installing labels.
 - 2. Install nameplate and label parallel to equipment lines.
 - 3. Secure nameplates to equipment fronts using screws if so specified on drawings.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
 - 1. NFPA70 – National Electrical Code.
- B. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
- C. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
 - 1. NEMA PB 1 - Panelboards
 - 2. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 - 3. NEMA AB 1 - Molded Case Circuit Breakers.
 - 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- D. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
 - 1. UL 50 - Enclosures for Electrical Equipment
 - 2. UL 67 - Panelboards.
 - 3. UL 98 - Enclosed and Dead-front Switches
 - 4. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
- E. Canadian Standards Association (CSA), Specifications and Standards, current edition:
 - 1. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
 - 2. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
- F. Federal Specifications and standards, current edition:
 - 1. W-P-115C - Type I Class 1
 - 2. W-C-375B - Molded Case Circuit Breakers
 - 3. W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
 - 4. W-P115C - Type 1 Class 2 Load Center
- G. American Society of Testing Materials (ASTM), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable Distribution and Branch Circuit Panelboards system as indicated on the drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS

- A. Submit shop drawings in accordance with Division 01.
- B. The following information shall be submitted in addition to the above:

1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
2. Overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. Illustrate one line diagrams with applicable voltage systems.

1.06 OPERATION & MAINTENANCE MANUALS

- A. Submit Operations & Maintenance Manuals in accordance with Division 01.

1.07 QUALITY ASSURANCE

- A. Provide quality assurance in accordance with Division 01.
- B. The panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
- C. All panelboards provided under this section shall be the products of a single manufacturer specializing in manufacture of panelboard products with a minimum of fifty years documented experience.
- D. Provide all necessary accessories required for a complete and operable system.

1.08 WARRANTY

- A. Panelboards shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).
- B. Provide a complete and fully functional distribution system using materials and equipment of types, sizes, and rating as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturer's standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an

integrated system, with components and interconnections matched for optimum performance of specified functions.

2.03 240VAC SERVICE RATED BRANCH CIRCUIT PANELBOARD

A. Manufacturers

1. Square D Company NQ – Class 1640
2. Cutler-Hammer
3. or equal

B. Interior:

1. Rated for 240 vac/48 VDC maximum. Continuous main current ratings, as indicated on the drawings, not to exceed 600 amperes maximum.
2. UL Listed short circuit current ratings per utility company requirements with a maximum of 200,000 RMS symmetrical amperes.
3. Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.
4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
6. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length.
7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Interior leveling provisions shall be provided for flush mounted applications.

C. Main Circuit Breaker:

1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40 degrees C ambient environment. Thermal elements shall be ambient compensating above 40 degrees C.
2. Two-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
3. Circuit breaker handle and faceplate shall indicate rated ampacity. Circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position where indicated on the drawings.
5. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application. Lug body shall be bolted in place; snap-in designs are not acceptable.
6. The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

- D. Branch Circuit Breakers:
1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
 2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
 3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
 4. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.
 5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
 6. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire or 90 degree C rated wire as required by the application.
 7. Breakers shall be UL Listed for use with the following accessories where indicated on the drawings: Shunt Trip, Auxiliary Switch, and Alarm Switch.
- E. Enclosures:
1. NEMA Type 3R:
 - a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
 - b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59- inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
 - c. Maximum enclosure dimensions shall not exceed 21-inches wide and 6.5-inches deep.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify equipment is in compliance with approved submittal drawings.
- B. Examine area to receive panelboard to assure adequate clearance for panelboard installation.
- C. Start work only after unsatisfactory conditions are corrected.
- D. Inspect completed installation for physical damage, anchorage, and grounding.
- E. Perform tests according to panelboard manufacturer's instructions.
- F. Tighten bus connections and mechanical fasteners.
- G. Touch-up scratched or marred surfaces to match original finish.

3.02 FIELD MEASUREMENTS

- A. Field verify locations of panelboards with other trades. Adjust as required to meet field conditions and code requirements. Do not base exact panelboard locations on the contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of electrical equipment.
- C. Adjust panelboard installation to satisfy field requirements.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.

- B. Do not store exposed to weather.
- C. Physically protect against damage from work of other trades.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.
- B. Cleaning:
 - 1. Prior to turning the system over to the Owner, the system shall be physically cleaned.
 - 2. All appearance defects shall be carefully and professionally touched up so that the equipment is in "factory new" condition.
 - 3. At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.
- C. Grounding
 - 1. All equipment shall be grounded in accordance with NEC, these specifications and drawings, and the equipment supplier's recommendations.
- D. Install panelboards so that circuit breakers are not more than 6 feet above the finished floor or grade.
- E. Selectively connect branch circuits to equally balance currents in the panelboard busses.
- F. See Section 26 05 29 for equipment mounting.
- G. Install panelboards plumb and flush with wall finishes.
- H. Install panelboards such that top of panel is located at an elevation of 6-feet above finished floor elevation.
- I. Provide filler plates for unused spaces in panelboards.
- J. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. See Section 26 05 53.
- K. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent. Take care to maintain proper phasing for multi wire branch circuits.
- L. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- M. Verify that bonding jumper is properly installed in service entrance rated panels.
- N. Thoroughly clean and remove construction debris from panelboard interior and exterior.

3.05 OWNER TRAINING

- A. Provide complete operator training for the Owner's personnel.
- B. Use submitted Operations & Maintenance manuals as reference during this demonstration and tour.

3.06 SPARE EQUIPMENT

- A. As shown on panel schedules.
 - B. All spare breakers listed on panel schedules to be mounted in panelboards.
- END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of ANSI/NFPA 70 - National Electric Code.
- B. Conform to current Underwriters Laboratories (UL) Specifications and Standards.
- C. Device specific standards and requirements are included in device specifications.

1.03 DESCRIPTION OF WORK

- A. Provide and install wiring devices as required on the drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS

- A. Submit shop drawings in accordance with Division 01.
- B. The following information shall be submitted in addition to items listed above:
 - 1. One sample of each switch will be supplied to Electrical Engineer, for review prior to installation.
 - 2. One sample of each receptacle will be supplied to Electrical Engineer for review prior to installation.

1.06 OPERATION & MAINTENANCE MANUALS

- A. Submit Operations & Maintenance Manuals in accordance with Division 01.

1.07 QUALITY ASSURANCE

- A. Provide quality assurance in accordance with Division 01.
- B. All materials, equipment and parts shall be new and unused of current manufacture.
- C. Provide all necessary accessories required for a complete and operable system.
- D. Store wiring devices and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

1.08 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 RECEPTACLES

- A. Receptacles shall be:
 - 1. UL listed for current, uses and voltages indicated.
 - 2. Tamper resistant.
 - 3. Shall comply with NEMA standard publication WD-1 and WD-6 standards.
- B. Receptacles shall be specification grade unless noted.
- C. Receptacles (with the exception of GFCI) shall have one piece brass strap.
- D. Receptacles shall have provisions for back and side wiring, screw clamp type suitable for solid or stranded wire with separate green ground screw.
- E. Receptacles shall be white unless noted.
- F. Modular receptacles with pigtailed terminals are allowed.
- G. Receptacles shall be made of nylon or high impact resistant material.
- H. Receptacles installed in wet or damp locations shall be weather resistant.
- I. Receptacles shall be supplied with face plate.
- J. Supply the following:
 - 1. Weather Resistant (Tamper Resistant) GFCI Duplex NEMA 5-20R
 - a. 20 ampere, 120 volt rating.
 - b. 2-pole, 3-wire grounding.
 - c. Standard GFCI face.
 - d. GFCI compatible face plate.
 - e. Weather resistant construction.
 - f. Provide "While-in-use" cover per plan detail.
 - g. Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

2.04 PLATE COVERS

- A. All plate covers shall be per plan notes and detail notes and rated for outdoor weatherproof use.
- B. Cast metal plates: Die cast profile, ribbed for strength, flash removed, primed with gray enamel, furnished complete with four mounting screws.
- C. Weatherproof receptacle plate shall be heavy duty type, cast aluminum with a deep cover hood to provide weatherproof protection while an attachment plug cap is inserted. Plate shall be code approved as "suitable for wet locations while in use". Weatherproof cover shall be provided with ¼" padlock hole. Plate must meet OSHA lockout/tagout requirements. Provide a padlock for each weatherproof receptacle cover installed on the project. All padlocks shall be keyed alike. Provide twenty spare keys for Owner's use.
- D. Approved vendors are: Cooper, Hubbell Wiring, Leviton, and Pass & Seymour.

PART 3 EXECUTION

3.01 EXAMINATION:

- A. Verify outlet boxes are installed at proper height.
- B. Verify all openings are neatly cut by shelter structure manufacturer and will be completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- D. Inspect each wiring device for defects.
- E. Operate each wall switch with circuit energized and verify proper operation.
- F. Verify that each receptacle device is energized.
- G. Test each receptacle device for proper polarity.
- H. Test each GFCI receptacle device for proper operation.
- I. Test that each receptacle is properly grounded.
- J. Adjust devices and wall plates to be flush and level.

3.02 FIELD MEASUREMENTS

- A. Field verify proper location of all wiring devices with field conditions and adjust accordingly.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.
- B. Maintain original quality and condition of equipment while it is in storage.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Install all materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

3. Start of installation shall not begin until areas are broom clean, properly lighted, exterior enclosing walls in place, exterior windows glazed, roof completely installed to prevent weather damage to equipment.
- B. Install products in accordance with manufacturer's instructions.
- C. Install devices plumb and level.
- D. Install switches with OFF position down.
- E. Install vertical receptacles with grounding pole on top and horizontal receptacles with grounding pole to left.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Connect wiring devices by wrapping solid conductor around screw terminal or inserting into wire clamp. Wrapping conductor not allowed for stranded wire.
- I. Mount switches at heights as noted on the plans.
- J. Preparation:
 1. Clean debris from outlet boxes.

3.05 OWNER TRAINING (NONE)

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

SECTION 26 56 29
EXTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Drawings and general provisions of contract, including general and supplemental conditions and Division 01 specification sections, apply to work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. Conform to requirements of current ANSI/NFPA 70 - National Electric Code.
- B. Conform to current Underwriters Laboratories (UL) Specifications and Standards.
- C. Conform to ACI recommendations.

1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable exterior lighting system as indicated on the drawings and as specified herein.
- B. Supply and install all concrete fixture bases.

1.04 RELATED WORK ELSEWHERE

- A. Division 26: Electrical

1.05 SHOP DRAWINGS

- A. Submit shop drawings in accordance with Division 01.

1.06 OPERATION & MAINTENANCE MANUALS

- A. Submit Operations & Maintenance Manuals in accordance with Division 01.

1.07 QUALITY ASSURANCE

- A. Provide quality assurance in accordance with Division 01.
- B. All materials, equipment and parts shall be new and unused of current manufacture.
- C. Provide all necessary accessories required for a complete and operable system.
- D. Store Lighting Fixtures and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

1.08 WARRANTY

- A. Equipment shall be warranted for a period of not less than 1 year from the date of commissioning against defects in material and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 BUILD AMERICA, BUY AMERICA REQUIREMENT

- A. All Iron and Steel Products, Manufactured Products, and Construction Materials installed for this project by any and all contractors and Manufacturers MUST comply with the Build America, Buy America (BABA) Act requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Funding Agency or designee.
- B. Notify the PE a minimum of 7 business days prior to bids being due if there are products specified herein that do not comply with BABA requirements.

2.02 GENERAL

- A. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).

2.03 FIXTURES AND COMPONENTS

- A. Salvage and install existing Flagpole fixture per plans.
- B. Fixtures shall be installed as required, for a full and complete installation, even though not specifically called out on plans.
- C. Provide all equipment, wiring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine each salvaged Flagpole light and report if fixture is not suitable for re-installation.

3.02 FIELD MEASUREMENTS

- A. Field verify exact location of all fixtures. Coordinate locations/openings in shelter structure with Shelter Manufacturer per plan locations. All wiring shall be concealed within structure tubing with NO exposed conduit.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Store all equipment in this section.
- B. Maintain existing quality and condition of equipment while it is in storage.

3.04 INSTALLATION

- A. General:
 - 1. The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable codes and the manufacturer's recommendations.
 - 2. Install all fixtures, materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing.

- B. Cleaning:
 - 1. Prior to turning the system over to the Owner, the system shall be physically cleaned.
 - 2. All appearance defects shall be carefully and professionally touched up so that the equipment is in "factory new" condition.
 - 3. At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

- C. Exterior Lighting Circuitry:
 - 1. Exterior Flagpole lighting is shown as being connected to a time clock programmed per owner direction.

- D. Start-Up and Testing:
 - 1. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.05 OWNER TRAINING

- A. Provide minimum of one hour training on luminaire/time clock operation.

3.06 SPARE EQUIPMENT (NONE)

END OF SECTION

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SECTION 31 05 19.13
GEOSYNTHETICS FOR EARTHWORK

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
 - 2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing and installing geotextile fabrics for subgrade separation and stabilization, and under riprap in accordance with the contract drawings and specified herein, and in accordance with Section 645 of the State of Wisconsin, Department of Transportation, Standard Specifications.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Subgrade Preparation - Division 31
- D. Riprap - Division 31

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. The Contractor shall furnish to the Engineer at least ten days prior to use in the work a manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use conforms to this specification. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

- A. The geotextile fabric shall consist of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest principal direction. Nonwoven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof.
- B. The geotextile fabric shall be insect, rodent, mildew, and rot resistant.

- C. The geotextile fabric shall be furnished in a wrapping which will protect the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. The geotextile is to be kept dry until installed.
- D. The geotextile fabric rolls shall be clearly marked showing the type of fabric.
- E. Samples of fabric for testing may be obtained from the job site as specified herein or as determined by the Engineer.
- F. If sewn seams are used, the Contractor shall furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment to be used on the project, prior to its incorporation into the work.
- G. All numerical values specified below represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

2.02 GEOTEXTILE FABRIC, TYPE SAS (SUBGRADE AGGREGATE SEPARATION)

- A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	170 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	70 max.
Permittivity, SEC ⁻¹	ASTM D 4491	0.35 min.

- B. Acceptable materials are Geotex 701, Thrace-LINQ 160EX, Mirafi 170N, and US 180 NW, or equal.

2.03 GEOTEXTILE FABRIC, TYPE R (RIPRAP)

- A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	200 min.
CBR Puncture Strength	ASTM D 6241	500 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC ⁻¹	ASTM D 4491	0.40 min.

- B. Acceptable materials are Geotex 801, Thrace-LINQ 180EX, Mirafi 180N, and US NW 205, or equal.

2.04 GEOTEXTILE FABRIC, TYPE HR (HEAVY RIPRAP)

- A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	300 min.
CBR Puncture Strength	ASTM D 6241	800 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC ⁻¹	ASTM D 4491	0.40 min.

- B. Acceptable materials are Geotex 1201, Thrace-LINQ 275EX, Mirafi 1120N, Mirafi HP370, and US 300 NW, or equal.

2.05 GEOTEXTILE FABRIC, TYPE RSF (RECIRCULATING SAND FILTER)

- A. The filter fabric shall be of preferentially orientated isotactic polypropylene. Fabric shall be nonwoven and may be needle punched, heat bonded, resin bonded or combination thereof. Fabric shall have the following characteristics:

<u>Test Property</u>	<u>Test Method</u>	<u>Value Minimum Requirements¹</u>
Nominal Weight (oz/yd ²)	ASTM D5261	8.0
Grab Tensile (lbs)	ASTM D4632	205
Grab Elongation At Break (%)	ASTM D4632	50
Puncture Resistance (lbs)	ASTM D4833	95
Trapezoidal Tear (lbs)	ASTM D4533	85
Mullen Burst (psi)	ASTM D3786	300
Water Flow Rate (gpm/ft ²)	ASTM D4491	130
Permittivity (sec ⁻¹)	ASTM D4491	1.6
Permeability kv (cm/sec)	ASTM D4491	0.4
A.O.S. ² (sieve size)	ASTM D4751	120-80
UV Resistance (500 hrs) ³	ASTM D4355	>85
pH Resistance		2-13

- B. Acceptable manufacturer of filter fabric materials are Phillips 66, Polyfelt, Mirafi, Du Pont, Webtec, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Installation procedures shall be in accordance with manufacturer's recommendations and as specified herein.
- B. Sewing. All factory and field seams shall be sewn with a thread having the same or greater durability as the material in the fabric. A 401 stitch conforming to Federal Standard No. 751a shall be used for all seams. All seams shall develop a tensile strength equal to or greater than 60 percent of the specified grab tensile strength of the fabric, unless otherwise specified.

3.02 GEOTEXTILE FABRIC, TYPE SAS

- A. Prior to the placement of the geotextile fabric, the subgrade shall be smoothed, shaped and compacted to the required grade, section, and density. After the fabric has been placed on the subgrade area, no traffic or construction equipment will be permitted to travel directly on the fabric.
- B. The fabric shall be rolled out on the roadway and pulled taut manually to remove wrinkles. Separate pieces of fabric shall be joined by overlapping or sewing. The fabric in the overlapped joints shall be placed with a minimum overlap of 18 inches.
- C. Weight or pins may be required to prevent lifting of the fabric by wind.
- D. After placement, the fabric shall be exposed no longer than 48 hours prior to covering.
- E. The base course material shall be placed over the fabric by back dumping with trucks and leveling with a crawler dozer. Construction equipment shall be such that ruts do not exceed 3 inches in depth. All ruts shall be filled with additional material. The smoothing of ruts without adding additional material will not be permitted. Damaged areas shall be covered with a patch of fabric using a 36 inch overlap in all directions.

3.03 GEOTEXTILE FABRIC, TYPE R

¹ Values in weaker principal direction. All minimum values represent minimum average roll values (i.e., test results from any sampled roll in a lot, tested in accordance with ASTM D 4759 shall meet or exceed the minimum values listed).

² Small sieve size number represents the maximum average roll value.

³ UV resistance testing is based on results from independent conformance testing.

- A. The area shall be graded smooth and all stones, roots, sticks, or other foreign material which would interfere with the fabric being completely in contact with the soil shall be removed prior to placing the fabric.
- B. The fabric shall be placed loosely and laid parallel to the direction of the water movement. Pinning or stapling may be required to hold the geotextile in place. Separate pieces of fabric shall be joined by overlapping or sewing. The fabric in the overlapped joints shall be placed with a minimum overlap of 24 inches in the direction of the flow.
- C. After placement, the fabric shall be exposed no longer than 48 hours prior to covering.
- D. Damaged areas shall be covered with a patch of fabric using a 36 inch overlap in all directions.
- E. Placement of riprap shall be from the base of the slope upward. Height of free fall of riprap shall be determined by the Engineer but in no case shall this height exceed 12 inches.

3.04 GEOTEXTILE FABRIC, TYPE HR

- A. The construction methods for Type HR fabric shall conform to the requirements of Subsection 3.03, except that the height of freefall of riprap shall not exceed 6 inches.

3.05 GEOTEXTILE FABRIC, TYPE RSF (RECIRCULATING SAND FILTER)

- A. The fabric shall be placed directly upon the sand filter liner.
- B. After placement, the liner shall be exposed no longer than 48 hours prior to covering.
- C. Damaged areas shall be covered with a patch of fabric using a 36 inch overlap in all directions.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Geosynthetics for earthworks shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 GEOTEXTILE FABRIC

- A. Geotextile Fabric, Square Yards. The measurement for geotextile fabric of the specified type shall be by the square yard of surface area upon which the geotextile fabric has been placed. Payment shall be made at the contract unit price bid per square yard of geotextile fabric of the specified type installed, as measured.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. Under this item the Contractor shall furnish all equipment and labor necessary to cut and dispose of any vegetation within the clearing limits as described in this section and specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

- A. Clearing and Grubbing shall consist of cutting and disposing of trees, brush, windfalls, logs, and other vegetation occurring within the clearing limits, and the removing and disposing of roots, stumps, stubs, grubs, logs and other timber from within the grubbing limits.
- B. All work performed under this section shall be done in accordance with Subsection 201.3 of the State of Wisconsin, Department of Transportation, Standard Specifications, with the following exceptions and additions:
1. Clearing and Grubbing Limits defined as follows:
 - a. Trees/brush as individually marked for removal.
 - b. Between lines 3 feet outside the grading limits (slope-intercept line) of the roadway cuts and fills, including intercepting embankments, channels, ditches, borrow pits, and marsh or waste disposal area.
 - c. Other parts of the right-of-way as designated in the plans or special provisions.
 - d. With Engineer's approval, areas with vegetation that interferes with excavation, embankment, or other construction operations.
 - e. At no time shall Clearing and Grubbing operations extend beyond the right-of-way without written approval from both Engineer and Owner.
 - f. At no time shall Clearing and Grubbing operations occur on trees, brush, or other vegetation clearly marked for preservation.

3.02 DISPOSAL OF MATERIALS

- A. Material removed shall be removed from the site and disposed of by the Contractor in accordance with all local codes and ordinances.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Clearing and Grubbing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- C. The following incidental Clearing and Grubbing operations required to perform the work will not be measured, and will be considered inclusive to the work for which the incidental Clearing and Grubbing must occur:
 - 1. Clearing areas of light brush, shrubs, and other vegetation that Contractor removes with a brush scythe or mowing machine.
 - 2. Clearing areas containing logs, tree roots, roots of brush and shrubs, and other vegetation having a woody structure that the Contractor can remove with a rooter.
 - 3. Trimming overhanging limbs and branches to provide required clearance.
 - 4. Clearing and Grubbing borrow pits.

4.02 CLEARING AND GRUBBING

- A. Clearing and Grubbing, Inch of Diameter. When so provided, measurement for Clearing and Grubbing will be by the inch of diameter acceptably completed. The diameter of the tree at a distance 4 feet above the existing ground level will be used (diameter will be computed by dividing circumference by 3.14). Only those trees and stumps larger than 3-inches in diameter will be added to the measurement. Measurement will be rounded to the nearest inch. Payment will be made at the contract unit price bid per inch of diameter cleared and grubbed.
- B. Clearing and Grubbing, Square Yards. When so provided, measurement for Clearing and Grubbing will be by the square yard of horizontal area bounded by the trunks cut and/or grubbed. Payment for Clearing and Grubbing shall be made at the contract square yard price bid or as specified in Special Procedures - Division 01.
- C. Clearing and Grubbing, Lump Sum. When so provided, payment for Clearing and Grubbing shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
- D. Clearing and Grubbing, Inclusive. When no quantity is provided, Clearing and Grubbing shall be considered inclusive in the payment for contract work related to the associated construction.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the grading for this project.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Structural Excavation for Structures - Division 31
- C. Trenching and Backfilling - Division 31
- D. Erosion and Sedimentation Controls - Division 31
- E. Topsoil Placement and Grading - Division 32
- F. Seeding - Division 32
- G. Sodding - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (NONE)

PART 3 EXECUTION

3.01 PROTECTION OF EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work before starting grading operations and provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during grading, consult the Engineer immediately for directions on how to proceed. Cooperate with the Owner, and public and private utility companies in keeping their respective services and facilities in operation.
- B. Repair damaged utilities to the satisfaction of the utility owner.

3.02 PRESERVATION OF TREES AND SHRUBS

- A. Trees and shrubs to be preserved shall be thoroughly protected from scarring or other injury during grading operations. Excavation operations shall not disturb the original ground around trees within a distance of one foot or twice the diameter of the tree, whichever is greater. Exposed roots resulting from excavation shall be cut cleanly and covered with humus-bearing soil.
- B. When necessary or required by the Contract Documents, trees or shrubs around which embankment is placed shall be protected by tree wells built in accordance with detailed drawings or as laid out in the field by the Owner or Engineer.

3.03 GRADING

- A. General. All areas within the project limits shall be graded to the finished grades, lines and details less an allowance for topsoil and/or sod depth, pavement, base and structures.
- B. Construction Methods. Grading shall be performed in accordance with Sections 205, 206, 207, and 208, of the State of Wisconsin, Department of Transportation Standard Specifications. If borrow is needed to provide the grades and elevations required, a borrow area will be selected by the Owner. The borrow area shall be restored to smooth lines, topsoiled with a minimum of 6 inches of salvaged topsoil and seeded.
- C. Tolerance. Finish earth grades shall be in reasonably close conformity with the lines, grades and thickness shown on the contract drawings or established by the Engineer with particular concern for drainage and appearance. Finish earth grades along buildings or structures, under and adjacent to pavements and in drainageways shall be within 0.10 foot of those staked or shown on the contract drawings. Grades in all other areas shall be within 0.50 foot unless drainage considerations require more accuracy.

3.04 DRAINAGE

- A. During construction, ditches and channels shall be drained by keeping the excavation areas and embankment sloped to the approximate section of the final earth grade. If existing surface drainage must be interrupted, temporary drainage shall be provided.
- B. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow, or which may result in contamination and/or silting of the stream.
- C. Precautions shall be taken to preserve, protect, and continue service of all existing tile drains, sewers, and other subsurface utilities; repair any damage to drains, sewers, and utilities.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Grading shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 GRADING

- A. Grading, Square Yards. When so provided, payment for grading shall be made at the contract square yard price bid.
- B. Grading, Lump Sum. When so provided, payment for grading shall be made at the contract lump sum price bid.

- C. Grading, Inclusive. When no quantity is provided, grading shall be in inclusive to payment for work associated with related utility or infrastructure improvement.

END OF SECTION

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SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing all material, equipment, and labor required to execute the earthwork for this project in accordance with Sections 201 through 214 of the State of Wisconsin, Department of Transportation Standard Specifications.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Erosion and Sedimentation Controls - Division 31
- C. Aggregate Base and Subbase - Division 32
- D. Topsoil Placement and Grading - Division 32
- E. Seeding - Division 32
- F. Sodding - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 PRESERVATION OF TREES AND SHRUBS

- A. Trees and shrubs to be preserved shall be thoroughly protected from scarring or other injury during grading operations. Excavation operations shall not disturb the original ground around trees within a distance of one foot or twice the diameter of the tree, whichever is greater. Exposed roots resulting from excavation shall be cut cleanly and covered with humus-bearing soil.
- B. When necessary or required by the Contract Documents, trees or shrubs around which embankment is placed shall be protected by tree wells built in accordance with Detailed Drawings or as laid out in the field by the Owner or Engineer.

3.02 UNCLASSIFIED EXCAVATION AND GRADING

- A. Excavation to subgrade shall be performed to provide a finished subgrade prepared for the application of crushed aggregate, curb and gutter, sidewalks and topsoil as shown on the typical section.
- B. Also included is the removal and disposal of existing stumps, trees, miscellaneous structures and rubble as shown on the contract drawings and any other obstructions encountered which interfere with the proposed construction. Stumps shown on contract drawings to be removed from terraces or backslopes shall be shredded to a minimum of 6 inches below finish subgrade or otherwise removed by the Contractor.
- C. Driveways shall be graded to a 10:1 maximum slope to match proposed construction.
- D. The Contractor shall adjust all valve boxes, manhole frames, and other utility appurtenances to within 1 inch of the final grade as shown on the contract drawings or as staked in the field by the Engineer.

3.03 FILLING

- A. All suitable excavated material shall be used for roadway construction, and at other places shown on the drawings.
- B. Fill shall be spread in successive uniform horizontal layers not exceeding 9 inches in depth over entire area before compaction. Each layer shall be worked to break down clods over 6 inches in size and to secure uniform moisture content. Where filling in 9 inch layers is not feasible, as in the case of filling in water or over steep slopes, construct fill in one layer to the minimum elevation at which equipment can be operated. Above this elevation, the fill shall be constructed in layers of the specified depth.
- C. Compact each layer of fill material to the following percentage of maximum dry density per modified proctor (ASTM D1557).
 - 1. 91 percent for fine grained soils (more than 50 percent passing the No. 200 sieve).
 - 2. 93 percent for coarse-grained soils (less than 50 percent passing the No. 200 sieve).

3.04 PREPARATION OF SUBGRADE

- A. The preparation of the subgrade shall consist of bringing the area to be paved to a subgrade conforming to the required grade and cross section, of uniform density, ready to receive the base course. This is to be accomplished by excavating or backfilling as needed, shaping, watering as required, or permitting to dry to proper consistency, and rolling the entire area with an approved self-propelled roller weighing not less than 8 tons. Shaping and rolling shall be continued until the subgrade has been properly prepared and shows that no further compaction of any practical benefit would result from continued compaction. The subgrade shall be tested as to cross section, crown, and elevation. After being properly prepared, it shall be so maintained until the base course is constructed. A completed subgrade shall be maintained sufficiently in advance of the base course operations to permit proper control. Any part of the subgrade area not accessible to a roller shall be thoroughly compacted by hand or mechanical compaction in a manner acceptable to the Engineer. This work shall be in accordance with Section 211 of the State of Wisconsin, Department of Transportation Standard Specifications.

3.05 UNSTABLE SUBBASE/EXCAVATION BELOW SUBGRADE (EBS)

- A. Deposits of frost-heave material, unstable soils, topsoil containing considerable amounts of organic matter, or other undesirable foundation material shall be removed from the area within the roadbed depths as shown on the drawings or as directed by the Engineer and shall be replaced as directed by the Engineer in the field.
- B. Contractor shall notify the Engineer of any questionable material. The work shall be performed in accordance with Section 205 of the State of Wisconsin, Department of Transportation, Standard Specifications.

3.06 DRAINAGE

- A. During construction, ditches and channels shall be drained at all times by keeping the excavation areas and embankments sloped to the approximate section of the final earth grade. If existing surface drainage must be interrupted, temporary drainage shall be provided.
- B. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow, or which may result in contamination and/or silting of the stream.
- C. Precautions shall be taken to preserve, protect, and continue service of all existing tile drains, sewers, and other subsurface utilities; repair any damage to drains, sewers and utilities.

3.07 TESTING

- A. A testing laboratory will perform compaction and density tests at locations determined by the Owner's Authorized Representative. Where tests indicate that the subgrade does not conform to the compaction density specified, the subgrade shall be replaced or re-worked until it does conform.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Subgrade preparation shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 UNCLASSIFIED EXCAVATION

- A. Unclassified Excavation, Cubic Yards. The measurement and payment for this item shall be per cubic yard. Measurement shall be taken in the field by cross sections before excavation and after topsoiling is placed, where required. Payment shall be made at the contract unit price bid per cubic yard of unclassified excavation.
- B. Unclassified Excavation, Lump Sum. Payment for subgrade preparation shall be made at the contract lump sum price bid for unclassified excavation.

4.03 UNSTABLE SUBBASE/EXCAVATION BELOW SUBGRADE

- A. Excavation Below Subgrade, Cubic Yards. The measurement and payment for this item shall be per cubic yard. Measurement shall be taken in the field by cross sections before any excavation below subgrade takes place and after a stable subbase is reached. Payment shall be made at the contract unit price bid per cubic yard of excavation below subgrade.

END OF SECTION

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SECTION 31 23 23.14
GRANULAR FILL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.
 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the filling, compaction, and testing of all subgrade excavations for this project.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Subgrade Preparation - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GRANULAR FILL

- A. All granular subbase and granular fill materials shall conform to Section 209 of the State of Wisconsin, Department of Transportation, Standard Specifications.
- B. Unless otherwise noted in the Contract Drawings or specifications, all Granular Backfill material shall be Grade 1 Backfill in accordance with the gradation requirements of Section 209 of the State of Wisconsin, Department of Transportation, Standard Specifications.

PART 3 EXECUTION

3.01 COMPACTION

- A. Granular fill materials shall be mechanically compacted in 6 inch to 8 inch lifts to 93 percent maximum dry density per modified proctor (ASTM-D1557).

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Granular fill shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 GRANULAR FILL

- A. Granular Fill, Cubic Yards. The measurement for granular fill shall be by the cubic yard truck volume or as specified in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per cubic yard of granular fill installed, as measured or as specified in Special Procedures - Division 01.
- B. Granular Fill, Ton. The measurement for granular fill shall be by the ton or as specified in Special Procedures - Division 01. Weight tickets from approved truck scales shall be provided. Payment shall be made at the contract unit price bid per ton of granular fill installed, as measured or as specified in Special Procedures - Division 01.

END OF SECTION

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
 2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.
 3. Wisconsin Administrative Code (WAC), Department of Natural Resources, Environmental Protection, Regulations, Current Edition.
 4. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall include all excavating, trenching, and backfilling for utilities as indicated from the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Dewatering - Division 31
- C. Rock Excavation – Division 31
- D. Structural Excavation for Structures - Division 31
- E. Erosion and Sedimentation Controls - Division 31
- F. Utility Horizontal Directional Drilling – Division 33

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 INSITU BACKFILL MATERIAL

- A. Previously excavated soil free of organic debris, clay balls, and aggregate larger than 1-1/2 inches as approved by the Engineer.

2.02 IMPORTED GRANULAR BACKFILL (TRUCKED BACKFILL) MATERIAL

- A. Imported granular fill (trucked backfill) shall be sand conforming to State of Wisconsin, Department of Transportation, Standard Specifications Subsection 209.2.2, Grade No. 1 Granular Backfill or well-graded sand and gravel conforming to Subsection 305.2.2.1 of said State Standard Specification 1-1/4 inch dense graded base with not more than eight percent (8 percent) by weight passing a No. 200 sieve.

2.03 FLOWABLE BACKFILL

- A. A cubic yard of flowable backfill shall consist of 1,350 pounds of sand, 775 pounds of #1 stone, 1,150 pounds of #2 stone, and 25 gallons of water. All weights are damp weights and no additional water will be allowed.
- B. The #1 stone shall conform to the gradation of ASTM C33 No. 67 Stone. The #2 stone shall conform to the gradation of ASTM C33 No. 4 stone.

2.04 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

- A. The CLSM shall include fine aggregate, cementitious material, and water to produce a flowable, non-shrinking backfill. The strength of the CLSM shall be less than 1200 psi. If future excavation of the area is a possibility, the CLSM shall have a maximum strength of 150 psi. The Contractor shall submit a mix design to the Engineer for approval prior to use.

PART 3 EXECUTION

3.01 SURFACE OBSTRUCTIONS

- A. Structures, sidewalk, driveways, curb and gutter, trees, shrubs, lawns, signs, fences, utilities, survey monuments, pavements, culverts and other appurtenances which are adjacent to the right-of-way or work easements, shall be carefully protected against damage. In the event of damage or inadvertent injury or removal of these surface features by failure of the Contractor to exercise reasonable precautions or proper construction techniques, he shall bear the full cost and responsibility for resulting damages and shall replace or repair such damage as early as possible. No allowance for extra payment or time lost will be allowed for such interferences that the Contractor could have suspected or anticipated during pre-bid site inspection and interpretation of the bidding documents.
- B. Clearing, grubbing, and removal of all pavements, sidewalks, curbs, signs, poles, fences, etc., shall be done only as necessary for the completion of the work. Brush, trees, shrubs, concrete, rubble, and other removals, which are not intended to be replaced, shall be disposed of by the Contractor off the work site.
- C. Obstructions, which are intended to be reset, shall be stored and protected by the Contractor. Fences, signs, mailboxes, trees, shrubs, structures, and similar features requiring removal, shall be restored to their original position except where permanent removal is indicated.
- D. Monuments for land surveys encountered in the path of work shall be carefully protected from movement. Should removal be necessary, the Contractor shall notify the Engineer in advance. The Contractor will be held responsible for re-establishing monuments lost due to his negligence or failure to notify the Engineer at least 24 hours in advance of disturbing.

3.02 SUBSURFACE OBSTRUCTIONS

- A. The approximate location and size of sewers, drains, culverts, gas mains, water mains, survey monuments, electric and telephone conduits and other underground structures shown on the drawings are based on records available to the Owner or surface markings indicating their existence.
- B. The Contractor shall use caution in excavating and trenching so that the exact location of underground structures, both known and unknown, may be determined; he shall be held responsible for the repair of such structures when broken or otherwise damaged during construction.
- C. The Contractor shall make arrangements with the utility companies for any relocation of interfering utilities. No extra cost due to unexpected delays or coordination work shall be incurred on the Owner except for authorized utility alterations performed by the Contractor as provided below.
- D. When the Engineer permits the Contractor to make a change to avoid a utility relocation, the Engineer shall determine whether the change constitutes extra work as defined in the General Conditions.

- E. Any underground utilities or other structures, which the Contractor wishes to have moved to facilitate construction, shall be arranged with the owner of such structures. The Contractor shall pay all costs of the accommodation.
- F. In the event that there is any question as to whether any of the above enumerated obstructions, underground utilities or other structures cross or pass through the space occupied by the completed structures of this contract, the Engineer's decision shall be binding upon the Owner and the Contractor.
- G. During the construction of the pipe lines, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits and other underground structures. Where necessary, the flow in drains or culverts shall be diverted so that the excavation is kept dry during the progress of the construction work. Every effort shall be made to prevent damage to such underground structures. Wherever such structures are disturbed or broken, they shall be restored to good condition at no additional cost to the Owner.
- H. The Contractor shall use sand or gravel backfill beneath said structures. This backfill shall be deposited and thoroughly compacted by mechanical means in layers not to exceed 6 inches in depth.

3.03 EXCAVATION

- A. General. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified.
 - 1. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as specified. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations and any water accumulated therein shall be removed by pumping or by other approved methods.
 - 2. Sheet piling and shoring shall be placed as may be necessary for the protection of the work and for the safety of personnel. Unless otherwise indicated, excavation shall be by open cut.
- B. Trench Excavation. Trenches shall be of the necessary width for proper laying of pipe and shall conform to WAC requirements. The banks of pipe trenches shall conform to OSHA requirements and the Contractor is responsible for all safety requirements of said codes.
 - 1. Care shall be taken not to overexcavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe. Bell holes and depressions for joints shall be dug after the trench bottom has been graded, and in order that the pipe rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid point bearing.
 - 2. Except as hereinafter specified for wet or other unstable material, overdepths shall be backfilled as and with materials specified for, backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be overexcavated to a depth to allow for construction of a stable pipe bedding. The trench shall be backfilled to the proper grade with suitable approved materials.
 - 3. Trench Width. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not be less than 6 inches nor exceed 8 inches on either side of the pipe, unless otherwise approved by the Engineer in writing. The width of the trench above that level shall be as wide as necessary for sheet piling and bracing and the proper performance of the work.
 - 4. Excavation for Appurtenances. Excavation for manholes and similar structures shall be sufficient to leave at least 12 inches clear space between the outer surface of structure and the bank or timber that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with sand, gravel, or concrete, as directed, at no additional cost to the Owner.

5. Embedment. Embedment for utilities shall be as specified in the respective utility specification section.

- C. Protection and Removal of Utility Lines. The Contractor shall notify all affected utility companies at least three consecutive working days preceding his construction operations to coordinate his work regarding poles, wires, valve boxes and other surface obstructions and to determine the location of gas, water main, power, light, telephone or telegraph conduit or service connection thereto or any other subsurface structure that crosses or passes through the space occupied by any of the proposed improvements. The Contractor shall make advance arrangements with the utility companies for any relocation of interfering utilities so as not to delay construction.

- D. Interruptions of Services. Interruptions of utility services to existing buildings or facilities which become necessary either directly or indirectly due to work required under this contract shall be coordinated with the Owner through the Engineer. If the down time for connections is limited by them as to duration and time (weekend, nights or holidays), the Contractor shall perform the work during the designated period at no additional cost to the Owner.

3.04 BACKFILLING

- A. Types of Backfill. Backfill for sanitary sewers, water mains, storm sewers, culverts, and drainpipes is the material placed between the bedding and the ground surface. Debris, frozen material, organic matter, unstable material, or stones greater than 8 inches in diameter shall not be suitable for backfill. Large clods and stones not exceeding 8 inches in diameter, when allowed for use as backfill, shall not be placed within two feet of the top of the pipe. Backfill shall be of the following types:
 1. Type I Backfill:
 - a. Type I backfill shall be used where shown on the contract drawings or stated in Special Procedures - Division 01, and unless directed otherwise shall extend from the top of the embedment to the underside of surface restoration.
 - b. Type I backfill shall be used under and around all existing underground structures, tunnels, conduits, and pipes crossing the excavation. Such backfill shall extend underneath and on all sides to a structure, tunnel, conduit or pipe.
 - c. Type I backfill shall be selected fill material consisting of granular subbase course, base course or approved existing sand. The backfill material shall be mechanically compacted in 6-inch layers, from a distance of one foot above the pipe to the surface. The degree of compaction shall be to 95 percent maximum dry density per modified proctor (ASTM D1557).
 2. Type II Backfill:
 - a. Type II backfill shall be used where shown on the contract drawings or stated in Special Procedures - Division 01.
 - b. Type II backfill shall be suitable excavated material, or other approved material, placed in uniform layers and mechanically compacted. The following compaction percentages based on the maximum dry density per modified proctor (ASTM D1557) for the materials are required:
 - 1) For fine grained soils (more than 50 percent passing the No. 200 sieve).

Zone III:	From bottom of surface restoration to 3 feet below - 91 percent
Zone II:	From bottom of Zone III to top of the embedment - 88 percent
Zone I:	Specified as embedment
 - 2) For coarse grained soils (less than 50 percent passing the No. 200 sieve).

Zone III:	From bottom of surface restoration to 3 feet below - 93 percent
Zone II:	From bottom of Zone III to top of the embedment - 90 percent
Zone I:	Specified as embedment
 3. Type III Backfill:
 - a. Type III backfill shall be used in all areas where shown on the Plans or stated in Special Procedures - Division 01. Backfill material shall be suitable excavated material placed, from top of embedment to the bottom of surface restoration, in 12 to 18 inch layers and consolidated by jetting, spading, tamping, or puddling, to the approval of the Engineer, to insure complete filling of the trench.
 4. Type IV Backfill:

- a. Utilize Type III Backfill with the following jetting: at least a 1-1/2 inch jetting hose, equipped with a regulating valve which permits the hydrant valve to be fully open during use, with a minimum 1-1/2 inch diameter pipe nozzle at least 6 feet long shall be used. During the flooding operation, the nozzle shall be inserted as deeply into the backfill as is possible without damaging the sewers, water mains, or foundations. The insertions shall be made at intervals of 5 feet or less and maintained until the backfill is saturated. Depressions caused by flooding shall be backfilled until there is no further settlement.
- 5. Flowable Backfill:
 - a. The materials shall be placed in a clean cement mixer truck and thoroughly mixed. Just prior to placement, the mixer shall be run at mixing speed for one full minute to insure an even mixture. The mixture shall be deposited in the trench directly from the mixer truck. Copies of the load tickets shall be provided to the Engineer.
- B. After Settlement. Should after settlement occur, succeeding any of the above backfilling methods, the Contractor shall scarify the surface of the fill material and place additional fill material in the same manner as herein described so that the surface elevation conforms to that shown on the Plans. No additional compensation shall be allowed for repairing filled areas where after-settlement occurs.
- C. Backfill Placement. The excavated space around and above underground structures, tunnels, conduits and pipes not filled with embedment material and where select fill backfill is not shown or specified may be backfilled by machine.
- D. Backfilling work shall be done in such a way as to prevent dropping of material directly on top of any conduit or pipe through any great vertical distance. In no case shall backfilling material from a bucket be allowed to fall directly on a structure or pipe and in all cases, the bucket shall be lowered so that the shock of falling earth will not cause damage.
- E. Lumps shall be broken up and if there are any stones, pieces of crushed rock or lumps, which cannot be readily broken up, they shall be distributed throughout the mass so that all interstices are solidly filled with fine material. Stones, lumps and clods shall also be placed to maintain a 2 foot minimum separation distance from the top of the pipe or structure. No frozen material shall be used for backfilling.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Trenching and Backfilling for utilities shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 TRENCHING AND BACKFILLING

- A. Trenching and Backfilling, Inclusive. When no quantity is provided, trenching and backfilling shall be included in the payment for contract work related to the associated utility.

4.03 IMPORTED GRANULAR BACKFILL (TRUCKED BACKFILL)

- A. Imported Granular Backfill (Trucked Backfill), Cubic Yard. Measurement for imported granular backfill (trucked backfill) shall be per cubic yard, as in truck volume. Payment shall be made at the contract unit price bid for imported granular backfill (trucked backfill), as measured.
- B. Imported Granular Backfill (Trucked Backfill), Ton. Measurement for imported granular backfill (trucked backfill) shall be per ton, as trucked in weight. Payment shall be made at the contract unit price bid for imported granular backfill (trucked backfill) as measured.

- C. Imported Granular Backfill (Trucked Backfill), Inclusive. When no quantity is provided, imported granular backfill (trucked backfill) shall be included in the payment for contract work related to the associated utility.

4.04 FLOWABLE BACKFILL

- A. Flowable Backfill. Measurement for flowable backfill shall be per cubic yard, as in truck volume. Payment shall be made at the contract unit price bid for flowable backfill, as measured.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. State of Wisconsin, Department of Natural Resources (WDNR), Conservation Practice Standards, Current Edition.
 2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover providing the necessary materials, equipment and labor to control erosion and sedimentation controls by the methods specified herein. If no specific quantities are shown on the contract drawings, the Contractor shall use whatever quantities are necessary to prevent sediment transport off the job site, into permanent manmade storm water conveyances or management facilities or to Waters of the State.
- B. The Contractor will be required to provide erosion control as per the current edition of the applicable State of Wisconsin, Department of Natural Resources (WDNR), Conservation Practice Standards. Copies of these standards can be obtained by contacting the following:

State of Wisconsin Department of Natural Resources
Non-Point Source and Land Management Section
101 South Webster Street, P.O. Box 7921
Madison, WI 53707-7921

or by visiting the following website:

http://dnr.wi.gov/topic/stormwater/standards/const_standards.html

- C. The Engineer has prepared an erosion control plan for this project. The intent of this plan is to identify erosion control provisions for the construction site that comply with local, state, and federal regulations. The Contractor shall submit for approval by the appropriate regulatory agency any changes to the Erosion Control Plan, prior to beginning any construction on the project which may cause erosion in the portion of the site where the change to the Erosion Control Plan is proposed.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Clearing and Grubbing - Division 31
- C. Grading - Division 31
- D. Subgrade Preparation - Division 31
- E. Structural Excavation for Structures - Division 31

F. Trenching and Backfilling - Division 31

G. Riprap - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and free of roots, stumps, stones larger than 2 inches in any dimension, and other matter harmful to plant growth. Topsoil to supplement insufficient topsoil on the site shall originate from local sources, but not from bogs or marshes.

2.02 LIME

A. Lime used for soil amendment shall be agricultural grade limestone ground sufficiently fine so that 80 percent passes a No. 8 sieve. Lime shall contain 80 percent calcium carbonate equivalent. Moisture shall not exceed 10 percent.

2.03 FERTILIZER

A. Fertilizer used in conjunction with seeding shall be dry, free-flowing granular fertilizer suitable for application by agricultural fertilizer spreaders or blower equipment, or non-volatile liquid commercial fertilizer, having an analysis of 20-10-10 (Nitrogen-Phosphoric Acid-Potash), or equal, unless use of phosphorus based fertilizers are banned by the community where the work is to be completed. In such communities, an analysis of 20-0-10, or equal, shall be used. Fertilizer having other analysis shall be applied at a rate to achieve at least the individual following amounts of nutrient per unit area:

<u>Nutrient</u>	<u>Application Rate</u> (Per Acre)	<u>Application Rate</u> (Per 1000 Sq. Ft.)
Nitrogen (N)	100 pounds	2.3 pounds
Phosphoric Acid (P ₂ O ₅)	50 pounds	1.2 pounds
Potash (K ₂ O)	50 pounds	1.2 pounds

2.04 SEEDING FOR CONSTRUCTION SITE EROSION CONTROL

- A. Seeding for Construction Sites shall conform with Wisconsin DNR Conservation Practice Standard 1059.
- B. Seed mixtures shall conform to one of the following:
 - 1. WisDOT, 2003. State of Wisconsin Standard Specifications For Highway and Structure Construction. Section 630, Seeding.
 - 2. United States Department of Agriculture – Natural Resource Conservation Service Field Office Technical Guide Section IV, Standard 342, Critical Area Planting.
 - 3. UWEX Publication A3434 Lawn and Establishment & Renovation.
- C. All seed shall conform to the requirements of the Wisconsin Statutes and of the Administrative Code Chapter ATCP 20.01 regarding noxious weed seed content and labeling.
- D. Seed mixtures that contain potentially invasive species or species that may be harmful to native plant communities shall be avoided.
- E. Seed shall not be used later than one year after the test date that appears on the label.

- F. Seed shall be tested for purity, germination and noxious weed seed content and shall meet the minimum purity and germination requirements as prescribed in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

2.05 MULCH FOR CONSTRUCTION SITES

- A. Mulching for construction sites shall conform with Wisconsin DNR Conservation Practice Standard 1058.
- B. Mulch shall consist of natural biodegradable material such as plant residue (including but not limited to straw, hay, wood chips, bark and wood cellulose fiber), or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period.
- C. Mulch shall be environmentally harmless to wildlife and plants. Materials such as gravel, plastic, fabric, sawdust, municipal solid waste, solid waste byproducts¹, shredded paper, and non-biodegradable products shall not be used.
- D. Mulch shall be free of diseased plant residue (i.e., oak wilt), noxious weed seeds, harmful chemical residues, heavy metals, hydrocarbons and other known environmental toxicants.
- E. Marsh hay shall not be used as mulch in lowland areas but may be used on upland sites to prevent the spread of invasive, nonnative species (i.e., reed canary grass) commonly found in marsh hay.
- F. Straw and hay mulch that will be crimped shall have a minimum fiber length of 6 inches.
- G. Wood chips or wood bark shall only be used for sites that are not seeded.

2.06 EROSION MAT

- A. Non-Channel Erosion Mat products shall conform with Wisconsin DNR Conservation Practice Standard 1052.
- B. Channel Erosion Mat products shall conform with Wisconsin DNR Conservation Practice Standard 1053.
- C. Erosion mat shall conform to the requirements of the State of Wisconsin, Department of Transportation, Product Acceptability List (PAL) for Erosion Control Revegetative Mat (ECRM) and Turf-Reinforcement Mat (TRM).
- D. For mats that utilize netting, the netting shall be bonded to the parent material to prevent separation of the net for the life of the product.
- E. For urban class mats the following material requirements shall be adhered to:
 - 1. Only 100% organic biodegradable netted products are allowed, including parent material, stitching, and netting.
 - 2. The netting shall be stitched with biodegradable thread/yarn to prevent separation of the net from parent material.
 - 3. All materials and additive components used to manufacture the anchoring devices shall be completely biodegradable as determined by ASTM D 5338.
 - 4. Mats with photodegradable netting shall not be installed after September 1st.
 - 5. Steel wire pins or staples shall not be used in lawns.

2.07 SEEDING AND SODDING

- A. Seeding and sodding shall conform to Seeding - Division 32 and Sodding - Division 32.

2.08 STRAW BALE EROSION BARRIERS

- A. Straw Bale (Sediment Bale Barriers) shall conform with Wisconsin DNR Conservation Practice Standard 1055.

- B. Bales used for erosion control shall be either hay or straw, shall have rectangular surfaces, and shall be tightly bound with twine, not wire. The material in the bales shall be reasonably free of grain, weed seed and mold, and shall be dry and suitable for the purpose intended.
- C. The minimum cross sectional area for wood stakes shall be 2.0 by 2.0 inches nominal.
- D. The minimum diameter of steel (rebar) stakes shall be one-half inch.

2.09 SEDIMENT CONTROL FENCE (SILT FENCE)

- A. Silt Fence shall conform with Wisconsin DNR Conservation Practice Standard 1056.
- B. Silt fence shall be in accordance with Section 628.2.6 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction.
- C. Wood Posts:
 - 1. Wood Posts used to support the fabric shall be at least 1-1/8 inch x 1-1/8 inch in cross-section and shall be a minimum of 4 feet with a minimum in ground depth of 2 feet. Posts shall be made from kiln-dried hickory or Oak.
 - 2. Staples used to attach silt fence to wood posts shall be at least 0.5-inches in length.
- D. Steel Supports:
 - 1. Steel posts shall be at least 5 feet long with a strength of 1.33 pounds per foot and shall have projections for the attachment of fasteners.
 - 2. The silt fence fabric shall be attached in at least three places on the upslope side with 50 pound plastic tie straps or wire fasteners.
- E. Silt fence shall have a support cord.
- F. The Contractor shall furnish upon request a manufacturer's Certificate of Compliance that the geotextile fabric as furnished meets the above requirements.
- G. Silt Fence shall be installed in accordance with Wisconsin DNR Conservation Practice Standard 1056.

2.10 STONE DITCH CHECKS

- A. Stone Ditch Checks shall be installed in accordance with Wisconsin DNR Conservation Practice Standard 1062.

2.11 RIPRAP

- A. Riprap shall be established in accordance with Riprap - Division 31 of this specification.

2.12 LAND APPLICATION OF POLYACRYLAMIDE

- A. Land Application of Polyacrylamide shall be performed in accordance with Wisconsin DNR Conservation Practice Standard 1050.

2.13 STONE TRACKING PAD

- A. Stone Tracking Pads shall be established in accordance with Wisconsin DNR Conservation Practice Standard 1057.
- B. The aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All material to be retained on a 3-inch sieve.

2.14 VEGETATIVE BUFFERS

- A. Vegetative Buffers for Construction shall be established in accordance with Wisconsin DNR Conservation Practice Standard 1054.
- B. Prior to land disturbance the perimeter of vegetative buffers shall be flagged or fenced to prevent equipment from creating ruts, compacting the soil and to prevent damage to existing vegetation.
- C. Trees should not be cut down to establish a vegetative buffer. Other erosion control measures are preferred.

2.15 TEMPORARY SEDIMENT TRAPS

- A. Temporary Sediment Traps shall conform with Wisconsin DNR Conservation Practice Standard 1063.
- B. The stone outlet of a Sediment Trap shall consist of a stone section of embankment located at the discharge point. Stone shall consist of angular well graded 3 to 6 inch clear washed stone.
- C. If filter fabric is indicated for the up-slope side of the stone outlet, a monofilament type fabric shall be used (such as WisDOT Type FF or equivalent).

2.16 TEMPORARY CONSTRUCTION SITE DIVERSION

- A. Temporary Construction Site Diversions shall conform to Wisconsin DNR Conservation Practice Standard 1066.

2.17 DUST CONTROL

- A. Dust Control measures shall be implemented in accordance with Wisconsin DNR Conservation Practice Standard 1068.
- B. Asphalt and petroleum based products shall not be used for dust control.
- C. Mulch or seed and mulch may be applied to protect exposed soil from wind erosion according to the provisions of WDNR Conservation Practice Standard 1058 Mulching for Construction Sites and 1059 Seeding for Construction Site Erosion Control.
- D. Polymers may be used for dust control according to the provisions of WDNR Conservation Practice Standard 1050 Erosion Control Land Application of Polymers.
- E. Tackifiers and Soil Stabilizers Type A – Products must be selected from the WisDOT Erosion Control PAL.
- F. Solid board fences, snow fences, burlap fences, crate walls, bales of hay and similar material may be used to control air currents and blown soil.

2.18 CONSTRUCTION SITE DE-WATERING

- A. Construction Site Dewatering activities shall be conducted in accordance with Wisconsin DNR Conservation Practice Standard 1061.

2.19 STORM DRAIN INLET PROTECTION

- A. Storm Drain Inlet Protection shall conform Wisconsin DNR Conservation Practice Standard 1060.
- B. All fabrics used as part of an inlet protection device must be selected from the list of approved fabrics certified for inlet protection, Geotextile Fabric, Type FF in the current edition of the WisDOT Product Acceptability List (PAL).
- C. Inlet Protection Barriers include, but are not limited to, straw bales, sandbags, other material filled bags and socks, and stone weepers.

- D. Manufactured bags, when used, shall conform to the standards below:
 1. Minimum Size 14 x 26 inches
 2. Grab Tensile strength of fabric, ASTM D-4632 = 95 lb. min.
 3. UV stability, ASTM D-4355 = 70 % min.
 4. Fabric shall be sewn together with double stitching.
- E. Straw Bale installation shall conform to the criteria outlined in the WDNR Conservation Practice Standard (1055) Sediment Bale Barrier (Non-Channel).
- F. Stone weeper installation shall conform to the criteria in WDNR Conservation Practice Standard (1063) Sediment Trap.

2.20 DITCH CHECK (CHANNEL)

- A. Ditch Checks for erosion and sediment control in drainage ditches and channels shall conform Wisconsin DNR Conservation Practice Standard 1062.
- B. Stone ditch checks shall be constructed of a well-graded angular stone, a D50 of 3 inch or greater, sometimes referred to as breaker run or shot rock.
- C. Manufactured products listed in WisDOT's PAL are also acceptable for temporary ditch checks.
- D. Silt fence and single rows of straw bales are not permitted.

2.21 LAND APPLICATION OF ANIONIC POLYACRYLAMIDE (POLYMERS, PAM).

- A. Land Application of Anionic Polyacrylamide (PAM) shall conform Wisconsin DNR Conservation Practice Standard 1050.
- B. Anionic PAM mixtures shall be environmentally benign, harmless to fish, aquatic organisms, wildlife, and plants. Anionic PAM mixtures shall be non-combustible.
- C. Cationic PAM shall not be used at any level. Anionic PAM mixtures shall have $\leq 0.05\%$ free acrylamide monomer by weight as established by the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA).
- D. The manufacturer or supplier shall provide a product expiration date for anionic PAM mixtures based on product expiration date of PAM in pure form. PAM shall not be used if the expiration date will be reached prior to establishment of vegetation in areas where PAM is to be used.
- E. Contractor shall store and mix polymer in accordance with manufacturer or supplier written instructions.

PART 3 EXECUTION

3.01 EROSION CONTROL REQUIREMENTS

- A. The erosion control requirements specified in the project Storm Water Management Plan shall be adhered to at all times.
- B. Temporary and permanent erosion control measures shall be performed by the Contractor. The Contractor shall control water pollution, erosion, and siltation through the use of intercepting embankments, berms, dikes, dams, settling basins, slope paving, ditch checks, riprap, mulches, erosion mats, seeding, sodding, plantings and other erosion control devices or methods.
- C. The Contractor shall submit for approval his plan of operations for accomplishing temporary and permanent erosion control work relating to grubbing, grading, paving and other work which might create erosion.

- D. The area of erosive land exposed to the elements by grubbing, excavation, borrow and fill operations at any one time shall be minimized to the maximum extent practicable and the duration of such exposure prior to final trimming, finishing and seeding or application of temporary erosion control measures shall be as short as practicable. Construction in and adjacent to rivers, streams, lakes, or other waterways shall be performed in such a manner as to avoid washing, sloughing or deposition of materials into such waterways which would obstruct or impair the flow thereof thus endangering the roadway or stream banks, or which would result in undue or avoidable contamination, pollution or siltation of such waterways.
- E. The Owner or Designated Representative shall have full authority to suspend or limit grading and other operations pending adequate performance of such permanent erosion control measures as finish grading, topsoiling, mulching, matting and seeding and any temporary erosion control measures ordered by the Engineer.
- F. Grubbing and grading operations shall be performed in proper sequence with other work to minimize erosion. Intercepting ditches or dikes shall be constructed as soon as practical after clearing and grubbing operations are completed and prior to or during the operations of excavating the cuts. Where erosion is likely to be a problem, the permanent erosion control measures shall follow immediately after the grading operations if conditions permit, unless the Engineer shall authorize temporary erosion control measures.
- G. Water pumped from the site shall be treated by temporary sedimentations basins, grit chambers, sand filters, upslope chambers, hydro-cyclones, swirl concentrators, or other appropriate controls designed and used to remove total suspended solids (TSS) to 40 mg/l or less for the highest dewatering pumping rate. If the water is demonstrated to contain less than 40 mg/l TSS during dewatering operations, then no control is needed before discharge. Water may not be discharged in a manner that causes erosion of the site or receiving channels. Construction Site Dewatering activities shall be conducted in accordance with Wisconsin DNR Conservation Practice Standard 1061.
- H. The Contractor shall take all possible precautions to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday.
- I. All storm drain or culvert inlets shall be protected with appropriate erosion control practices as identified in the appropriate Conservation Practice Standard. Channelized runoff from adjacent areas passing through the site shall be diverted around disturbed areas, if practical. Otherwise, the channel shall be protected. Sheet flow runoff from adjacent areas greater than 10,000 square feet in area shall also be diverted around disturbed areas unless shown to have resultant runoff velocities of less than 0.5 ft/sec across the disturbed area for one-year design storms having a duration of from 0.5 to 24 hours. Diverted runoff shall be conveyed in a manner that will not erode the conveyance and receiving channels.
- J. All disturbed ground left inactive for seven (7) or more days shall be stabilized by seeding or sodding (only prior to October 15) or by mulching or covering, or other equivalent control measure.
- K. For sites with more than 10 acres disturbed at one time, or if a channel originates in the disturbed area, one or more Temporary Sediment Traps shall be constructed in accordance with Wisconsin DNR Conservation Practice Standard 1063. The basin discharge rate shall also be sufficiently low as to not cause erosion along the discharge channel or the receiving water.
- L. For sites with less than 10 acres disturbed at one time, sediment control fences, hay bales, or equivalent control measures shall be placed along all sideslope and downslope sides of the site. If a channel or area of concentrated runoff passes through the site, sediment control fences shall be placed along the channel edges to reduce sediment reaching the channel.
- M. Any soil or dirt storage piles containing more than ten cubic yards of material should not be located with a downslope drainage length of less than 25 feet to a roadway or drainage channel. If remaining for more than seven (7) days, they shall be stabilized by mulching, vegetative cover, tarps, or other means. Erosion from piles which will be in existence for less than seven (7) days shall be controlled by placing hay bales or sediment control fence barriers around the pile. In-street utility repair or construction soil; or dirt storage

piles located closer than 25 feet to a roadway or drainage channel must be covered with tarps or a suitable alternative control must be used if exposed for more than seven (7) days, and storm drain or culvert inlets must be protected with straw bales or other appropriate filtering barriers (CPS 1060).

3.02 TEMPORARY SEEDING

- A. Seeding for Construction Sites shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1059.
- B. Temporary Seeding (Cover Crop) - Areas needing protection during periods when permanent seeding is not applied shall be seeded with annual species for temporary protection. See table below for seeding rates of commonly used species. The residue from this crop may either be incorporated into the soil during seedbed preparation at the next permanent seeding period or left on the soil surface and the planting made as a no-till seeding.

<u>Species</u>	<u>Lbs/Acre</u>	<u>Percent Purity</u>
Oats	131 ¹	98
Cereal Rye	131 ²	97
Winter wheat	131 ²	95
Annual Ryegrass	80 ²	97

1 Spring and summer seeding

2 Fall seeding

- C. Permanent Seeding - Rates shall be based on pounds or ounces of Pure Live Seed (PLS) per acre. If a nurse crop is used in conjunction with permanent seeding, the nurse crop shall not hinder establishment of the permanent vegetation. A nurse crop shall be applied at 50% its temporary seeding rate when applied with permanent seed.
- D. Inoculation - Legume seed shall be inoculated in accordance with the manufacturer's recommendations. Inoculants shall not be mixed with liquid fertilizer.
- E. Sowing
 - 1. Seed grasses and legumes no more than 1/4 inch deep. Distribute seed uniformly. Mixtures with low seeding rates require special care in sowing to achieve proper seed distribution.
 - 2. Seed may be broadcast, drilled, or hydroseeded as appropriate for the site.
 - 3. Seed when soil temperatures remain consistently above 53°F. Dormant seed when the soil temperature is consistently below 53°F (typically November 1st until snow cover). Seed shall not be applied on top of snow.
- F. Turf seedlings must not be mowed until the stand is at least 6 inches tall. Do not mow closer than 3 inches during the first year of establishment.
- G. Alternate plans must be submitted for approval.

3.03 APPLICATION OF STRAW OR HAY MULCH

- A. Mulching for Construction Sites shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1058.
- B. Application Rate:
 - 1. Mulch shall cover a minimum of 80% of the soil surface for unseeded areas. For seeded areas, mulch shall be placed loose and open enough to allow some sunlight to penetrate and air to circulate but still cover a minimum of 70% of the soil surface.
 - 2. Mulch shall be applied at a uniform rate of 1½ to 2 tons per acre for sites that are seeded, and 2 to 3 tons per acre for sites that are not seeded. This application results in a layer of ½ to 1½ inches thick for seeded sites, and 1½ to 3 inches thick for sites not seeded.

3. Wood chips or wood bark shall be applied at a rate of 6 to 9 tons per acre to achieve a minimum of 80% ground cover. This application should result in a layer of wood chips or wood bark ½ to 1½ inches thick.
- C. In areas where mulch is to be placed over seed, mulch shall be placed within 24 hours of seeding.
 - D. Mulch Anchoring Methods - Anchoring of mulch shall be based on the type of mulch applied, site conditions, and accomplished by one of the following techniques:
 1. Crimping: Immediately after spreading, the mulch shall be anchored by a mulch crimper or equivalent device consisting of a series of dull flat discs with notched edges spaced approximately 8 inches apart. The mulch shall be impressed in the soil to a depth of 1 to 3 inches.
 2. Polypropylene Plastic, or Biodegradable Netting: Apply plastic netting over mulch application and staple according to manufacturer's recommendations.
 3. Tackifier: Tackifier shall be sprayed in conjunction with mulch or immediately after the mulch has been placed. Tackifiers must be selected from those that meet the WisDOT Erosion Control Product Acceptability List (PAL). Asphalt based products shall not be applied.
 - a. The tackifiers shall be applied at the following minimum application rates per acre:
 - 1) Latex-Base: mix 15 gallons of adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 375 gallons of water.
 - 2) Guar Gum: mix 50 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as tracer with 1,300 gallons of water.
 - 3) Other Tackifiers: (Hydrophilic Polymers) mix 100 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.

3.04 PLACING EROSION MAT

- A. Installation instructions shall be supplied by the manufacturer. The Contractor shall install the mat in accordance with the manufacturer's recommendations and in accordance with Section 628.2 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, and the State of Wisconsin, Department of Transportation general requirements for erosion mat except as may be modified herein.
- B. Erosion control revegetative mats shall be installed after all topsoiling, fertilizing, liming and seeding is complete.
- C. The mat shall be in firm and intimate contact with the soil. It shall be installed and anchored per the manufacturer's recommendation.
- D. The mat shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, mat shall be unrolled and applied parallel to the direction of drainage. On slopes, mat shall be applied parallel to the slope direction.
- E. Turf-reinforcement mat shall be installed in conjunction with the topsoiling operation and shall be followed by Erosion Control Revegetative Mat installation.
- F. At time of installation, document the manufacturer and mat type by retention of material labels and manufacturer's installation instructions. Retain this documentation until the site has been stabilized.
- G. In channels and on slopes, each upslope and each downslope end of each piece of mat shall be placed in a 4-inch trench, stapled on 12-inch centers, backfilled and tamped. Where one roll ends and second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12 inch overlap, placed in a 4 inch trench, stapled on 12 inch centers, backfilled and tamped. In channels, erosion mats shall extend for whichever is greater: upslope one-foot minimum vertically from the ditch bottom or 6 inches higher than the design flow depth.

- H. On slopes, where two or more widths of mat are applied, the two edges shall be overlapped according to the manufacturer's installation instructions and stapled at 18 to 24 inch intervals along the exposed edge of the lap joint. The body of the mat shall be stapled in a grid pattern with staples 3 feet on center each way.
- I. Where heavy concentrations of water or extremely erodible soil conditions exist, as noted on the contract drawings, erosion checks shall be installed at intervals of 50 feet, or less. Such a check shall consist of a 4-inch deep trench perpendicular to the flow direction across the entire width of the fabric. The mat shall be stapled at 9-inch intervals along the bottom of the trench across the entire width of the mat. The trench shall then be backfilled and tamped.
- J. If anchoring devices become loosened, or if any fabric loosens, is torn or undermined, repairs shall be made immediately without additional compensation.
- K. Erosion mat when used in conjunction with fertilizing and seeding done for surface restoration, shall be installed immediately after fertilizing and seeding operations have been completed. Straw or hay mulch shall not be used under the fabric.
- L. Erosion mat shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
 - 1. If there are signs of rilling under the mat, install more staples or more frequent anchoring trenches. If rilling becomes severe enough to prevent establishment of vegetation, remove the section of mat where the damage has occurred. Fill the eroded area with topsoil, compact, reseed and replace the section of mat, trenching and overlapping ends per manufacturer's recommendations. Additional staking shall be provided where rilling was filled.
 - 2. If the reinforcing plastic netting has separated from the mat, remove the plastic and if necessary replace the mat.
 - 3. Maintenance shall be completed as soon as possible with consideration to site conditions.

3.05 VEGETATIVE BUFFERS

- A. Vegetative Buffers for Construction shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1054.
- B. Trees should not be cut down to establish a vegetative buffer.
- C. A stand of dense vegetation shall be maintained to a height of 3 – 12 inches.
- D. Vegetative buffers shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Vegetative buffers shall be inspected for proper distribution of flows, sediment accumulation and signs of rill formation.
- E. If the vegetative buffer becomes silt covered, contains rills, or is otherwise rendered ineffective, other perimeter sediment control measures shall be installed. Eroded areas shall be repaired and stabilized. Repair shall be completed as soon as possible with consideration to site conditions.

3.06 TEMPORARY SOD PLACEMENT

- A. The Contractor shall place sod with edges in close contact and with joints staggered. Sod placement on slopes shall commence at the bottom of the slope, and the rows shall be laid perpendicular to the slope. The edge of the sod at the tops of slopes shall be turned slightly under, and a layer of soil shall be compacted over the edge to direct surface drainage over the edge onto the top of the sod. Sod placement in areas other than on slopes shall be made so that the top sod surface is flush with adjoining surfaces.
- B. On slopes steeper than 4:1 horizontal to vertical, the Contractor shall stake the sod with split cedar shingles, or other equally effective stakes, spaced from 18 to 36 inches apart along the longitudinal axis of the sod strip. These stakes shall be placed near the top edge of the sod strip and shall be driven flush with the sod.

- C. After the sod is placed, it shall be rolled or firmly tamped to press the sod onto the underlying soil. The Contractor shall, at the end of the day in which the sod is laid, thoroughly soak all sodded areas by sprinkling them with water.
- D. Sod shall be maintained in a moist, growing condition. The Contractor shall repair all areas damaged by erosion or traffic of any kind.

3.07 PLACING HAY BALE BARRIERS

- A. Straw Bale (Sediment Bale Barriers) shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1055.
- B. Sufficient bales shall be on the site to create the necessary barriers prior to the start of groundbreaking operations. The bales shall be stacked and covered with plastic sheeting until required for use.
- C. At a minimum, sediment bale barriers shall be placed in a single row, lengthwise on the contour, with the ends of adjacent sediment bale barriers tightly abutting one another. The holes between bales shall be chinked (filled by wedging) with straw, hay or equivalent material to prevent water from escaping between the bales.
- D. The maximum allowable slope lengths contributing runoff to a sediment bale barrier are specified below:

Slope Barrier Row Spacing	
< 2%	100 feet
2 to 5%	75 feet
5 to 10%	50 feet
10 to 33%	25 feet
33 to 50%	20 feet
> 50%	Not Permitted

- E. Sediment bale barriers shall not be placed perpendicular to the contour.
- F. The end of the sediment bale barrier shall be extended upslope to prevent water from flowing around the barrier ends.
- G. Installed sediment bale barrier shall be a minimum of 10 inches high and shall not exceed a maximum height of 20 inches from ground level.
- H. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a sediment bale barrier and the length of the proposed barrier to a minimum depth of 4 inches. After bales are staked and chinked, the excavated soil shall be backfilled and compacted against the barrier. Backfill to ground level on the down slope side. On the upslope side of the sediment bale barrier backfill to 4 inches above ground level.
- I. At least two wood stakes, "T" or "U" steel posts, or 1/2 inch rebar driven through at equidistance along the centerline of the barrier shall securely anchor each bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes shall be driven a minimum 12-inches into the ground to securely anchor the sediment bale barriers.
- J. Bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings.
- K. Sediment bale barriers shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
- L. Damaged or decomposed sediment bale barriers, any undercutting, or flow channels around the end of the sediment bale barriers shall be repaired.

- M. Sediment shall be properly disposed of once the deposits reach 1/2 the height of the sediment bale barrier.
- N. Sediment bale barriers and anchoring devices shall be removed and properly disposed of when they have served their usefulness, but not before the upslope areas have been permanently stabilized.
- O. Any sediment deposits remaining in place after the sediment bale barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

3.08 CONSTRUCTION OF SEDIMENT CONTROL FENCE (SILT FENCE)

- A. Silt Fence shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1056.
- B. When installed as a stand-alone practice on a slope, silt fence shall be placed on the contour. The parallel spacing shall not exceed the maximum slope lengths for the appropriate slope as specified:

Slope Fence Spacing	
< 2%	100 feet
2 to 5%	75 feet
5 to 10%	50 feet
10 to 33%	25 feet
> 33%	20 feet
> 50%	Not Permitted

- C. Silt fences shall not be placed perpendicular to the contour.
- D. The ends of the fence shall be extended upslope to prevent water from flowing around the ends of the fence.
- E. When attached to wooden posts the silt fence fabric shall be stapled, using at least 0.5-inch staples, to the upslope side of the posts in at least 3 places.
- F. When attached to steel supports the silt fence fabric shall be attached in at least three places on the upslope side with 50 pound plastic tie straps or wire fasteners. To prevent damage to the fabric from fastener, the protruding ends shall be pointed away from the fabric.
- G. The maximum spacing of posts for nonwoven silt fence shall be 3 feet and for woven fabric 8 feet.
- H. Where joints are necessary, each end of the fabric shall be securely fastened to a post. The posts shall then be wrapped around each other to produce a stable, secure joint or shall be overlapped the distance between two posts.
- I. On the terminal ends of silt fence the fabric shall be wrapped around the post such that the staples are not visible.
- J. A minimum of 20 inches of the post shall extend into the ground after installation.
- K. Anchoring – Silt fence shall be anchored by spreading at least 8 inches of the fabric in a 4 inch wide by 6 inch deep trench, or 6 inch deep V-trench on the upslope side of the fence. The trench shall be backfilled and compacted. Trenches shall not be excavated wider and deeper than necessary for proper installation.
- L. Removal – Silt fences shall be removed once the disturbed area is permanently stabilized and no longer susceptible to erosion.
- M. Silt fences shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.

- N. Damaged or decomposed fences, undercutting, or flow channels around the end of barriers shall be repaired or corrected.
- O. Sediment shall be properly disposed of once the deposits reach 1/2 the height of the fence.

3.09 STONE TRACKING PAD

- A. Stone Tracking Pads shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1057.
- B. The tracking pad shall be installed prior to any traffic leaving the site.
- C. The aggregate shall be placed in a layer at least 12 inches thick. On sites with a high water table, or where saturated conditions are expected during the life of the practice, stone tracking pads shall be underlain with a WisDOT Type R geotextile fabric to prevent migration of underlying soil into the stone.
- D. Tracking pads and tire washing stations shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
- E. The tracking pad performance shall be maintained by scraping or top-dressing with additional aggregate.
- F. A minimum 12-inch thick pad shall be maintained.

3.10 STORM DRAIN INLET PROTECTION

- A. Storm Drain Inlet Protection shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1060.
- B. The contributing drainage area to the inlet protection device shall be one acre or less. In instances where a larger contributing drainage area exists, runoff shall be routed through a properly designed sediment trapping or settling device upstream of inlet.
- C. Other than Type D inlet protection devices, no gaps shall be left in the material used that would allow the flow of water to bypass the inlet protection device.
- D. Filter Fabric Barrier Criteria - See Inlet Protection Detail
 1. Inlet protection Type A devices shall be utilized around inlets and unpaved areas until permanent stabilization methods have been established. Type A devices shall be utilized on inlets prior to installation of curb and gutter or pavement, and where safety considerations are not compromised on the site.
 2. Type B shall be utilized after the casting and grate are in place.
 3. Type D shall be utilized in areas where other types of inlet protection are identified as incompatible with roadway and traffic conditions, causing possible safety hazards when ponding occurs at the inlet. Type D shall only be used after castings are in place on top of the inlet boxes.
 4. Type D inlet protection shall conform to the standard drawing as shown in the contract drawings. There shall be a three-inch space between the bag and the sides of the inlet to prevent the inlet sides from blocking the overflow; and shall only be used in inlets deeper than 30 inches from the top of grate to bottom of the inlet. If such clearance is not available, cinch or tie the sides of the bag (with rope or ties) to provide clearance.
- E. Criteria Applicable to the Post-Paving/Curbing Phase of Construction
 1. Inlet protection Types B, C, and D are applicable to post paving construction. See Inlet Protection Detail.
 - a. Type B shall be utilized on inlets without curb box.
 - b. Type C shall be utilized on street inlets with curb heads. A 1½ inch x 3½ inch (37 mm by 87 mm) minimum, piece of wood shall be wrapped and secured in the fabric and placed in

front of the curb head as shown in the contract drawings. The wood shall not block the entire opening of the curb box and be secured to the grate with wire or plastic ties.

c. Type D.

- F. Remove inlet protection devices once the contributing drainage area is stabilized with appropriate vegetation or impervious area.
- G. Inlet protection shall be at a minimum inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
- H. Sediment deposits shall be removed and the inlet protection device restored to its original dimensions when the sediment has accumulated between 1/3 to 1/2 the design depth of the device, or when the device is no longer functioning as designed. Removed sediment shall be deposited in a suitable area and stabilized.
- I. Any material falling into the inlet shall be removed.

3.11 DITCH CHECK (CHANNEL)

- A. Ditch Checks for erosion and sediment control in drainage ditches and channels shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1062.
- B. Ditch checks shall be utilized during rough grading and shall be removed once the final grading and channel stabilization is applied, unless intended to be part of a permanent storm water management plan.
- C. Channel erosion mat or other nonerodible materials shall be placed at the base of a ditch check, and extended a minimum of 6 feet, to prevent scour and washing out the toe of the ditch check. DNR Conservation Practice Channel Erosion Mat (1053) contains criteria for the placement of erosion mat in this location.
- D. Stone ditch checks may be underlain by a nonwoven geotextile fabric to ease installation and removal. If the geotextile fabric is extended, it can serve purpose specified in item 3.11 C above.
- E. Chink or seal stone and rock ditch checks to minimize the flow through the ditch check.
- F. For added stability, the base of a stone or rock ditch check shall be keyed into the soil to a depth of 6-inches.
- G. Ditch checks shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.
- H. Unless incorporated into a permanent storm water management system, ditch checks shall be removed once the final grading and channel stabilization is applied.
- I. Maintenance shall be completed as soon as possible with consideration to site conditions.

3.12 TEMPORARY SEDIMENT TRAPS

- A. Temporary Sediment Traps shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1063.
- B. Sediment traps shall be constructed prior to disturbance of up-slope areas and placed so they function during all phases of construction.
- C. The depth of the sediment trap measured from the sediment trap bottom to the invert of the stone outlet, shall be at least three feet to minimize re-suspension and provide storage for sediment.
- D. The sediment trap shall have a length to width ratio of at least 2:1. The position of the outlet to the inlet shall be as such to minimize short-circuiting of the water flow path.

- E. Side slopes shall be no steeper than 2:1.
- F. Embankments of temporary sediment traps shall not exceed five feet in height measured from the downstream toe of the embankment to the top of the embankment. Construct embankments with a minimum top width of four feet, and side slopes of 2:1 or flatter. Earthen embankments shall be compacted.
- G. Sediment traps shall be constructed with both a principal and emergency spillway. The stone outlet of a sediment trap shall consist of a stone section of embankment (stone outlet) located at the discharge point. The stone outlet section provides a means of dewatering the basin back to the top of the permanent storage between storm events, and also serves as a non-erosive emergency spillway for larger flow events.
- H. The stone outlet shall have a minimum top width of 2 feet and a maximum side-slope of 2:1.
- I. The stone outlet shall be protected from undercutting by excavating a keyway trench across the stone foundation and up the sides to the height of the outlet.
- J. Sediment Traps shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Sediment may need to be removed more frequently.
- K. Deposits of sediment shall be removed when they reach a depth of one foot.
- L. If the outlet becomes clogged it shall be cleaned to restore flow capacity.
- M. Maintenance shall be completed as soon as possible with consideration given to site conditions.
- N. Sediment traps shall be removed and the location stabilized after the disturbed area draining to the sediment trap is stabilized and no longer susceptible to erosion.

3.13 TEMPORARY CONSTRUCTION SITE DIVERSION

- A. Temporary Construction Site Diversions shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1066.
- B. The minimum berm cross section shall have side slopes of 2:1 (horizontal:vertical) or flatter, a minimum top width of two feet and a minimum height of 1.5 feet.
- C. Diversions that are to serve longer than 30 days shall be stabilized as soon as they are constructed.
- D. Diversions shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
- E. Maintenance shall be completed as soon as possible with consideration to site conditions.
- F. Accumulated sediment shall be removed when it reaches one half the height of the diversion berm.
- G. Diversions shall be removed and the area stabilized according to construction contract drawings.

3.14 DUST CONTROL

- A. Dust Control measures shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1068.
- B. Polymers may be used in areas that do not receive vehicle traffic. Dry applied polymers must be initially watered for activation to be effective for dust control. Polymers shall be utilized in accordance with the provisions of WDNR Conservation Practice Standard 1050 Erosion Control Land Application of Polymers.

- C. Tackifiers and Soil Stabilizers Type A – Products must be installed at rates conforming to the WisDOT Erosion Control PAL.
- D. Chlorides shall be applied according to the most recent version of the WisDOT Standard Specifications for Highway and Bridge Construction.
- E. Barriers - Barriers shall be placed at right angles to prevailing wind currents at intervals of about 15 times the barrier height.
- F. Areas that have dust control practices shall at a minimum be inspected daily.

3.15 LAND APPLICATION OF ANIONIC POLYACRYLAMIDE (POLYMERS).

- A. Land Application of Anionic Polyacrylamide (polymers) shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1050.
- B. Application rates shall not exceed manufacturer's written application rate recommendations that shall not exceed the WDNR use restrictions.
- C. Maximum application rates, in parts per million (ppm or mg/L or mg/kg), shall be determined by multiplying 1.4 by the number of pounds applied per acre. This number shall be less than or equal to the WDNR use restriction. Repeated applications of anionic PAM mixtures may be applied, if necessary, to ensure adequate effectiveness.
- D. The application method shall provide uniform coverage to the target area and avoid drift to non-target areas.
- E. When used on bare soil, without seed or mulch, anionic PAM mixtures shall be used on slopes 2.5:1 or flatter.
- F. Anionic PAM mixtures shall not be applied to channel bottoms.
- G. The applicator of anionic PAM mixture shall document, at the time of application, the following: name of applicator, application rate per acre, date applied, product type, weather conditions during application, and method of application. Copies of this documentation shall be entered into the contractor's monitoring log or project diary and made available upon request.
- H. Unused liquid anionic PAM mixtures shall be minimized. Excess material shall not be applied at a rate greater than the maximum application rate. Disposal shall not occur in storm water conveyance systems (i.e., storm sewer manholes, storm sewer inlets, ditches, and culverts).
- I. PAM shall not be used within 30 feet of surface waters of the state.
- J. Maintenance will consist of reapplying anionic PAM mixtures to disturbed areas, including high use traffic areas, which interfere in the performance of this practice.
- K. Anionic PAM mixtures should be reapplied in areas where wind or rill erosion is apparent and whenever an area has been graded, driven upon, or otherwise disturbed since the anionic PAM mixture was last applied.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Erosion and sedimentation controls shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 EROSION AND SEDIMENTATION CONTROLS

- A. Erosion and Sedimentation Controls, Lump Sum. When so provided, payment for erosion and sedimentation controls shall be made at the contract lump sum price bid.
- B. Erosion and Sedimentation Controls, Inclusive. When no quantity is provided, erosion and sedimentation controls shall be considered inclusive to payment for contract work related to the associated construction.

END OF SECTION

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SECTION 31 32 19.13
GEOGRID

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

- A. This work under this section shall consist of furnishing and installing geogrids for subgrade stabilization, base reinforcement, or pavement structure applications in accordance with the contract drawings and specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Subgrade Preparation - Division 31

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. The Contractor shall furnish a manufacturer's Certified Report of Test or Analysis that verifies that the geogrid conforms to this specification. If requested by the Engineer, the Contractor shall deliver a sample of the geogrid material at least 10 days prior to its incorporation into the work.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GEOGRID – RECTANGULAR APPERATURE SHAPE

- A. The geogrid shall consist of either single or joined multiple layers of a uniform rectangular grid of either extruded or formed, polymer tensile strands crossing with a nominal right angle orientation. The polymer shall consist of polyester, polypropylene, polyamide, or polyethylene. The grid shall maintain dimensional stability during handling, placing, and installation. The geogrid shall be insect, rodent, mildew, and rot resistant. Minimum geogrid width shall be 6.0 feet.

- B. The geogrid shall comply with the following physical properties:

<u>Test</u>	<u>Method</u>	<u>Value1</u>
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1 All numerical values represent minimum/maximum average roll values, i.e. the average minimum test results on any roll in a lot should meet or exceed the minimum specified value.

Minimum Rib Thickness (in.)	Measurement	0.03 in.
Tensile Strength at 5% Strain, Both Principal Directions (lb./ft.)	ASTM D 6637	580 min.
Flexural Rigidity Both Principal Directions (mg-cm)	ASTM D 13882	250,000 min.
Aperture Area (sq. in.)	Inside Measurement ³	5.0 max.
Aperture Dimension (in.)	Inside Measurement ³	0.5 min.

- C. The Geogrid shall be protected from ultraviolet radiation and from damage due to shipping and handling. The geogrid shall be kept dry until it is installed. The geogrid rolls shall be clearly marked to identify the material contained.

2.02 GEOGRID – TRIANGULAR APPERTURE SHAPE

- A. The geogrid shall consist of a single layer of a uniform triangular formed or extruded, polymer tensile strands. The polymer shall consist of polyester, polypropylene, polyamide, or polyethylene. The grid shall maintain dimensional stability during handling, placing, and installation. The geogrid shall be insect, rodent, mildew, and rot resistant. Minimum geogrid width shall be 6.0 feet.

- B. The geogrid shall comply with the following physical properties:

- C.

Properties	Longitudinal	Diagonal	Transverse	General
Rib pitch, mm (in)	40 (1.60)	40 (1.60)	-	
Mid-rib depth, mm (in)	-	1.4 (0.06)	1.2 (0.05)	
Mid-rib width, mm (in)	-	1.0 (0.04)	1.1 (0.04)	
Rib shape	-	-	-	rectangular
Aperture shape	-	-	-	triangular

- D. The Geogrid shall be protected from ultraviolet radiation and from damage due to shipping and handling. The geogrid shall be kept dry until it is installed. The geogrid rolls shall be clearly marked to identify the material contained.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prior to placement of the geogrid, the indicated placement surface shall be brought to the required lines, grades, and dimensions as shown on the contract drawings. The surface shall be smoothed and shaped to eliminate any rocks, clods, roots, or other items, which may cause damage to the geogrid during placement or covering. The geogrid shall be placed on the prepared surface at the locations and to the limits as shown on the contract drawings.

2 Values shall be determined by Option "A" (Cantilever Test) of testing method ASTM D1388 using test specimens that are 36 inches ± 0.04 inch long. Test specimen widths for differing geogrids shall be variable and equal to 1 element plus 1/2 the aperture width on both sides of that element. An element is defined as the minimum number of parallel strands, which form a distinguishable repeating pattern.

3 Aperture Area and Aperture Dimension for joined multi-layer geogrids shall be determined based on measurement of a single layer of the geogrid.

- B. After placement, the geogrid shall be pulled taut and shall be secured with pins, clips, staples, or other devices to prevent movement or displacement between overlapping layers. Parallel strips of geogrid shall be placed with a minimum overlap of 6 inches. Butt joints between roll ends shall be lapped a minimum of 12 inches. All lapped sections shall be fastened together by the use of ties, straps, clips, or other devices to develop a secure joint. No vehicles or construction equipment shall be permitted to operate directly on the geogrid until at least 6-inches of material cover the grid.
- C. Small rips, tears, or defects in the geogrid shall be covered with an additional section of geogrid which shall be secured in place so as to overlap the damaged area by at least 3 feet in all directions. Geogrid sections with large rips, tears, defects, or other damage shall be removed and replaced. All costs to repair or replace damaged or defective geogrid shall be the responsibility of the Contractor.
- D. After placement, the geogrid shall be covered with 12 inches of crushed aggregate base course, unless indicated otherwise in the contract drawings or Special Procedures - Division 01. If additional excavation is required, it will be paid as excavation below subgrade. Placing, spreading, and compacting of this material shall comply with the applicable sections of these specifications, except that the initial lift of material placed on the geogrid must be at least 4 inches. Placing, spreading, and compaction operations shall be conducted so that the geogrid is not displaced or damaged.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Geogrid reinforcement shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 GEOGRID

- A. Geogrid, Square Yard. Geogrid reinforcement shall be measured by the square yard of surface area upon which the geogrid has been placed. Geogrid reinforcement measured as provided above shall be paid for at the contract unit price per square yard. This price shall be full compensation for furnishing, transporting, and installing the geogrid; for furnishing and installing all devices and materials necessary to join or secure the geogrid in place; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.
- B. Geogrid, Inclusive. When no quantity is provided, geogrid shall be included in the payment for contract work related to the project.

END OF SECTION

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SECTION 32 11 23
AGGREGATE BASE AND SUBBASE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work covered under this section shall consist of furnishing all material equipment and labor required to construct a dense compacted base course composed of one or more courses or layers of coarse aggregate, fine aggregate and binder or filler blended to produce an intimate mixture of the required gradation and stability, in accordance with Sections 301 and 305 of the State of Wisconsin, Department of Transportation, Standard Specifications. This work shall also consist of a furnishing all material equipment and labor required to place breaker run and select crushed material for this project in accordance with Sections 301, 311 and 312 of the State of Wisconsin, Department of Transportation, Standard Specifications.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Subgrade Preparation - Division 31
- C. Salvage Existing Pavement and Base - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 DENSE GRADED BASE

- A. Materials furnished and used in this work shall consist of coarse and fine aggregate with sufficient binder to produce a stable base for the surfacing. Base materials shall be free from vegetative or organic matter, shale and lumps of clay. Dense graded base shall be crushed stone or crushed gravel conforming to the gradations required in Section 305.2.2.1 of the State of Wisconsin, Department of Transportation, Standard Specifications, unless indicated otherwise in Special Procedures - Division 01 or on the contract drawings.

2.02 BREAKER RUN

- A. Breaker Run shall be used when shown on typical sections or called for in Special Procedures - Division 01. Breaker run shall be free of organic matter, shale and lumps of clay. The material shall comply with Section 311 of the State of Wisconsin, Department of Transportation, Standard Specifications. If the cross section thickness of breaker run is less than 12 inches, the gradation for breaker run shall conform to 3-inch dense graded base as per Section 305.2.2.1 of the State of Wisconsin, Department of Transportation, Standard Specifications.

2.03 SELECT CRUSHED MATERIAL

- A. Select Crushed Material shall be used when shown on typical sections or called for in Special Procedures - Division 01. Select Crushed shall be free of organic matter, shale and lumps of clay. The material shall comply with Section 312 of the State of Wisconsin, Department of Transportation, Standard Specifications.

PART 3 EXECUTION

3.01 DENSE GRADED BASE

- A. Each layer of base shall be compacted over the entire area per Section 301.3 and 305.3 of the State of Wisconsin, Department of Transportation, Standard Specifications.
- B. Each layer shall also be compacted and consolidated to the degree that there will be no appreciable displacement of it laterally or longitudinally under compaction equipment or a fully loaded tandem dump truck.
- C. Where aggregate base is being placed on top of existing gravel, the existing gravel shall be scarified to a depth of three inches prior to placement of additional base.
- D. Aggregate base course beneath and within 10 feet of a structure shall be compacted to 95 percent maximum dry density per modified proctor (ASTM D1557).
- E. The aggregate base shall be graded, shaped and rolled to the finished cross section template shown on the contract drawings and to the satisfaction of the Engineer.

3.02 BREAKER RUN

- A. Each layer of breaker run shall be compacted over the entire area per Section 301.3 and 305.3.2.3 of the State of Wisconsin, Department of Transportation, Standard Specifications.
- B. Each layer shall also be compacted and consolidated to the degree that there will be no appreciable displacement of it laterally or longitudinally under compaction equipment or a fully loaded tandem dump truck.
- C. The breaker run shall be graded, shaped and rolled to the finished cross section template shown on the contract drawings and to the satisfaction of the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Aggregate base course shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 DENSE GRADED BASE

- A. Dense Graded Base, Square Yard. Measurement for dense graded base will be per square yard installed as measured in the field. The dense graded base shall be installed and compacted to the thickness stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per square yard for dense graded base installed and compacted.
- B. Dense Graded Base, Ton. Measurement will be per ton of dense graded base compacted in place. The Contractor shall supply the Engineer with load tickets to verify the amount of material used. Each load shall

have its own load ticket showing weights, truck number, time, date, and placement location. Payment shall be made at the contract unit price bid per ton for dense graded base installed and compacted.

- C. Dense Graded Base, Cubic Yard In Place. Measurement for dense graded base will be per cubic yard installed, computed from the square yards measured in the field multiplied by the compacted thickness stated on the contract drawings or in the Special Procedures – Division 01. Payment will be made at the contract unit price bid per cubic yard in place for dense graded base installed.

4.03 BREAKER RUN

- A. Breaker Run, Square Yard. Measurement for breaker run shall be per square yard installed as measured in the field. The breaker run shall be installed and compacted to the thickness stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per square yard for breaker run installed and compacted.
- B. Breaker Run, Ton. Measurement shall be per ton of breaker run compacted in place. The Contractor shall supply the Engineer with load tickets to verify the amount of material used. Each load shall have its own load ticket showing weights, truck number, time, date, and placement location. Payment shall be made at the contract unit price bid per ton for breaker run installed.
- C. Breaker Run, Cubic Yards. Measurement for breaker run shall be per cubic yard installed as measured in the field. The breaker run shall be installed and compacted to the depth stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per cubic yard for breaker run installed and compacted.

4.04 SELECT CRUSHED MATERIAL

- A. Select Crushed Material, Square Yard. Measurement for select crushed material shall be per square yard installed as measured in the field. The select crushed material shall be installed and compacted to the thickness stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per square yard for select crushed material installed and compacted.
- B. Select Crushed Material, Ton. Measurement shall be per ton of select crushed material compacted in place. The Contractor shall supply the Engineer with load tickets to verify the amount of material used. Each load shall have its own load ticket showing weights, truck number, time, date, and placement location. Payment shall be made at the contract unit price bid per ton for select crushed material installed.
- C. Select Crushed Material, Cubic Yards. Measurement for select crushed material shall be per cubic yard installed as measured in the field. The select crushed material shall be installed and compacted to the depth stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per cubic yard for select crushed material installed and compacted.

END OF SECTION

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SECTION 32 13 10
CONCRETE SIDEWALK, STEPS AND DRIVEWAYS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.
 - 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the concrete sidewalk, driveway and step work for this project.
- B. This work shall be in accordance with Section 602 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as indicated on the contract drawings and specifications.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Concrete Quality Control - Division 01
- C. Maintenance of Existing Conditions - Division 02
- D. Cast-in-Place Concrete - Division 03
- E. Subgrade Preparation - Division 31
- F. Aggregate Base and Subbase - Division 32

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts to relate the materials supplied to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 CONCRETE

- A. Concrete for sidewalk, steps and driveways shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

2.02 BASE MATERIAL

- A. Base material shall be as specified in Aggregate Base and Subbase - Division 32 of these specifications or conform with Section 305 of the State of Wisconsin, Department of Transportation, Standard Specifications.

2.03 DETECTABLE WARNING FIELDS

- A. Detectable warning fields shall be included in the current WisDOT Prequalified Product List.

2.04 CURING COMPOUND

- A. Curing compound shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

PART 3 EXECUTION

3.01 BASE PREPARATION - GRADING

- A. Prepare foundation by excavating to the lines, grades and cross section as required. All soft or unstable material shall be removed and replaced with sand or aggregate base course material compacted to a relative field density of 95%, based on the Modified Proctor Density, ASTM D1557. Proof-roll subbase to check for unstable areas needing additional compaction. Finish to a true and firm surface.
- B. If not listed as a separate bid item, minor clearing and grubbing shall be considered incidental to the respective concrete work.
- C. Disposal locations for all excess or unsuitable excavated material shall be subject to Owner approval.

3.02 BASE MATERIAL

- A. A minimum thickness of 4 inches of compacted aggregate base course or granular subbase course material is required under sidewalks and steps, unless indicated otherwise on the contract drawings or Special Procedures - Division 01.

3.03 SIDEWALK

- A. Sidewalks shall be constructed to a uniform depth of 4 inches except at alleys and driveways where they shall be constructed to a uniform depth of 6 inches unless otherwise noted.
- B. Sidewalks shall slope toward the roadway at 1 foot vertical per 50 feet horizontal (2 percent).
- C. The concrete shall be placed on a moist foundation, deposited to the required depth, and consolidated and spaded sufficiently to bring the mortar to the surface, after which it shall be struck off and finished to a true and even surface.
- D. The final floating shall be done with a wooden float. Before the mortar has set, the surface shall be brushed or lightly broomed, perpendicular to the direction of travel or as shown on the contract drawings. Before the concrete is given the final surface finish, the surface of the walk shall be checked with a ten-foot straightedge, and any areas which show a variation or departure from the testing edge of more than 1/4 inch shall be corrected by adding or removing concrete as necessary while the concrete is still plastic.
- E. Concrete sidewalks may be constructed with suitable, approved slip-form equipment when permitted by the Engineer. The wood floating may be omitted when a suitable finish is produced by the slip-form equipment.
- F. Ramps for individuals with disabilities shall be constructed at the locations and in accordance with the details and dimensions shown on the contract drawings, these specifications and the Americans with Disabilities Act (ADA). Ramps shall include detectable warning fields installed per manufacturer's recommendations.
- G. Where reinforcement is required, it shall conform to and be placed in accordance with the details shown on the contract drawings.

- H. Joints for sidewalks, including transverse joints, longitudinal joints, contraction joints, expansion joints and joint felts and filler materials shall conform to the requirements of Section 602.3.2.5 of the State of Wisconsin, Department of Transportation, Standard Specifications, except as modified herein.
 - 1. Sidewalks shall be divided into sections not less than 3 feet nor more than 12 feet, unless otherwise indicated on the contract drawings. Transverse joints shall be spaced at 6 foot intervals.
 - 2. Prefabricated expansion joint of 1/2-inch thickness shall be placed where steps or sidewalks abut curbs, pavements, steps, or existing sidewalk. Prefabricated expansion joint of 1 inch thickness shall be placed where sidewalk abuts buildings, retaining walls, or other rigid structures. Expansion joints shall be provided on each side of driveways and at uniform intervals of not more than 96 foot centers for sidewalk construction.
 - 3. Extend joint fillers full-width and depth of joint and not less than 1/4-inch or more than 1/2-inch below finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Trim top edge of filler to conform to profile of concrete.

3.04 STEPS

- A. Steps shall be constructed and placed as shown on the contract documents.

3.05 DRIVEWAYS

- A. Driveways shall be constructed to a uniform depth of 6 inches. Driveways shall be constructed to the limits and slope shown on the contract drawings or as staked by the Engineer.

3.06 CURING COMPOUND

- A. Curing compound shall be applied at the recommended coverage requirement and application rate of the manufacturer. The compound shall be applied by sprayer as soon as all free water has disappeared after finishing operations.
- B. If the coating is damaged within 72 hours of its application, the damaged surfaces shall be resprayed immediately.

3.07 ADJUSTING UTILITY APPURTENANCES

- A. Valves and curb stop boxes shall be adjusted to finished grade of new construction in a manner that the new construction will not interfere with the proper operation of the facility. Catch basins, manholes and inlet covers shall be adjusted to the required elevation by adjusting the top of the existing structure by removing or adding adjusting rings and reinstalling the fixtures firmly in place.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Concrete sidewalk, steps and driveways shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CONCRETE SIDEWALK

- A. Concrete Sidewalk, Square Foot. Measurement for concrete sidewalk shall be per square foot of a specific thickness installed. Payment shall be made at the contract unit price bid per square foot of the specific thickness of concrete sidewalk installed.

4.03 STEPS

- A. Steps, Square Foot. Measurement for concrete steps shall be per square foot of tread surface. Payment shall be made at the contract unit price bid per square foot of tread surface.

4.04 DRIVEWAYS

- A. Driveways, Square Foot. Measurement for concrete driveways shall be per square foot of a specific thickness installed. Payment shall be made at the contract unit price bid per square foot of the specific thickness of concrete driveway installed.

4.05 DETECTABLE WARNING FIELDS

- A. Detectable Warning Fields, Square Foot. Detectable warning fields shall be measured and paid per square foot installed.

END OF SECTION

SECTION 32 16 13
CONCRETE CURB AND GUTTER

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
 - 2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing all material, equipment, and labor required to execute the construction of concrete curb and gutter for this project.
- B. This work shall be in accordance with Section 601 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as indicated on the contract drawings and these specifications.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Cast-in-Place Concrete - Division 03
- C. Subgrade Preparation - Division 31
- D. Aggregate Base and Subbase - Division 32
- E. Concrete Sidewalk, Steps, and Driveways - Division 32

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 CONCRETE

- A. Concrete for curb and gutter construction shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

2.02 BASE MATERIAL

- A. Base material for concrete curb and gutter construction shall be as specified in Aggregate Base and Subbase - Division 32 of these specifications.

2.03 CURING COMPOUND

- A. Curing compound for curb and gutter construction shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

PART 3 EXECUTION

3.01 CONCRETE CURB AND GUTTER, GENERAL

- A. All work shall be in accordance with Section 601 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as otherwise indicated on the contract drawings and as specified herein.

3.02 GRADING

- A. Prepare foundation by excavating to the lines, grades and cross section as required.
- B. All soft or unstable material shall be removed and replaced with sand, gravel or crushed stone base course material compacted to a relative density of 95 percent, of the Modified Proctor density, ASTM D1557. Proof-roll subbase to check for unstable areas needing additional compaction. Finish to a true and firm surface.
- C. Dispose of all excess or unsuitable excavated material, subject to Engineer's approval.

3.03 BASE MATERIAL UNDER CURB AND GUTTER

- A. A minimum of 4 inches of compacted aggregate base course material is required under the curb and gutter, unless otherwise indicated on the contract drawings or Special Procedures - Division 01.

3.04 CONCRETE CURB AND GUTTER

- A. This work shall consist of constructing combination curb and gutter of the type shown on the contract drawings and to the line and grade as staked in the field.
- B. Driveway entrances shall be installed where shown on the contract drawings or at any other locations required by the Engineer.
- C. Final brooming shall be done perpendicular to the curb.

3.05 JOINTS

- A. Construct expansion, weakened-plane (contraction), and construction joints with face perpendicular to surface, unless otherwise shown. Construct traverse joints at right angles to curb, unless otherwise shown on the contract drawings or specifically designated in Special Procedures - Division 01.
 - 1. Provide expansion joints on each side of catch basins, inlets, structures, and other fixed objects; abutting to existing curb and gutter; at radius points; and at 300 foot centers, unless otherwise shown.
 - 2. Contraction joints shall be a slot or groove at least 1 inch in depth by 1/4 inch width at 20-foot maximum and 6-foot minimum intervals.
- B. Extend joint fillers full-width and depth of joint, and not less than 3/4 inch or more than 1 inch below finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Trim top edge of filler to conform to profile of concrete.

3.06 CURING COMPOUND

- A. Curing compound shall be applied at the recommended coverage requirement and application rate of the manufacturer. The compound shall be applied by sprayer as soon as all free water has disappeared after finishing operations.
- B. If the coating is damaged within 72 hours of its application, the damaged surfaces shall be resprayed immediately.

3.07 ADJUSTING UTILITY APPURTENANCES

- A. Adjust valve and curb stop boxes to finished grade of new construction in a manner that the new construction will not interfere with the proper operation of the facilities.
- B. Adjust catch basin, manhole and inlet frames and covers to the required elevation by adjusting the top of the existing structure by removing or adding concrete masonry and reinstalling the fixtures, supporting them in a collar of concrete mortar and brick constructed to hold them firmly in place.

3.08 SAWCUTTING

- A. The existing curb and gutter shall be sawcut full-depth, where the existing curb and gutter sections will butt to the new sections.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Concrete curb and gutter shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CONCRETE CURB AND GUTTER

- A. Concrete Curb and Gutter, Lineal Foot. Measurement shall be per lineal foot of concrete curb and gutter installed as measured in the field along the flow line of the gutter. Payment shall be made at the contract unit price bid per lineal foot of concrete curb and gutter installed.

END OF SECTION

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SECTION 32 36 00
SITE FURNISHINGS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
 - 2. State of Wisconsin, Department of Transportation (WDOT), Facilities Development Manual, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall consist of providing all work, materials, labor, equipment and supervision necessary to complete installation of site furnishings and specialty items in accordance with the plans and the specifications, materials in the stated quantities, and install per manufacturer's specifications. The Contractor is responsible for coordinating with the Owner's Representatives to ensure timely delivery of site furnishings to the project site. The Contractor is fully responsible for any assembly and all installation.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Cast-in-Place Concrete - Division 03
- C. Grading - Division 31

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. Submittal Schedule (Product Data and/or Installation Shop Drawing (If applicable)):
 - 1. Bike Rack
 - 2. Circular Picnic Table
 - 3. Drinking Fountain
 - 4. Shade Structure
 - 5. Gateway Feature
 - 6. Memorial Stone
 - 7. Flagpole

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

- A. Where applicable for anchoring, the contractor is to provide grade 316 stainless steel anchor sleeves/shields and tamper-proof bolts for all items in sufficient quantities to secure all furnishings per manufacturer written installation instructions.

2.02 BIKE RACK

- A. Basis of Design Model: 'Orion Circular Bike Rack', Round Tubing
- B. Fabrication: Steel
- C. Finish: Powder coat, 'Patriot Blue'
- D. Manufacturer: Madrax, 1080 Uniek Drive, Waunakee, WI 53597, USA, 1.800.448.7931, www.madrax.com or approved equal.
- E. Mounting: Surface-mount to concrete slab per manufacturer's specifications.
 - 1. Flanges to be installed in such a way so as to avoid placement across concrete control joints.
- F. Location: Install bike racks in the locations shown within the Construction Drawings.
- G. Payment.
 - 1. Owner to furnish, Contractor to Install.
 - 2. All labor, materials, and work and work associated with the installation of the Bike Rack shall be paid for under the unit price bid item "Bike Rack, EA".

2.03 CIRCULAR PICNIC TABLE

- A. Basis of Design Model: 'Carnival Courtyard Table'
 - 1. Dining Height with Vertical Straps and Round Tabletop
 - 2. 4-seat and 3-seat, Backed
- B. Fabrication: Steel
- C. Finish: Powdercoat, 'Patriot Blue'
- D. Manufacturer: Thomas Steele, 1080 Uniek Drive, Waunakee, WI 53597, USA, 1.800.448.7931, www.madrax.com or approved equal.
- E. Mounting: Surface-mount to concrete slab per manufacturer's specifications.
 - 1. Flanges to be installed in such a way so as to avoid placement across concrete control joints.
- F. Location: Install tables in the locations shown within the Construction Drawings.
- G. Payment. N/A. Tables to be furnished and installed by Owner.

2.04 DRINKING FOUNTAIN

- A. Basis of Design Model: '440 SMFA' with Front Approach

- B. Fabrication: Steel
- C. Finish: Stainless Steel Color, Blue
- D. Manufacturer: Most Dependable Fountains, 5705 Commander Dr, Alrington, TN 38002, USA, 901.867.0039, www.mostdependable.com, or approved equal.
- E. Mounting: Mount to concrete slab per manufacturer's specifications.
 - 1. Flanges to be installed in such a way so as to avoid placement across concrete control joints.
- F. Location: Install drinking fountains in the locations shown within the Construction Drawings.
- G. Payment. All labor, materials, and work and work associated with the installation of the Drinking Fountain shall be paid for under the unit price bid item "Drinking Fountain, EA".

2.05 SHADE STRUCTURE

- A. Basis of Design Model: 'Triangle Sail'
 - 1. Size: 15 x 15 x 15
 - 2. Entry Height: 10-feet
- B. Fabrication: UV stabilized high density polyethylene fabric, Steel
- C. Finish: Fabric Shade with Steel Frame, one (1) 'Yellow' shade, two (2) 'Alnet Lime' shades, Powder coated 'Streak Blue' frame.
- D. Manufacturer: Poligon, 4240 136th Avenue, MI 49424, 616.888.3500, www.poligon.com or approved equal.
- E. Installation: Install per manufacturer's specifications.
- F. Location: Install shade structures in the locations and sizes as shown within the Construction Drawings.
- G. Payment. All labor, materials, and work and work associated with the installation of the Shade Structure(s) shall be paid for under the unit price bid item "Shade Structure, EA".

2.06 GATEWAY FEATURE

- A. Basis of Design Model as shown in Construction Drawings.
- B. Fabrication: Aluminum, Faux Brick
- C. Finish: Black, Sandstone Faux Brick with Clear Coat
- D. MSA has previously had discussions with Creative Sign Company, Inc. regarding the design and installation of this feature. Contractor may submit alternative manufacturer for approval prior to bid opening.
 - 1. Creative Sign Company, Inc.
 - a. Product Contact: Sarah Brainard, (920)336-8900 x 1033, sarah@creativesigncompany.com

- E. Installation: Install per manufacturer's specifications. Contractor shall submit shop drawings to engineer/owner for final approval.
- F. Location: Install Gateway Feature in the locations and sizes as shown within the Construction Drawings.
- G. Payment. All labor, materials, and work and work associated with the installation of the Gateway Feature shall be paid for under the unit price bid item "Gateway Feature, LS" under Additive Alternate #1.

2.07 GRANITE MEMORIAL STONE WITH BRONZE PLAQUE

- A. Basis of Design Model as shown in Construction Drawings.
- B. Fabrication: Stone, Bronze Plaque
- C. Finish: Architect/Engineer to select color from manufacturer's standard range. Contractor to purchase and install.
- D. Installation: Install per manufacturer's specifications.
 - 1. Clean and refinish Bronze Plaque as noted in Construction Documents.
 - 2. Confirm foundation requirements shown are adequate.
- E. Location: Install in the location and size as shown within the Construction Drawings.
- F. Payment. All labor, materials, and work and work associated with the installation of the Granite Memorial Stone with Bronze Plaque shall be paid for under the unit price bid item "Granite Memorial Stone with Bronze Plaque, LS".

2.08 FLAGPOLE

- A. Basis of Design Model, or approved equal:
 - 1. Liberty Flag and Specialty Company
 - 2. 30' Height
 - 3. Clear anodized finish (pole and hardware). Include sets of cleat, cleat cover with lock and all required tackle. 6063-T6 aluminum with .125 min. walls or as required to withstand wind loads.
 - 4. <https://liberty-flag.com/products/heavy-duty-flagpoles?variant=44239468986662>
- B. Storage
 - 1. Store flagpole in a secure location on site.
 - 2. Protect the flagpole from damage during storage and installation.
- C. Installation: Install per manufacturer's specifications.
 - 1. Submit manufacturer's installation instructions.
 - 2. Confirm foundation requirements shown are adequate.
 - 3. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.
 - 4. Electrically ground flagpole installation.
 - 5. Install foundation plate and centering wedges.
- D. Location: Install flagpole in the location as shown within the Construction Drawings.
 - 1. Coordinate with the Owner's representative to verify location prior to installation.

2. Ensure vertical alignment and install per manufacturer's recommendations or approved details.
- E. Payment. All labor, materials, and work and work associated with the installation of the flagpole shall be paid for under the unit price bid item "Flagpole, Each".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin prior to completion of final grading. Examine areas and conditions for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance. Notify the Owner's Representative immediately of any unsatisfactory conditions in writing. Proceed with installation only after Unsatisfactory conditions have been corrected.
- B. Construction shall take place in accordance with the contract drawings. Where materials or dimensions on the contract drawings conflict with the text of this specification, the text shall govern.

3.02 INSTALLATION

- A. Provide site furnishings in quantities and locations as indicated in Construction Drawings.
- B. The contractor shall furnish, assemble and install/anchor all site furnishings. Complete field assembly of site furnishings, where required.
- C. Comply with the manufacturer's written installation instructions unless more stringent requirements are indicated.
- D. Place or stake layout of all site furnishings on-site and obtain approval of location, orientation and spacing from an Owner's Representative prior to installation of anchor sleeves or final installation of all site furnishing items.
- E. Unless otherwise indicated, install site furnishings after pavements have fully cured.
- F. Use Grade 316 stainless steel anchor sleeves and tamper proof bolts to secure all site furnishings unless otherwise noted. The contractor is responsible for providing all fastening hardware for all site furnishings.

3.03 CLEANING

- A. After completing site furnishing and specialty items installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Site Furnishing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurements and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 SITE FURNISHINGS

- A. Site Furnishings, Each. Basis for payment shall be per each unit. All costs for furnishing and installing site furnishings, including accessories, shipping, and handling, shall be included in the contract unit price bid for site furnishings.

- B.** Site Furnishings, Lump Sum. When so provided, payment for Site Furnishings shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.

END OF SECTION

SECTION 32 84 23

UNDERGROUND IRRIGATION SYSTEM

GENERAL

1.01 DESCRIPTION OF WORK

- A.** This specification for underground irrigation system work is a "Performance" specification, providing a basis-of-design. The IRRIGATION CONTRACTOR shall assume full responsibility for the design and details of the underground irrigation system to meet the requirements of the State of Wisconsin Commercial Building Code and all local codes and regulations.
- B.** Wherever the terms "approve", "approval" or "approved" are used in the specifications, they shall mean the approval of the LANDSCAPE ARCHITECT, ENGINEER, or OWNER in writing.
- C.** Before submitting a bid, it is the responsibility of the IRRIGATION CONTRACTOR to visit the site and verify all existing conditions affecting the work of this Section. The IRRIGATION CONTRACTOR shall adapt new work to fit all existing conditions and obtain the approval of all government agencies requiring review. Failure to do so will not result in additional payment.
- D.** The IRRIGATION CONTRACTOR is responsible for coordinating all material selection, sizes, joints and connection details as necessary to carry out the intent of the plans and specifications for the work. Proprietary names are being used to call out the kind and quality of materials as a basis of design.
- E.** Supply water shall be the Village water system, with permanent water and electrical service connections to the meter pit and panelboard as shown on the irrigation and plumbing plans.
- F.** IRRIGATION CONTRACTOR is to provide a whole and complete underground irrigation system, ready for test and operation with approval of agencies have authority, as shown and specified. The Work includes, but is not limited to:

 - 1. Design, layout, and calculations for a complete, permanent, automatic underground irrigation system including piping, fittings, sprinkler heads, and accessories;
 - 2. Coordination with GENERAL CONTRACTOR, OWNER, VILLAGE ENGINEER, and all other stakeholders to provide phased installation of a fully operational irrigation system;
 - 3. Connecting to a permanent water and electrical source at the proposed panelboard and meter pit
 - 4. Controller and sensors;
 - 5. Sleeves (By GC, IRRIGATION CONTRACTOR to coordinate);
 - 6. Valves, fittings, and valve boxes;
 - 7. Irrigation heads, designed with overlapping head to head coverage;
 - 8. If required - 3-phase Pump, motor control, wiring;
 - 9. Controller field wiring;
 - 10. Testing;
 - 11. Excavation, trenching, and backfilling all associated irrigation system work;
 - 12. First year winterization

13. Second year spring start-up and winterization.
 14. Provide OWNER with Operation/Maintenance Manual and Instructions;
 15. Provide OWNER with Record Drawings/As-built Drawings at project completion.
- G. The work under this contract shall include final material sizing and distribution layout. The layout shall be submitted to the LANDSCAPE ARCHITECT or ENGINEER for approval. Pump(s), controls, and wiring shall be incidental to this contract. The IRRIGATION CONTRACTOR shall base the design and bid on the following:
1. Municipal Water System as supply:
 - a. Municipal Water System static supply pressure is ~63 psi at the water main.
 - b. Irrigation System Supply:
 - 1) Pressure at connection to plumbing system is ~ 59 psi. with anticipated losses due to back flow prevention, meters, fittings, etc.
 - 2) CONTRACTOR to provide design for maximum system flow of 45 GPM.
 - c. If system design requires, IRRIGATION CONTRACTOR to provide a 240V single phase Booster Pump system adequate to supply zone distribution break down of irrigation system as designed.
 2. The IRRIGATION CONTRACTOR shall calculate and estimate residual pressure for the water service, plumbing system supplying the irrigation system and at the zone distribution valve(s) located in the irrigation vaults. The plumbing system will provide a connection and supply to the irrigation system as shown in the drawings. The irrigation system shall be sized and assembled based on water supply.
- H. The work under this contract shall include coordination of the construction schedule.
- I. System shall be designed to operate and survive the Wisconsin climate. The system shall be installed to automatically drain –OR- to be winterized utilizing standard blow-outs and compressed air connections.
- J. A responsive and qualified local IRRIGATION CONTRACTOR shall provide lump sum cost for design, supply, and installation of an automatic underground irrigation system to spaces shown on the plans.

1.02 RELATED WORK ELSEWHERE

- A. Reduced pressure backflow preventer.
- B. If required - Irrigation pump, pump starter and related items furnished and installed provided by the IRRIGATION CONTRACTOR. All work shall be provided by qualified and licensed CONTRACTOR.
- C. Irrigation Controller shall be furnished by the IRRIGATION CONTRACTOR and connected by the ELECTRICAL CONTRACTOR. Connections and wiring to field valves by IRRIGATION CONTRACTOR. All other wiring shall be by provided by a qualified and licensed Electrician.
- D. Associated interior plumbing and accessories to complete the system.
- E. Pipe sleeves for irrigation piping and wiring under walks and drives provided and installed by the GENERAL CONTRACTOR. IRRIGATION CONTRACTOR to coordinate and verify.

F. Contracting Documents and Requirements (All Sections)

G. All Drawings

1.03 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.04 APPLICABLE PUBLICATIONS

A. ASTM Standards

1.05 QUALITY ASSURANCE

A. Qualification of Installer:

1. Company specializing in performing the work of this section with minimum (5) five years documented experience.
2. In acceptance or rejection of installed work, the LANDSCAPE ARCHITECT or ENGINEER shall make no allowances for lack of skill on part of the installers.
3. Use adequate quantity of skilled, trained workers experienced in the necessary crafts and familiar with the specified requirements and methods required to properly complete the work of this Section.
4. All work shall be installed in a professional manner by a State of Wisconsin licensed CONTRACTOR.

B. Qualification of Manufacturer:

1. Company specializing in manufacturing products specified in this section with a minimum of 10 years' experience. Manufacturer shall conform to the ratings and certifications indicated.

C. Drawings and General Provisions of Contract, including Bidding Requirements, General and Supplementary Conditions, and Division 1 Specification sections, apply to Work specified in this Section.

D. Materials, equipment, and methods of installation shall comply with the following codes and standards:

1. National Fire Protection Association (NFPA): National Electrical Code.
2. National Sanitation Foundation (NSF).
3. The Irrigation Association (IA).
4. Excavating, Backfilling, and Compacting Operations: Comply with project Earthwork requirements, and as specified.

E. The IRRIGATION CONTRACTOR shall coordinate with the turf and Landscape CONTRACTORS in ensure adequate irrigation of all turf and plant material when needed after installation.

1.06 COORDINATION

A. Cooperate and coordinate with other trades to ensure that work may be installed in the best arrangement. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

- B. Arrange work in a neat, well-organized manner, with piping and similar services running parallel with primary lines of construction.
- C. Locate equipment properly to provide easy access and arrange entire plumbing work with adequate access for operation and maintenance.
- D. Give right-of-way to piping which must slope for drainage.

1.07 SUBMITTALS

- A. Submit detailed plans indicating water supply location and size, piping layout and size, sprinkler locations and type, equipment locations and type, valve locations and type, hydraulic reference points, design areas, and discharge densities.
- B. Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet and detailed work sheets. Describe characteristics of water supply and location of effective point used in calculations. Include graph illustration of water supply and sprinkler demand.
- C. Submit shop drawings for all equipment, components, and systems as indicated in the specification. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
- D. Include with any diagrams of electrically powered equipment.
 1. Shop drawings shall include, but are not limited to, the following items and equipment
 - a. Piping materials
 - b. Valves
 - c. Flow switch
 - d. Sprinkler heads
 - e. Pump(s) (if required)
 2. All shop drawings, product data and samples submitted by the CONTRACTOR shall illustrate details of work, equipment, materials, products, systems, designs or workmanship that the CONTRACTOR intends to use in order to comply with the design concept established in the Contract Documents. Review of these submittals by the AE or its representative is only for the limited purpose of checking the same for conformity with the design concept of the work as established in the Contract Documents, and is not intended to be for the purpose of determining the accuracy of other matters that may be contained in such submittals, including but not limited to such matters as dimensions, quantities, performance of equipment and systems designed by the CONTRACTOR, CONTRACTOR-furnished engineering and design, construction means, methods, techniques, sequences, procedures or safety precautions, the correctness of which as set forth in the Contract Documents or submittal, shall be the sole responsibility of the CONTRACTOR.
 3. It is the CONTRACTOR's obligation to flag all deviations from specified items on shop drawing submittals. Approval of shop drawings without noted deviations will not be considered acceptance of the deviation.

1.08 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
 - 1. Copies of all approved submittals along with approval letters.
 - 2. Manufacturer's wiring diagrams for electrically powered equipment.
 - 3. Records of tests performed to certify compliance with system requirements.
 - 4. Certificates of inspection by regulatory agencies.
 - 5. Part lists for manufactured equipment.
 - 6. Manufacturer's installation, operation and maintenance recommendations for manufacturer equipment.
 - 7. Valve schedules.
 - 8. Lubrication instructions, including list/frequency of lubrication.
 - 9. Warranties.
 - 10. Additional information as indicated in the technical specification sections.
- B. Provide (2) two hard copies and (1) one digital copy.

1.09 AS-BUILT/RECORD DRAWINGS

- A. As installation occurs the IRRIGATION CONTRACTOR shall create and update an as-built drawing displaying deviations from the bid documents that occur during construction. These include but are not limited to final locations of main line pipe, lateral pipe, controller locations, remote control valves, quick-coupling valves and all sprinkler heads. The drawings shall also indicate and show approved substitutions of size, material and manufacturer's name and catalog name number. The drawings shall be delivered to the Owner as Record Drawings before final acceptance of work.
- B. Provide (1) hardcopy and (1) digital format.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Receive, sign for and store all equipment in this section.
- B. Maintain original quality and condition of equipment while it is in storage.

1.11 WARRANTY AND MAINTENANCE

- A. Standard one year guarantee shall include:
 - 1. Filling and repairing depressions and replacing plantings due to settlement of irrigation trenches.
 - 2. Adjusting system to supply proper coverage of areas to receive water.
 - 3. Ensuring system can be adequately drained.
 - 4. Maintenance Service
 - a. Drain entire system at end of first watering season following installation.
 - 1) Train Owner's designated personnel by having them assist in the winterizing procedure.
 - b. Start-up system beginning of first full watering season to readjust and repair any winter damage.
 - 1) Train Owner's designated personnel by having them assist in the start-up procedure.
- B. The manufacturer shall warrant the booster pump to be free of defects for one year from date of start-up.

1.12 SPARE PARTS

- A. Provide:
 - 1. (3) Three extra sprinkler heads of each size and type.
 - 2. (1) One extra valve of each size.
 - 3. (1) One extra valve access box.
 - 4. (1) One quick coupler valve key for every three quick coupler valves. Provide a minimum of (2) two keys.
 - 5. (2) Two keys to controller box.
 - 6. (2) Two valve box cover keys.
 - 7. (2) Two quick coupler keys with brass hose swivel.

PRODUCTS AND MATERIALS

1.13 GENERAL

- A. All materials throughout the system shall be new and in perfect condition. After award of the contract and prior to beginning work, the IRRIGATION CONTRACTOR (CONTRACTOR) shall submit for approval the complete list of materials which he proposes to install. Quantities of materials and equipment need not be included. No deviations from the specifications shall be allowed without approval.
- B. All Equipment or Materials being submitted as "Equal" shall be approved by the Engineer (5) five days before the bid date.

1.14 DESIGN

- A. System design and layout shall be by a qualified expert irrigation system designer with more than 5 years' experience.

1.15 MATERIALS

- A. Furnish all materials, labor, and equipment necessary to supply and install the irrigation system.

1.16 BEDDING, GRAVEL PACK, AND BACKFILL

- A. Rock-Free Soil – soil shall contain no rocks larger than ¼-inch in any dimension.
- B. Sand – fine granular material naturally produced bed rock disintegration and free form organic material, mica, loam, clay, and deleterious substances.
- C. Pea Gravel – Pea gravel is to be used around drains, valves and quick couplers and is to be 0.5-inch maximum round, water worn, washed rock.
- D. Topsoil – Existing in-place topsoil material. Remove rocks, roots, sticks, clods, debris and other foreign matter over 1.5-inches longest dimension encountered during trenching.
- E. Coordinate with Division 31, 32, & 33 as required.

1.17 MIXES

- A. Concrete for Thrust Blocks

1. One c.f. cement, 2 c.f. sand, 4 c.f. gravel, and 5-6 gallons water.
2. Mix completely before placing.

1.18 PIPING

- A. All buried main line and lateral pipes 3 inches and smaller shall be SDR 21 or SDR 26, Type 1120-1220 polyvinyl chloride (PVC) pipe and shall conform to ASTM D2241. Solvent cement shall be compatible with PVC pipe and of proper consistency.
- B. All exposed materials, pipe, fittings, valves, riser stems, and specialties shall be stainless steel brass, bronze, or copper. Exposed refers to anything that is not completely buried. Partially buried items will be considered exposed.
- C. Pipe, Pipe Fittings and Connections – During delivery, installation and storage materials are to be protected from damage and prolonged exposure to sunlight.
 1. Pipe shall be continuously and permanently marked with manufacturer's name, size, schedule, type and working pressure.
 2. Pipe sizes shown on Drawings are minimum. Larger sizes may be substituted without additional cost to Owner.
 3. Pipe – (or as scheduled on the Drawings)
 - a. Pressure lines – rigid PVC type 1-SDR26 (class 160) conforming to ASTM D2241.
 - b. Lateral lines – rigid PVC type 1-SDR26 (class 160) conforming to ASTM D2241.
 - c. Backflow Assembly Piping – Red brass.
 - d. Quick Coupler Piping shall be PVC swing joint fitting.
 - e. Fittings – Schedule 40 PVC, except where specified otherwise.

1.19 SLEEVES FOR PIPES

- A. Sleeves – Sleeves placed under parking areas and driveways for pipes should use a minimum Schedule 40 PVC pipe. Sleeves in all other areas should use a minimum Class 200 PVC pipe. All sleeve diameters shall be a minimum of two times larger than pipe installed in sleeve.

1.20 SLEEVES FOR CONTROL WIRES

- A. Sleeves – Sleeves placed under parking areas and driveways for control wires should use PVC 1220-160 psi plastic pipe or galvanized heavy wall steel conduit.

1.21 FITTINGS

- A. Plastic fittings shall be Schedule 40, PVC standard weight as manufactured by Sloane, Lasco or approved equal.
- B. All exposed materials, pipe, fittings, valves, riser stems, and specialties shall be stainless steel brass, bronze, or copper. Exposed refers to anything that is not completely buried. Partially buried items will be considered exposed.

1.22 UNIONS AND FLANGES

- A. Unions, flanges and gasket materials shall have a pressure rating of not less than 175 psig.

1.23 GENERAL PROCESS VALVES

- A. Valves shall be manufactured by Kennedy, Milwaukee, Nibco, Stockham, Viking, ITT Grinnell, or equal, and must be approved and listed by UL or FM if applicable.

1.24 PRESSURE GAUGES

- A. Pressure gauges shall be located upstream and downstream of the pump for easy reading of the intake and discharge pressure. Pressure gauges shall be 304 stainless steel case and bezel construction. Gauges shall be 2-1/2" diameter, liquid filled. Pressure sensing connection shall be 1/4" NPT lower gauge connection.

1.25 SPRINKLER/IRRIGATION SYSTEM AND COMPONENTS

- A. Manufacturer
 - 1. Systems shall be constructed with like-components from a single manufacturer.
 - 2. Pre-approved manufacturers include:
 - a. Hunter Industries, Toro, or Rain Bird
 - b. Equal shall be approved (5) five days prior to the bid opening.
- B. Sprinkler Heads, Nozzles, Spray Heads, Rotors, MP Rotors, Spray Bodies, Bubblers, Root Devices, Drip Assemblies, etc.
 - 1. Each type of head shall be the product of an approved manufacturer and conform to requirements shown on approved detailed irrigation plan as to type, size, radius of throw, pressure and discharge.
 - 2. Shall be pop-up styles.
 - 3. Spray and wetting pattern shall be selected for each location.
- C. Sprinkler Head Risers
 - 1. Sprinkler heads shall have risers made up one of the following ways:
 - a. CONTRACTOR shall use Schedule 40 Stainless pipe, Copper, or Schedule 80 PVC for risers. Pipe shall be cut in a standard pipe cutting tool with sharp cutters. Ream only to full diameter of pipe and clean all rough edges or burrs. Cut all threads accurately with sharp dies. Not more than three full threads shall show beyond fittings when pipe is constructed.
 - b. Manufactured swing pipe with spiral barb fittings
 - c. Manufactured flexible pipe connection
- D. Leaky Pipe
 - 1. Leaky pipe and fittings shall be Techline or provided by an approved manufacturer.
 - 2. Leaky pipe shall be stapled. Install staple every 4-inch and two at each elbow, tee and cross.
 - 3. Leaky pipe control valve shall be provided with "Y" strainer filter.
 - 4. Leaky pipe valve boxes for control valve, disk filter and pressure regulator shall be a 12L x 18W x 12H-inch rectangular box.
- E. Remote Control Valves
 - 1. Remote control valves shall be by an approved manufacturer. Valves shall be either Brass Series, brass diaphragm valve, or Plastic body, or approved equal. Electrically activated remote control valve(s) shall be of brass construction with stainless steel trim, normally closed with manual bleed plug and manual flow control (cross handle on 1-1/2 inch and 2-inch models; screwdriver adjustment on 1-inch model).

- F. Quick Couplings
 - 1. Shall be provided on main line and at zone control valve stations.
- G. Flushing Stations
 - 1. Shall be provided on all dead-end and loops for O&M and winterizing.
- H. Valve Boxes
 - 1. Shall be concealed and sized for appertences to be concealed and accessed.

1.26 BACKFLOW PREVENTION DEVICE

- A. A backflow prevention device must be installed in accordance with State and Local plumbing codes to protect all potable water.
- B. Backflow prevention device to be furnished and installed by GENERAL CONTRACTOR.
- C. Install in landscape beds as shown on the Contract Drawings.

1.27 IDENTIFICATION

- A. Valve Tags: Identify each valve in the system with round brass tags with 1/2-inch numbers, 1/4-inch system identification abbreviation, 1-1/4-inch minimum diameter with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company or W.H. Brady.
- B. Chart: Furnish three (3) charts, listing all valves, giving them locations in the building and their function in the system. One (1) chart with glass cover and neat frame; two (2) charts without frames to be delivered to the AE. Provide electronic copies to the owner.

1.28 TRACER WIRE

- A. All underground piping and irrigation system elements must be installed with tracer wire.
- B. For direct burial installations, tracer wire shall be No. 12 gauge, ASTM D 1248, solid insulated copper wire rated for wet conditions.

1.29 DISTRIBUTION VALVE VAULTS

- A. Valve Vault shall be by QUAZITE, or approved equal.
 - 1. Open Bottom
 - 2. Includes CA (Standard) Cover w/2 bolts
 - 3. Precast Polymer Concrete Pull Box
 - 4. 24L x 36W x 24H-inch minimum
- B. Sizes provided are approximate, the CONTRACTOR shall adjust and select final size. Box size shall provide reasonable room for an organized and accessible installation of materials to be protected by the box.

1.30 AUTOMATIC CONTROLLERS

- A. AC Powered Automatic Controller (Standard) with battery for temporary installation.
 - 1. A Modular Controller shall be selected by the irrigation system designer.
 - a. Controller shall be manufactured by Hunter Industries, Rain Bird, Toro or approved equal.

2. Controller Selection should consider/provide the following:
 - a. Installation location (interior or exterior)
 - b. Enclosure Type
 - c. Central Control Compatible
 - d. Input electrical requirements
 - e. Output signal and control output (Valve Wire Options)
 - f. (2) two Pump/Master Valve Outputs
 - g. Proposed zones and ultimate future zones that will be controlled.
 - 1) Minimum (48) forty-eight zones
 - h. Maximum zone run time
 - i. Minimum of (8) eight start times per program
 - j. Minimum of (4) four programs
 - k. Sensor compatibility: Rain, moisture ET, Weather, Flow, etc.
 - l. Solar Compatibility
3. Rated for Commercial applications
4. Warranty: Three years.

1.31 SENSORS AND DEVICES

- A. Soil Moisture Sensor (Required)
 1. A soil moisture sensor shall be supplied and the controller mounted within the enclosure by the manufacturer prior to shipment.
 2. The soil moisture sensor shall be compatible with the irrigation system controller.
 3. The soil moisture sensor shall include all accessories and appurtenances necessary to be a complete and operable system.
- B. Rain Sensor (Required)
 1. A rain sensor shall be supplied, and the controller mounted within the enclosure by the manufacturer prior to shipment.
 2. The rain sensor shall be compatible with the irrigation system controller.
 3. The rain sensor shall include all accessories and appurtenances necessary to be a complete and operable system.
- C. Evapotranspiration (ET) Station (Future)
 1. CONTRACTOR shall provide all accommodation necessary for future installation of an ET station by Owner.

1.32 BOOSTER PUMP(S)

- A. If required - Booster Pump(s) shall be installed in a place suitable to the Owner. The booster pump shall be manufactured by Berkeley, Grundfos, Pentair, or approved equal.

1.33 ELECTRICAL

- A. Refer and comply with Division 26.
- B. Control Wires
 1. Control wires shall be 120VAC or 24-volt solid wire U.L. approved for direct burial in ground. Minimum wire size, 14 gauge. Wire size shall be selected based on application, distance, and load.
 2. Provide WP plug connector between controller and control valve.

3. Control wire shall be UF-UL listed, color coded copper conductor direct burial size 12 or PE insulated 14 AWG color coded wire. Do not use green color-coded wire.
 4. Polyethylene jacketed 18-gauge multi-strand control wire approved for irrigation.
 5. Waterproof wire connectors acceptable products and manufacturers.
 - a. DBY or DBR by 3M
- C. Conduit for Control Wires
1. Conduit for control wires, where indicated on drawings or determined necessary, shall be Schedule 40 or galvanized heavy wall steel conduit.
 2. Shall comply with NEC.
 3. Sleeves: Refer to 2.08 Sleeves for control wires.

CONSTRUCTION METHODS

1.34 GENERAL

- A. CONTRACTOR shall obtain all permits required by governmental agencies having jurisdiction over the work. Inspections required by local ordinances during construction shall be arranged as required by CONTRACTOR. On completion of the work, satisfactory evidence shall be furnished to the ENGINEER to show that all work has been installed in accordance with the ordinances and code requirements.
- B. Before any work commences, a conference shall be held between the GENERAL CONTRACTOR, IRRIGATION CONTRACTOR, and the OWNER concerning the work under this contract.
- C. IRRIGATION CONTRACTOR shall coordinate and cooperate with all other CONTRACTORS to enable the work to proceed as rapidly and efficiently as possible.
- D. IRRIGATION CONTRACTOR shall layout work as accurately as possible to the drawings. The drawings are diagrammatic in nature, to the extent that swing joints, offsets and all individual fittings are not shown.
- E. The IRRIGATION CONTRACTOR shall be responsible for full and complete coverage of all irrigated areas with head-to-head overlapping coverage and shall make any necessary minor adjustments at no additional cost to the Owner.
- F. Any major revisions to the irrigation system must be submitted and answered in written form, along with any change in contract price.
- G. Within (10) ten days after award of the contract, the CONTRACTOR shall submit to the Owner a work schedule.

1.35 SITE INSPECTION AND PREPARATION

- A. IRRIGATION CONTRACTOR shall acquaint themselves with all site conditions. Should utilities not shown on the contract drawings be found during excavations, CONTRACTOR shall promptly notify the Owner for instructions on further action. Failure to do so will make the CONTRACTOR liable for all damage arising from his operations after discovery of such utilities not shown in contract drawings.

- B. IRRIGATION CONTRACTOR shall make necessary adjustments in the layout as required to connect to existing stub-outs, should such stubs not be located exactly as shown, and as may be required to work around existing work at no increase in cost to the Owner.
- C. Site verification of Conditions – GENERAL CONTRACTOR or IRRIGATION CONTRACTOR must perform a pressure test at stub-out on main water line provided for irrigation system or at nearby fire hydrant. Notify Engineer if pressures over 70 psi or under 40 psi are found to determine if system design adjustments are necessary before beginning work on system.
- D. Protection - Repair or replacement of work of this Section damaged during course of the work should be performed by the CONTRACTOR at no additional cost to Owner. If damaged work is new, repair or replacement shall be performed by the installer of original work.
- E. Roots - Do not cut existing tree roots measuring over 2-inches in diameter to install sprinkler lines.
- F. Layout of Irrigation Heads – Location of heads and piping shown on drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc. During layout, consult with Architect to verify proper placement and make recommendations where revisions are advisable. Minor adjustments in the system layout will be permitted to avoid existing fixed obstructions. CONTRACTOR must make certain changes are documented on record drawings

1.36 PROTECTION OF EXISTING PLANTS AND SITE CONDITIONS

- A. The IRRIGATION CONTRACTOR shall take necessary precautions to protect existing site conditions. Should damage occur, the IRRIGATION CONTRACTOR shall repair the damage to its original condition at his own expense.

1.37 EXCAVATION AND TRENCHING

- A. Perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins. Restore all surfaces, existing underground installations, etc., damaged, or cut because of excavation, to their original condition and in a manner approved by the OWNER.
- B. Trenches shall be made wide enough to allow a minimum of 6-inches between parallel pipelines. Trenches for pipelines shall be made of sufficient depths to provide the minimum cover from finish grade as follows:
 1. 18-inch minimum cover over main lines;
 2. 12-inch minimum cover over control wires from controller to valves;
 3. 12-inch minimum cover over lateral lines to heads.
- C. Maintain all warning signs, shoring, barricades, flares, and red lanterns as required by the Safety Orders of the Division of Industrial Safety and any local ordinances.

1.38 BACKFILL AND COMPACTING

- A. After the system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of rubbish.

- B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 90% density of Standard Proctor density.
- C. Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.
- D. Topdress soil in all areas to raise grade to finish elevations.

1.39 PIPELINE ASSEMBLY

- A. Install remote control valves where shown, and group together where practical; place no valves closer than 12-inches to walk edges, buildings, and walls.
- B. Plastic pipe and fittings shall be solvent welded using solvents and methods as recommended by the manufacturer of the pipe, except where screwed connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.
- C. Pipe may be assembled and welded on the surface. Snake pipe from side to side of trench bottom to allow for expansion and contraction.
- D. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.
- E. Install pipe in manner to provide for expansion and contraction as recommended by manufacturer.
- F. Unless otherwise indicated in drawings, install main lines and lateral lines connecting pop-up, rotor and impact sprinklers with minimum cover of 18-inches based on finished grade. Install remaining lateral lines with minimum of 12 inches of cover based on finished grade.
- G. Install pipe and wires under driveways or parking areas in specified sleeves at a minimum of 24-inches below finish grade or as shown on drawings.
- H. Heads immediately adjacent to mowstrips, walks or curbs shall be one inch below top of mowstrip, walk or curb and have 1 to 3-inches clearance between head and mowstrip, walk or curb.
- I. Cut plastic pipe square. Remove burrs at cut ends before installation so an unobstructed flow will result.
- J. Make solvent weld joints as follows:
 1. Do not make solvent weld joints if ambient temperature is below 40-degrees Fahrenheit.
 2. Clean mating pipe and fitting with clean, dry cloth and apply one coat of P-70 primer to each connection.
 3. Apply uniform coat of 711 solvent to outside of pipe then apply solvent to fitting in similar manner.
 4. Re-apply a light coat of solvent to pipe and quickly insert into fitting.
 5. Give pipe or fitting a quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
 6. Hold in position for 15-seconds minimum or long enough to secure joint.

7. Wipe off solvent appearing at outer shoulder of fitting. Do not use excessive amount of solvent thereby causing obstruction to form on inside of pipe
 8. Allow joints to set at least 24-hours before applying pressure to PVC pipe.
 9. Tape threaded connections with Teflon tape.
- K. If pipe is larger than 2-inches, install concrete thrust blocks wherever change of direction occurs on PVC main pressure lines, unless otherwise detailed on drawings.

1.40 INTAKE AND DISCHARGE DROP PIPES

- A. The inlet and discharge piping system will be attached to dual 90-degree drop pipes to provide below grade connection to a suction pipe or municipal water supply pipe or below grade connection to a discharge main line. Drop pipe sizes, connection fitting style, and depth of bury will be shown on the project drawings.

1.41 SPRINKLER HEADS

- A. Use pipe joint compound on all fittings.
- B. Before installation of sprinkler heads, open control valves and use full head of water to flush out system.
- C. Set sprinkler heads and quick-coupling valves perpendicular to finish grade. Do not install sprinklers using side inlets. Install using base inlets only, unless approved otherwise in writing by LANDSCAPE ARCHITECT.
- D. Set sprinkler heads at a consistent distance from existing walks, curbs and other paved areas and to grade.

1.42 VALVES

- A. Arrange valve stations to operate in an easy-to-view progressive sequence around building and site.
- B. Tag valves with waterproof labels showing final sequence station assignments.

1.43 TRACER WIRE

- A. Tracer wire shall be installed in conjunction with all main line and laterals and installed continuously to the greatest extent possible and in accordance with the contract drawings and the requirements of the Engineer.
- B. 18-inches of extra wire shall be provided at all terminations.
- C. Splices in the wire shall be held to a minimum. Where splices are necessary, they shall be made with underground rated mechanical wire connectors or by twisting the wires a minimum of 4-times and soldering, then wrapping with two layers of polyethylene tape to 6-inches beyond the stripped wire. Splicing with wire nuts shall not be allowed.

1.44 BACKFLOW PROTECTION

- A. Notify and coordinate with ENGINEER prior to installation.

- B. Install 24-inches minimum from structures or hardscaping. When installed adjacent to any structure, mount test cocks on the side away from structure.
- C. In outside installations, plumbing unions are to be used before and after the backflow protection for removal or maintenance of backflow unit.

1.45 CONTROL VALVES AND CONTROLLERS

- A. Install controller, control wires and valves in accordance with manufacturer's recommendations and according to electrical code.
- B. Install valves in plastic boxes with reinforced heavy duty plastic covers. Locate valve boxes within 12-inches of sidewalks and shrub bed edges with tops at finish grade.
- C. Place 6-inches minimum of pea gravel below bricks supporting valve boxes to drain box and extend pea gravel 3-inches minimum beyond limits of valve box and maintain 4-inches minimum between bottom of valve and top of pea gravel. Set valve boxes over valve so all parts of valve can be reached for service.
- D. Set cover of valve box even with finish grade.
- E. Valve box cavity shall be reasonably free from dirt and debris.
- F. Install 1-inch brass ball valve in valve box on downstream side of main line after pipe exits building and before quick coupler.

1.46 AUTOMATIC CONTROLLERS

- A. Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.

1.47 BOOSTER PUMP

- A. If Required - Booster pump shall be installed in a place suitable to the Owner. IRRIGATION CONTRACTOR to coordinate with PLUMBING and ELECTRICAL CONTRACTOR.

1.48 NATIONAL ELECTRICAL CODE STANDARDS

- A. Electrical controls shall conform to National Electrical Code Standards.
- B. Any electrical installation beyond irrigation control shall be performed by a State of Wisconsin Licensed Master Electrician.

1.49 AUTOMATIC CONTROL WIRING

- A. Install control wires, sprinkler mains and laterals in common trenches wherever possible.
- B. Install control wires at least 18 inches below finish grade and lay to the side and below main line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at 10-foot intervals.
- C. Control wire splices will be allowed only on runs greater than 500 feet. Connections shall be as detailed.

- D. All wire passing under existing or future paving, construction, etc., shall be encased in plastic or galvanized steel conduit extending at least 12-inches beyond edges of paving or construction.
- E. Use waterproof wire connectors at splices and locate all splices within valve boxes.
- F. Use white for common wire and other colors for all wire. Each common wire may serve only one controller

1.50 LEAKY PIPE

- A. Install control valves in accordance with manufacturer's recommendations for installation. Only one valve shall be installed per valve box.
- B. Leaky pipe lateral lines begin after valve assembly and shall be installed in accordance with irrigation design. Tape all open ends during installation to keep debris out of pipe.
- C. Install leaky pipe on top of grade before mulching. Install at even spacing with a maximum of 3-feet on center and a minimum of 2-feet on center. Install staples at 4-foot intervals and at all curves to hold in place. Work leaky pipe around all plants and avoid any kinks in pipe during installation

1.51 CLOSING OF PIPE AND FLUSHING LINES

- A. Cap or plug all openings as soon as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
- B. Thoroughly flush out all water lines before installing heads, valves, and other hydrants.
- C. Test in accordance with paragraph on Hydrostatic tests.
- D. Upon completion of the testing, the IRRIGATION CONTRACTOR shall complete assembly and adjust sprinkler heads for proper distribution.

1.52 ADJUSTING

- A. Adjust heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering or raising of head shall be part of the original contract with no additional cost to Owner.
- B. Adjust sprinkler heads for proper distribution and trim so spray does not fall on buildings and minimize spraying over walks and pavement.
- C. Adjust the watering time of valves to provide proper amounts of water to all plants.
- D. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
- E. Perform system testing upon completion of each section. Make necessary repairs and re-test repaired sections as required.

- F. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
- G. Tighten nozzles on spray type sprinklers after installation.
- H. Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.
- I. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.

1.53 SITE CLEANUP

- A. Remove all debris created during the work of this section from the site.

1.54 HYDROSTATIC TESTS

- A. Request the presence of the OWNER in writing at least 48 hours in advance of testing.
- B. Testing to be accomplished at the expense of the IRRIGATION CONTRACTOR and in the presence of the OWNER.
- C. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
- D. Apply a continuous and static water pressure of 60 psi when welded plastic joints have cured at least 24 hours and with the risers capped as follows:
 1. Main lines and submains to be tested for 12-hours;
 2. Lateral lines to be tested for 2-hours.
- E. Repair leaks resulting from tests.

1.55 START-UP AND OWNER TRAINING

- A. The irrigation system shall be commissioned and started up by a qualified representative.
- B. The work under this contract shall include (3) three trips to cover the IRRIGATION CONTRACTOR:
 1. Performing the initial start-up;
 2. Trouble shooting;
 3. Owner training.
- C. The work under this contract shall include (1) one trip at the end of the first season to cover the IRRIGATION CONTRACTOR:
 1. Draining all water from the system and blowing out the system with compressed air in the fall for the winterization;
 2. Owner training.
- D. The work under this contract shall include (2) two trips during the one-year guarantee period to cover the IRRIGATION CONTRACTOR:
 1. Draining all water from the system and blowing out the system with compressed air in the fall for the winterization;

2. Starting up the irrigation system into operation in the spring.

E. The IRRIGATION CONTRACTOR shall demonstrate to the OWNER the proper procedures for the system start-up, operation, and maintenance at no additional cost to the Owner.

1.56 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. The IRRIGATION CONTRACTOR shall provide as-built record drawings as described in Part 1 of these specifications.

1.57 AS-BUILT/RECORD DRAWINGS

A. The IRRIGATION CONTRACTOR shall provide as-built record drawings as described in Part 1 of these specifications.

1.58 ACCEPTANCE

A. The OWNER reserves the right to reject material or work which does not conform to the Contract Documents. Rejected work shall be removed or corrected at the earliest possible time.

B. Final acceptance of work may be obtained from the OWNER upon the satisfactory completion of all work.

1.59 GUARANTEE

A. The IRRIGATION CONTRACTOR shall guarantee all work for (1) one full irrigation season following acceptance against all defects in material, equipment, and workmanship.

B. The guarantee shall also cover repair of damage to any part of the premises resulting from leaks or other defects in material, equipment, and workmanship to the satisfaction of the OWNER. Repairs, if required, shall be done promptly at no cost to the OWNER.

PART 2 MEASUREMENT AND PAYMENT

2.01 GENERAL

A. Underground irrigation System shall be paid for at the bid price in a lump sum unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

SECTION 32 93 00
LANDSCAPING

GENERAL

1.01 SUMMARY

- A. The work under this section shall consist of furnishing and planting plants of the species, varieties and size specified, complete in place at locations designated on the plans or as directed by the Landscape Architect. This shall include furnishing all necessary materials and performing all necessary work such as excavation of plant holes, salvaging topsoil, transplanting, backfilling, pruning, mulching, watering, fertilizing, support staking where necessary, disposing of surplus waste materials, necessary care and required replacements pending acceptance, and such work necessary or incidental to complete the item in accordance with the plans, specifications and contract.

1.02 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Grading - Division 31
- D. Erosion and Sedimentation Controls - Division 31
- E. Seeding - Division 32
- F. Sodding - Division 32

1.03 REFERENCES

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Association of Nurserymen, (AAN), Horticultural Specifications and Standards, Current Edition.
 - 2. American National Standards Institute (ANSI), Specifications and Standards, Current Edition.
 - a. ANSI Z60.1 - Nursery Stock, Current Edition.
 - 3. Federal Specifications (FS), Specifications and Standards, Current Edition.
 - a. FS O-F-241 - Fertilizers, Mixed, Commercial, Current Edition.
 - 4. United States Department of Agriculture (USDA), Natural Resource Conservation Service - Wisconsin, Technical Guide:
 - a. NRCS 612 - Tree/Shrub Establishment, Current Edition.

1.04 QUALITY ASSURANCE

- A. All plant material shall conform to the American Standards for Nursery Stock, unless noted otherwise herein.
- B. All plant material shall be true to the species and variety/hybrid/cultivar specified, and nursery-grown in accordance with good horticultural practices, and under climatic conditions similar to

those of the site location. Nursery dug specimens to be replanted shall have been freshly dug and properly prepared for planting.

- C. Trees and shrubs shall be trained in development and appearance as to be superior in form, compactness and symmetry. Trees with multiple leaders, unless specified otherwise, and shrubs with damaged or cut main stem(s), will be rejected.
- D. Trees and shrubs with a damaged, cut or crooked leader, abrasion of bark, sunscald, frost crack, disfiguring knots, insects (including eggs and larvae) or insect damage, cankers/cankeros lesions or fungal mats, mold, prematurely-opened buds, or cuts of limbs over 3/4" (1.9 cm) diameter that are not completely callused will be rejected.
- E. Trees and shrubs shall have healthy, well-developed root systems, and be free from physical damage or other hindrances to healthy growth.
- F. Balled and burlapped plants shall be dug with solid balls of a diameter not less than that recommended by the American Standards for Nursery Stock, and of sufficient depth to include both fibrous and feeding roots. Balls shall be securely wrapped with burlap, and tightly bound with rope or twine. No plant shall be bound with rope or wire in such manner as to damage bark or break branches. The root flare should be within the top 2" (5.1 cm) of the soil ball.
- G. Balled and burlapped plants will not be accepted if the ball is dry, cracked, or broken before or during planting.
- H. Containerized plants are to be well-established within the container, with a root system sufficiently developed to retain its shape and hold together when removed from the container. Soil within the container should be held together by the roots, in form and whole. Plants shall not be pot-bound, nor have kinked, circling, or bent roots.
- I. Bare root plants are to have a healthy, well-branched, and adequately spreading root system characteristic of the species.
- J. Herbaceous perennials, annuals and bulbs shall only be supplied from nurseries certified by state plant inspectors. Substitutes or collected material may be used if approved by Owner or Architect/Engineer.
- K. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed
- L. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
- M. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
- N. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
- O. Report suitability of tested soil for plant growth.

- P. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
- Q. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Names of nurseries shall be identified for each plant purchased. Plant submittals shall include scientific naming. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. Planting soil test results and treatment recommendations (if any).
- C. Submit physical samples of materials as required in 1-gallon containers.

1.06 MEASUREMENT

- A. Plants shall conform to the measurements specified within the contract documents. Specified height and spread dimensions will refer to the main body of the plant, and not from branch tip to branch tip. Plants meeting a specified measurement, but judged to lack the balance between height and spread characteristic of the species will be rejected.
- B. Plants shall be measured when branches are in their normal position.
- C. No plant shall be less than the minimum size specified, and no less than fifty (50) percent of the plants shall be as large as the maximum size specified.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
- D. Containerized shrubs shall be measured by height and width for conformity with the plant list.
- E. Herbaceous perennials shall be measured by pot size, not by top growth.
- F. All other measurements, such as number of canes, ball sizes, and quality designations, shall conform to *American Standards for Nursery Stock, current edition*.

1.07 SUBSTITUTIONS

- A. The substitution of plant materials is not permitted unless authorized in writing by Owner. If written proof is submitted by the Contractor that a plant of specified species, variety or size is unavailable, consideration will be given towards the nearest available size or variety, or towards an alternate species selection, with a corresponding adjustment of the contract price.
- B. Larger plants than those specified can be used upon approval of the Owner or Architect/Engineer. The use of larger plants shall not increase the contract price. The root ball, root spread and

container size of the larger specimen shall be proportionally increased, relative to the specified size.

1.08 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is to arrange for the acceptance and unloading of plants at the project site.
- B. All plants are to be labeled by plant name and size. Labels shall be attached securely to all plants, bundles, and containers of plant materials when delivered. Labels shall be durable and legible, with information given in weather-resistant ink or embossed process lettering.
- C. All plant materials, shipments and deliveries shall comply with current state and federal laws and regulations governing the inspection, shipping, selling and handling of plant stock. If required by law or regulation, a certificate of inspection, or a copy thereof, for injurious insects, plant diseases, and other plant pests shall accompany each shipment or delivery of plant material. The certificate shall bear the name(s) and address(es) of the source of the plant stock.
- D. During transport, no plant shall be bound with rope or wire in a manner that damages trunks or breaks branches. Plants shall also not be dragged, lifted or pulled by the trunk, branches or foliage in a damaging way. No plant shall be thrown off of a truck or loader to the ground.
- E. Prior to installation, all plants must be protected from sun and drying winds.
- F. Containerized or balled and burlapped plants not being installed immediately must be kept in a shaded area, well-covered with wood chips, soil, or other approved material, and kept well-watered. Install all plants within three (3) days of delivery.
- G. Cover roots of bare root plants with a moist tarp, burlap, sphagnum moss, or mulch while being transported to, or while being held at the project site. Soak the bare roots overnight in water before planting. Just before planting, extend the roots carefully into a natural position, free of bunching, kinking or circling. Cut back all broken or damaged roots to a point clean and free of rot. No additional root pruning is allowed. Carefully work backfill mix among the roots while simultaneously watering.
- H. Fertilizer shall be delivered to the site in original, sealed containers, and stored in a waterproof space. Containers shall bear the manufacturer's name, analysis, trademark and guarantee as per standards of the Wisconsin Department of Agriculture.

1.09 JOB CONDITIONS

- A. Protect all plants, lawns, and grass areas from damage at all times. Damaged plants, lawns or grass areas shall be replaced or treated as required to conform with specifications herein for fresh stock.
- B. Work areas shall be kept clean and orderly during the installation period. Under no condition shall debris from planting activities result in a safety hazard on-site or to adjacent off-site property.
- C. Damage to lawns or grass areas incurred as a result of replacement operations shall be repaired by Contractor at no cost to Owner.

1.10 WARRANTY

- A. All plants shall be warranted to be in healthy and flourishing condition by June 30 after the end of one full growing season. The warranty shall not cover damage from vandalism, animals, freezing rains, or winds of sixty (60) miles per hour or greater, if the Contractor burlaps or otherwise protects any plants that he/she feels could be damaged during the warranty period.
- B. At any time during the warranty period, the Contractor shall remove or replace, without cost to the Owner, and within a specified planting period, all plants not in a healthy and flourishing condition as determined by the Owner or Architect/Engineer.
- C. Replacement plants shall be subject to the same specified requirements of the contract. The warranty of replacement plants shall extend until June 30 after the end of one full growing season. In the event that a replacement plant is not acceptable during, or at the end, of the said warranty extension period, Owner may choose between subsequent replacement or credit for that item.
- D. Include the following remedial actions as a minimum:
 1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 2. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
- E. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PRODUCTS

1.11 MATERIALS

- A. Plant Materials: A complete list of plant materials, including a schedule of quantities, sizes, root condition, quality and source location, shall be included in the contract documents. If discrepancies occur between the printed plant list, and the drawings, the printed list will take precedent.
- B. Root Conditions:
 - a. Bare rooted shrubs shall be dug with adequate fibrous roots. Roots of these plants shall be covered or packed in moist straw, or other water holding material until time of planting.
 - b. B&B plants shall be dug with firm natural balls of earth of sufficient diameter and depth to include most of the fibrous roots. Root balls shall be wrapped with burlap and secured with twine and/or a wire basket.
 - c. Container grown stock shall have been grown in a container long enough for the root systems to have developed sufficiently to hold its soil together, firm and whole. No plants shall be loose in the container. Prune roots as needed and prune of any encircling roots once the plant is removed from its container.
- C. Owner may request a written list of the proposed sources of nursery stock at the preconstruction meeting. This list may not be added to or otherwise altered without the consent of Owner.
- D. Topsoil: Naturally fertile, agricultural soil, capable of sustaining vigorous growth, of uniform composition throughout, without admixtures of subsoil, free of clay, stones larger than 1" inch diameter, roots, trash and debris of any kind, supplied by Contractor at his/her expense, and subject to approval by the Owner or Architect/Engineer.

- E. Organic Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Organic Matter Content: 50 to 60 percent of dry weight.
- F. Planting Mixture: Material used in tamping around balls and roots during the planting operation shall be prepared on site.
 - 1. Ratio of Loose Compost to Topsoil by Volume: Four (4) parts native topsoil from project site to one (1) part organic compost. Conform to alternate mixes as specified for beds of certain ornamental plants. All mixtures subject to the approval of the Project Representative or Landscape Architect.
- G. Fertilizer: Granular, non-burning product composed of not less than fifty (50) percent organic slow-acting, guaranteed analysis professional fertilizer. Commercial fertilizer shall conform to Wisconsin State Statutes, Section 94.64, and meet the standards of the Wisconsin Department of Agriculture as to registration and labeling. Fertilizer shall be specified in the contract documents as to composition, but is subject to revision to suit project site conditions.
- H. Organic Mulch: Double Shredded Hardwood Bark (Except walnut), free of colorants or material detrimental to healthy plant growth. Organic Mulch shall be 1/8" nominal thickness, with at least fifty (50) percent having an area of not less than 1 sq. inch, and no piece having an area of more than 6 sq. inches.
- I. Weed control fabric: Spun-bonded, rot-resistant polypropylene fabric, water and air permeable, and unaffected by freezing and thawing, or by deterioration from fertilizers or pesticides. This should only be used where no plants are installed and decorative gravel mulch is specified.
- J. Stakes: 6-8 foot (1.8 - 2.4 m) long sections of unflanged metal, or 2" x 2" (5.1 cm x 5.1 cm) hardwood.
- K. Flexible Support ties: 2" (5.1 cm) or wider bands of polypropylene, or elasticized or webbed strapping.
- L. Wrapping material: Biodegradable geotextile (fabric) trunk wrap, or waterproofed crepe wrapping paper, secured with 1" (2.5 cm) wide masking tape.
- M. Anti-desiccant: If required as protection for leaf surfaces, anti-desiccant shall be permeable to permit transpiration, and mixed and applied in accordance with manufacturer's specifications.
 - 1. Pre-emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- N. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
 - 1. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material
- O. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

- P. Metal Edging. If called for in the plans use only metal edging made of steel with a minimum 1/8" thickness and 4" height, capable of being formed to the design of the planting bed edge.
- Q. Stone Mulch. Shall be 1-2" stone similar to Pond Pebbles by Bluemels (<https://www.bluemels.com>). Contractor to submit sample for approval by architect.

EXECUTION

1.12 PREPARATION

- A. Receive Owner or Architect/Engineer approval of staking layout prior to excavation.
- B. Stake all planting areas and notify Digger's Hotline (1-800-242-8511 statewide) to verify location of all underground utilities prior to excavation.
- C. Excavate planting areas as shown in the contract drawings.
- D. Adequately barricade with proper warning devices any planting pit left open when planting work is not in progress, and that poses a hazard to vehicles and/or pedestrians.
- E. Notify the Owner in writing of any soil conditions, obstructions, or concerns about water drainage deemed detrimental to healthy plant growth. These conditions or obstructions shall be detailed, along with any suggestions for correction, removal or relocation. Where soil conditions, poor drainage or other obstructions are encountered that cannot be easily remedied, the Owner will designate alternate locations, and will bear the additional costs of such relocation.
- F. The planting pit for balled and burlapped plants shall be at least 2 times the diameter of the soil ball, or to a dimension otherwise specified.
- G. The planting pit for a single shrub shall be 12" (30.5 cm) wider than the root ball. Excavate individual shrub pits to the proper depth.
- H. Loosen the soil beyond the edge of the planting pit. The soil at the base of the planting pit is to remain undisturbed, the depth of which shall correspond to the distance from the bottom of the soil ball to the root flare, or slightly less.
- I. Planting pits for bare root plants shall be only broad enough to receive the full extension of the roots when the plant is set, and only deep enough to set the uppermost roots just below existing grade.
- J. Application of Mycorrhizal Fungi: At time directed by Architect/Engineer, broadcast dry product uniformly over prepared soil at application rate recommended by manufacturer.

1.13 PLANTING OF TREES AND SHRUBS

- A. Root balled plants shall have rope, string, wire baskets, burlap and other wrapping material removed from the top two-thirds (2/3) of the ball after the plant has been set in the hole. Remaining wrappings, other than those made from plastic or synthetic material, may be left around the bottom half of the ball.
- B. If deciduous species are planted in leaf, they may be sprayed with an approved anti-desiccant prior to planting when so directed by the Owner.

- C. Trees and shrubs grown using root containment material shall have the containment bag removed prior to setting.
- D. The root flare of trees must be visible and trees shall be set such that the root flare is approximately 2 inches above adjacent soil grades.
- E. Set trees and shrubs straight and upright, and in the center of the planting hole and on the unexcavated base of the planting pit, with the most desirable face towards the most prominent view.
- F. Root-balled shrubs are to be carried and set in the hole by the root ball.
- G. Backfilling: Backfill pits with Planting Mixture. No soil in frozen or muddy condition shall be used for backfilling.
- H. When pit is approximately two-thirds backfilled, tamp down and water to eliminate air pockets. After initial watering, add remainder of the soil to the top of pit, water without puddling, and firmly tamp without over compacting. Form a 2-3" high saucer around the outer rim of the pit prior to mulching.

1.14 FINISHING

- A. Finish-grade planting areas to required elevations after plants have fully settled.
- B. No soil is to cover the top of the root ball. All plants shall be completely mulched over the root system with a 3" layer of specified mulching material immediately after planting. Pull back mulch no less than 3" and no more than 6" from the trunk.
- C. Where specified lay weed control fabric over grade prior to mulching as per manufacturer's recommendations. Secure to slopes with pin anchors.
- D. Thoroughly water plants immediately after planting and before mulching, primarily within and filling the saucer.
- E. Wrapping: Only trees so designated shall be protected with tree wrap. Secure wrapping at a minimum of 5 locations, including the top, middle and bottom of the trunk. Cover the trunk's entire surface in a spiral manner, starting at the tree's base and extending to just below the height of the lowest main branches. Overlap material at 1/2-1". Owner will be responsible for removing the tree wrap after a recommended period.
- F. Prune any dead or broken branches. Prune newly-planted hedges as directed by the Landscape Architect or Project Representative.
- G. Remove all twine and rope after planting, along with any labels attached around trunks or branches.

1.15 STAKING

- A. Stake only those individual plants designated on-site by Owner and Engineer.
- B. Space stakes evenly outside of, and driven clear of, the root ball. Stakes are to be driven at an angle then drawn to vertical.

- C. Ties made of approved material shall be directly attached to the stakes. Attach ties so as to allow for 1-3" of sway in the trunk. For drooping stems, ties shall be placed at the point on the stem at which the top can then stand on its own.
- D. Staking shall conform to any additional directions found in the drawings.

1.16 PLANTING OF GROUND COVERS, PERENNIALS, ANNUALS AND BULBS

- A. Preparation: Loosen soil of the planting bed to a depth of 8" by mechanical or hand tilling while soil is dry. For bulbs, the depth of loosened soil will be determined by the type of bulb planted, and specified in the contract or landscape plan.
- B. After soil is loosened, till organic compost into the soil across the planting bed to a uniform depth of 2" for compost.
- C. Fertilizer, at amounts determined by the soil test, shall be top dressed to the soil. Liquid fertilizer may be applied to annuals if directed by Owner or Architect/Engineer.
- D. Planting: Space as described in the landscape plan.
- E. Plugs shall be installed through straw mulch and erosion control blankets.
- F. Unless otherwise specified, install plants no closer than 12" to the trunks of trees or shrubs within planting bed, and to within 6" of the edge of the bed.
- G. Prior to planting, biodegradable plant containers shall be split and non-biodegradable containers removed. The root systems of all such plants shall be split or crumbled by hand.
- H. For small quantities of bulbs, or in sections where bulbs are set within other plants, drive bulb planting holes through mulch using a bulb planter, hand trowel, or power auger. Plant bulb such that its basal plate faces downward, then cover with soil and mulch.
- I. For larger quantities of bulbs, excavate designated areas to specified planting depth, place bulbs such that their basal plates face downward, then cover with soil and mulch.
- J. When applying stone mulch lay weed control fabric over grade prior to mulching as per manufacturer's recommendations. Secure to slopes with pin anchors.
- K. When applying organic mulch apply pre-emergent herbicide per manufacturer's recommendations before applying mulch.
- L. Apply approved mulch uniformly across the entire planting bed to a depth of 3", except as noted in the drawings.

1.17 INSPECTION AND ACCEPTANCE

- A. Client Project Representative and a representative of the A/E Consultant with the Contractor of all plant material at one (1) week and three (3) week intervals (or other specified interval) after the original planting to note and correct any discrepancies from the contract. Plants that are alive and healthy following the three (3) week (or other time frame specified) inspection shall be accepted.

- B. Acceptance of plant material by Owner shall reflect general conformity with the *American Standards for Nursery Stock* as to specified size, character and quality. Acceptance shall not relieve the Contractor of responsibility for full conformity to the contract documents and the guarantee period. Any defects or imperfections appearing in whole or any part of the work caused by or due to any fault or negligence on the part of the Contractor shall be corrected before the work is accepted.
- C. Planting work may be accepted in stages when the Contractor and Owner deem that practice to be in their mutual interest. Approval must be given in writing by Owner to the Contractor verifying that work may be completed in stages. Acceptance of planting work in stages shall not waive any other provisions of the contract.

1.18 CLEANING

- A. Soil, branches, binding and wrapping material, rejected plants, or other debris resulting from plant installation shall be promptly cleaned up and removed. New landscape construction in and around the planting areas are to be especially well-cleaned.
- B. The contractor shall repair any damages that occurred during the completion of the work outlined in this section. All areas that are damaged by the contractor during completion of the work shall be repaired by the contractor. The damaged areas are to be restored to the conditions outlined on the plans at no additional cost to the owner.

1.19 PRUNING

- A. Prune in accordance with current *American National Standards (ANSI) for Tree Care Operations*. Perform all pruning work in a manner consistent with the landscape design intent. Plants overhanging and blocking pedestrian and/or vehicular paths shall be pruned as needed to allow the desired clearance.
- B. Except in the cases of hedges, or to conform to some design intent, all pruning of ornamental trees, shrubs and ground covers should aim to retain their natural shapes. With multiple leader plants, preserve the leader that best promote the plant's symmetry. Prune branches of deciduous stock to improve the branch structure of the plant.
- C. Plants that flower before late spring should be pruned immediately after flowering. Those that flower in summer or fall should be pruned in winter or spring before new growth emerges.
- D. Prune evergreens only to remove dead, broken or damaged branches. Prune yews, junipers, hemlocks and arborvitae after new growth has hardened off in late summer.
- E. Where necessary, repairs to damaged wood shall be performed under the direction of Owner, or a certified arborist.
- F. Prune using scissors-style cutting devices, and not anvil-style hand pruners, pole pruners or loppers.
- G. The Contractor shall remove all trimmed branches and other debris from the site at the end of each work day.

1.20 MAINTENANCE

- A. Fertilizing: Any and all chemical applications are to be performed in accordance with current federal, state and local laws, through EPA-registered materials and application techniques, and performed under the supervision of a licensed certified applicator. Apply fertilizer to planted areas at the specified rate, and as per manufacturer's recommendations.
- B. Watering: All plant materials installed under the contract shall be watered within the first 24 hours of initial planting and not less than twice weekly until final acceptance by Owner.
- C. Water used shall be of sufficient quality for irrigation and free of materials harmful to plant growth. Contractor responsible to supply water for temporary irrigation.
- D. Pesticide: Any use of pesticides during the contracted maintenance period, as determined by the Owner, shall utilize the minimum amount of approved pesticide needed to control pests on plant materials installed under the contract. Pesticide applications are to be performed in accordance with current federal, state and local laws, through EPA-registered materials and application techniques, and performed under the supervision of a licensed certified applicator. Apply at the specified rate, and as per manufacturer's recommendations.

MEASUREMENT AND PAYMENT

1.21 PLANTS

- A. General. Landscaping shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. No measurement will be made of corrective actions necessary to non-establishment of plant material.
 - 1. Landscaping, Square Foot. All items included, but not limited to, that pertain to the furnishing, installation, labor, equipment, and materials to trees, shrubs, planting beds and mulch shall be included under the respective bid item, "Landscaping, SF."
 - 2. Stone Mulch, Square Foot. All items included, but not limited to, that pertain to the furnishing, installation, labor, equipment, and materials to stone mulch, shall be included under the respective bid item, "Stone Mulch, SF."

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SECTION 33 05 16.13
PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 - 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
 - a. ASTM A82 - Specification for Steel Wire, Plain, for Concrete Reinforcement, Current Edition.
 - b. ASTM A496 - Specification for Steel Wire, Deformed, for Concrete Reinforcement, Current Edition.
 - c. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Current Edition.
 - d. ASTM A668 - Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use, Current Edition.
 - e. ASTM A730 - Specification for Forgings, Carbon and Alloy Steel, for Railway Use, Current Edition.
 - f. ASTM C76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Current Edition.
 - g. ASTM C478 - Specification for Precast Reinforced Concrete Manholes Sections, Current Edition.
 - h. ASTM C913 - Specification for Precast Concrete Water and Wastewater Structures, Current Edition.
 - i. ASTM C1227 - Specification for Precast Concrete Septic Tanks, Current Edition.
 - 2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.
 - 3. Federal Specifications (FS), Specifications and Standards, Current Edition.
 - 4. State Department of Commerce (DOC), Administrative Code of Rules and Regulations, Current Edition.
 - 5. State Department of Natural Resources (DNR), Administrative Code of Rules and Regulations, Current Edition.
 - 6. State Standard Specifications (SSS), for Sewer and Water Construction, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover the furnishings of all materials, equipment, tools, labor and supervision necessary to provide precast concrete structures as shown on the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Granular Fill - Division 31
- D. Trenching and Backfilling - Division 31

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. Contractor shall submit such submittals and details required for the construction and installation of the materials. Submittals and details shall indicate the intended materials arrangement, dimensions, major support requirements, and intricate or detailed construction requirements.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

- A. All precast concrete utility structures shall be watertight.
- B. Compressive strength of the concrete shall be 5,000 psi. Minimum concrete thickness shall be 6 inches for walls and 8 inches for floors and ceilings.
- C. Reinforcing steel shall meet ASTM A82, ASTM A496, ASTM A615 or ASTM A668, GR60. Minimum concrete cover over reinforcing steel shall be 1 inch. Lap of reinforcement at splices shall be a minimum of two cross wires for wire mesh.
- D. Each piece of a structure shall be cast from a one piece mold. The use of connecting form ties which may result in corrosion or leakage points is not acceptable.
- E. All joints shall be bell and spigot connections in conformance with ASTM C478.
- F. Joint materials shall be plastic gasket material or butyl rubber gasket material. Plastic gaskets shall be preformed, high adhesion material, packaged ready for use between protective paper strips conforming to Federal Spec SS-S-00210, Type I, Rope Form; Ram-Nek by K.T. Snyder Company, Inc.; Kent Seal No. 2 or equal. Butyl rubber gaskets shall be preformed, high adhesion material, packaged ready for use between protective paper strips, conforming to Federal Spec SS-S-210A, Rope Form; CPS-210 by Press Seal Gasket Corporation or equal.
- G. Waterstop seals shall be flexible, watertight, rubber wedge ring or O-ring compression seals for pipe entrance holes. Wedge ring type shall be Press-Wedge II by Press-Seal Gasket Corporation, PSX Boot by Press Seal Gasket Corporation, Boot Coupling by KOR-N-SEAL or equal. O-ring type shall have cast iron compression flange, Res-Seal by Scales Manufacturing Corporation or equal.

2.02 CIRCULAR PRECAST CONCRETE UTILITY STRUCTURES

- A. Wall thicknesses of structures will vary with diameter in conformance with ASTM C76 for CLASS B concrete tongue and groove joint pipe. Larger diameter circular precast concrete utility structures (7 feet +) shall have wall thickness a minimum of one twelfth the inside diameter of the structure as specified in ASTM C478.
- B. Steel reinforcement (sq. in./lin. ft.) shall not be less than 0.0025 times the inside diameter of the structure in inches.

2.03 RECTANGULAR PRECAST CONCRETE UTILITY STRUCTURES

- A. Tanks shall meet all the requirements of ASTM C913 and ASTM C1227.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all equipment in accordance with manufacturer's instructions and reviewed Submittals.
- B. The bottom of the excavation shall be dry and firm. Dewater as necessary to provide these conditions.
- C. The precast concrete utility structures shall sit on a layer of 12 inch washed stone wrapped in geotextile fabric Type SAS. Backfill material shall be as specified in Granular Backfill - Division 31.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Precast concrete utility structures shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 PRECAST CONCRETE STRUCTURES

- A. Precast Concrete Utility Structures, Lump Sum. When so provided, payment shall be made in accordance with the price bid for the precast concrete utility structures complete and shall include all labor and materials necessary to install.
- B. Precast Concrete Utility Structures, Inclusive. When no quantity is provided, precast concrete utility structures shall be considered inclusive to payment for associated work.

END OF SECTION

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SECTION 33 05 26.16
TRACER WIRE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

- A. Contractor shall install tracer wire in conjunction with buried, non-metallic piping in accordance with the contract drawings and the requirements of the Engineer.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Low Pressure Utility Sewerage - Division 33
- C. Sanitary Utility Sewerage Force Main - Division 33
- D. Public Sanitary Utility Sewerage Pipe – Division 33
- E. Water Utilities - Division 33

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 TRACER WIRE

- A. For direct burial installations, tracer wire shall be No. 12 gauge, ASTM D 1248, solid insulated copper wire rated for wet conditions.
- B. Tracer wire directionally drilled installations shall be No. 12 gauge, copper clad, steel core, hard drawn, extra high strength wire, 1,150 pound average tensile break load, 45 mil HDPE coated, 30 volt rating. A minimum of two (2) wires is required to be installed.
- C. Tracer wire for pipe bursting installations shall be 7 x7 stranded copper clad steel wire with a 4,700 pound average tensile break load, 50 mil HDPE coating, 30 volt rating. A minimum of two (2) wires is required to be installed
- D. Tracer wire for sanitary sewerage utilities installation shall have green colored insulator.
- E. Tracer wire for water utilities applications shall have blue colored insulator.

2.02 TERMINAL LOCATION BOXES

- A. Tracer wire terminal location boxes shall be Valvco or equal, with a cast iron lockable top. Cast iron tops shall be appropriately labeled, "WATER" or "SEWER" .

PART 3 EXECUTION

3.01 INSTALLATION

- A. Tracer wire shall be installed in conjunction with all PVC and HDPE utilities and installed continuous to the greatest extent possible and in accordance with the contract drawings and the requirements of the Engineer.
- B. For open cut installations, wire shall be placed along the top of the entire length of the pipe, and taped to the pipe, including hydrant barrels, at intervals not exceeding 10-feet.
- C. Wire shall surface at all hydrants. Wire may also surface at valve boxes, above laterals at the property line, or manholes. Where spacing of these appurtances exceeds 400 feet; terminal location boxes shall be installed. Terminal location boxes shall be located by the Contractor to meet the maximum spacing or as called out in Special Procedures, Division 1 or as shown on the Contract Drawings.
 - 1. Within valve boxes, the wire shall be installed in ½-inch PVC conduit beginning below the valve nut terminating six inches below the finished grade.
 - 2. At manholes, the wire transition from outside to inside the manhole shall be watertight.
 - 3. Adjacent to hydrants, the wire shall terminate in a terminal location box.
- D. Eighteen inches of extra wire shall be provided at all terminations.
- E. Splices in the wire shall be held to a minimum. Where splices are necessary, they shall be made with underground rated mechanical wire connectors or by twisting the wires a minimum of 4 times and soldering, then wrapping with two layers of polyethylene tape to 6-inches beyond the stripped wire. Splicing with wire nuts shall not be allowed.

3.02 TESTING

- A. All tracer wire must pass a locating test. Locates shall be done in the presence of the Engineer prior to acceptance of respective pipe installation. All equipment necessary to make the test shall be provided by the Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 TRACER WIRE

- A. General. Tracer wire shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 1.
 - 1. Tracer Wire, Lump Sum. When so provided, payment for tracer wire shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 1.
 - 2. Tracer Wire, Lineal Foot. When so provided, payment for tracer wire shall be made at the contract unit price bid or as specified in Special Procedures - Division 1.
 - 3. Tracer Wire, Inclusive. When no quantity is provided, tracer wire shall be considered inclusive to payment for work scheduled under this contract.
- B. Tracer Wire Testing, Inclusive. All testing shall be inclusive to the payment for the respective utility. Payment for utilities requiring tracer wire will not be issued until an accepted locate has been performed and accepted by the Engineer.

4.02 TRACER WIRE TERMINAL LOCATION BOXES

- A. General. Tracer wire terminal location boxes shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 1.

1. Tracer Terminal Location Boxes, Each. When so provided, payment for tracer wire terminal boxes shall be made at the contract bid price for each box or as specified in Special Procedures - Division 1.
2. Tracer Wire Terminal Box, Inclusive. When no quantity is provided, tracer wire terminal boxes shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 33 10 00
WATER UTILITIES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
1. American National Standards Institute (ANSI) and American Water Works Association (AWWA), Specifications and Standards:
 - a. ANSI/AWWA C104/A21.4 - American Water Works Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, Current Edition.
 - b. ANSI/AWWA C105/A21.5 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems, Current Edition.
 - c. ANSI/AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings for Water, Current Edition.
 - d. ANSI/AWWA C111/A21.11 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, Current Edition.
 - e. ANSI/AWWA C151/A21.51 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, Current Edition.
 - f. ANSI/AWWA C153/A21.53 - American National Standard for Ductile-Iron Compact Fittings for Water Service, Current Edition.
 - g. ANSI/AWWA C502- American Water Works Association Standard for Dry-Barrel Fire Hydrants, Current Edition.
 - h. ANSI/AWWA C504 - American Water Works Association Standards for Rubber-Seated Butterfly Valves, Current Edition
 - i. ANSI/AWWA C509- American Water Works Association Standard for Resilient-Seated Gate Valves for Water Supply Service, Current Edition.
 - j. ANSI/AWWA C515 – American Water Works Association Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service, Current Edition.
 - k. ANSI/AWWA C600 – American Water Works Association Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances, Current Edition.
 - l. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water, Current Edition.
 - m. ANSI/AWWA C651 – American Water Works Association Standard for Disinfecting Water Mains, Current Edition.
 - n. ANSI/AWWA C800 – American Water Works Association Standard for Underground Service Line Valves and Fittings, Current Edition.
 - o. ANSI/AWWA C900 – American Water Works Association Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 60-inch, for Water Transmission and Distribution, Current Edition.
 - p. ANSI/AWWA C901 – American Water Works Association Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½-inch through 3 inches for Water Service, Current Edition.
 - q. ANSI/AWWA C906 – American Water Works Association Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission, Current Edition.
 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
 - a. ASTM A536 – Standard Specification for Ductile Iron Castings.
 - b. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation, Current Edition.
 - c. ASTM D1598 – Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure, Current Edition.

- d. ASTM D1599 – Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings, Current Edition.
 - e. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120, Current Edition.
 - f. ASTM D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter, Current Edition.
 - g. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series), Current Edition.
 - h. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, Current Edition.
 - i. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, Current Edition.
 - j. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40, Current Edition.
 - k. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, Current Edition.
 - l. ASTM D2513 – Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings, Current Edition.
 - m. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
 - n. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
 - o. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings, Current Edition.
 - p. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter, Current Edition.
 - q. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals, Current Edition.
 - r. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, Current Edition.
 - s. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Material, Current Edition.
 - t. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, Current Edition.
 - u. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing, Current Edition.
 - v. ASTM B88 – Standard Specification for Seamless Copper Water Tube
3. Factory Mutual Research (FM), Specification and Standards, Current Edition.
 4. National Fire Protection Agency (NFPA 24).
 5. Underwriters Laboratories, Inc. (UL) Specifications and Standards, Current Edition.

1.03 DESCRIPTION OF WORK

- A. The work under this section shall cover furnishing all materials, equipment, labor and supervision required for water main, water service and other appurtenant materials, installed for the transmission and/or distribution of potable water, as shown on the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Submittals - Division 01
- C. Removal, Salvage and Abandonment – Division 02
- D. Geosynthetics for Earthwork - Division 31
- E. Trenching and Backfilling - Division 31

F. Erosion and Sedimentation Controls - Division 31

G. Tracer Wire – Division 33

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.
- B. Contractor shall submit such submittals and details required for the construction and installation of the materials. Submittals and details shall indicate the intended materials arrangement, dimensions, major support requirements, plot area and intricate or detailed construction requirements.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 PIPE

- A. All water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Shall be Thickness Class 52 meeting the requirements of ANSI/AWWA C151/A21. Standard cement-mortar lining shall meet the requirements of ANSI/AWWA C104/A21.4. Pipe shall have minimum of 1 mil asphaltic outside coating in accordance with ANSI/AWWA C151/A21.51. Spotty or thin seal coating, shall be cause for rejection.
 2. Polyvinyl Chloride Pipe. (Not available in 3-inch diameter) PVC pipe 4 inches to 12 inches in diameter shall be manufactured in accordance with ASTM D2241 and meet the requirements of ANSI/AWWA C900-16 or latest edition. Pipe shall be Pressure Class (PC) 235 psi minimum; or Pressure Rating (PR) 250 minimum; and have a Dimension Ration (DR) 18 or less. PVC pipe 14 inches to 60 inches in diameter shall meet the requirements of ANSI/AWWA C900 Pressure Class (PC) 235, minimum and have a Dimension Ratio (DR) of 14 or less.
 3. High Density Polyethylene Pipe (HDPE). Polyethylene pipe shall meet or exceed the requirements of ANSI/AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch for Water Distribution and Transmission. The furnished pipe shall be approved for potable water and marked with a continuous blue stripe. PE4710, HDPE Pressure Class 200, DR11 and DR11. Pipe shall have outside diameters similar to ANSI/AWWA C151/A21.51 ductile iron pipe (DIPS). Ends shall be plain for butt fuse joining.
- B. All water main 2-inches in diameter or less shall meet the following minimum requirements:
1. Copper pipe shall be Type K copper tubing, ASTM B88, and shall conform to the sizing requirements of ANSI/AWWA C800.
 2. High Density Polyethylene Pipe (HDPE) shall meet the requirements of ASTM D2239, D2737 or D3035 and shall have a minimum working pressure of 160 psi.

2.02 FITTINGS

- A. All fittings for water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Full body fittings shall conform to ANSI/AWWA C110/ A21.10 and ANSI/AWWA C111/A21.11 with bituminous coating. Compact fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11 with bituminous coating. All fittings shall be provided with cement mortar lining conforming to ANSI/AWWA C104/A21.4.
 2. Polyvinyl Chloride Pipe. (Not available in 3-inch diameter) Full body fittings shall conform to ANSI/AWWA C110/ A21.10 and ANSI/AWWA C111/A21.11 with bituminous coating. Compact fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11 with bituminous

coating. All fittings shall be provided with cement mortar lining conforming to ANSI/AWWA C104/A21.4.

3. All DI fittings shall be manufactured in North America
 4. High Density Polyethylene (HDPE). All fittings shall be molded polyethylene fused-type, PE3408, HDPE Class 160, DR11 or PE4710, HDPE Class 160, DR 13.5, DIPS and have outside diameters similar to ANSI/AWWA C151/A21.51 ductile iron pipe. Ends shall be plain for butt fuse joining.
- B. All fittings for water main 2 inches or less in diameter shall meet the following minimum requirements:
- C. High Density Polyethylene Pipe (HDPE). All fittings shall be molded polyethylene fused-type, PE3408, HDPE Class 160, DR11 or PE4710, HDPE Class 160, DR 13.5, and have outside diameters similar to ANSI/AWWA C151/A21.51 ductile iron pipe. Ends shall be plain for butt fuse joining.
- D. Bolts shall be stainless steel, Cor-Blue.
- E. Live (Hot) Tapping Saddle. The live tap saddle shall be a full ductile iron body with MJ Outlet.

2.03 JOINTS

- A. All joints for water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Joints shall be either push-on or mechanical joint conforming to ANSI/AWWA C111/A21.11 unless specified otherwise. All joints, fittings, etc., shall be equipped to provide electric continuity. The continuity must be provided through the use of a trademarked, well-established method acceptable to the Engineer.
 2. Polyvinyl Chloride Pipe. (Not available in 3-inch diameter). Joints shall be push-on type employing rubber gaskets which conform with ASTM F477 and joints which conform with ASTM D3139.
 3. High Density Polyethylene (HDPE). Joints shall be butt fusion meeting the requirements of ASTM D3261. Electrofusion meeting the requirements of ASTM F1055 shall be used where necessary for pipe coupling or where approved by the engineer.
- B. All joints for water main 2 inches in diameter or less shall meet the following minimum requirements:
1. High Density Polyethylene (HDPE). Joints shall be butt fusion meeting the requirements of ASTM D3261. Electrofusion meeting the requirements of ASTM F1055 shall be used where necessary for pipe coupling or where approved by the engineer.
- C. All joints for water main requiring joint restraint shall meet the following minimum requirements:
1. Mechanical Joints. Mechanical joints shall be installed with wedge action restraining glands, Mega-Lug by EBAA Iron Sales, Inc. or equal.
 2. Push-on Joints. Restrained push-on joints for straight pipe shall be as shown on the plans or as recommended by Pipe Manufacturer. Restrained joint retainer rings shall be manufactured of ductile iron compatible with pipe. All nuts, bolts, and tie rods shall be stainless steel or with a corrosion-resistant coating. Restraints shall be Mega-Lug by EBAA Iron Sales, Inc. or equal.
 3. All restrained joints shall have a pressure rating equal to that of the pipe.

2.04 VALVES

- A. All valves for water main 3 inches thru 12 inches in diameter shall meet the following minimum requirements:
1. Valves shall be resilient-seated gate valves, mechanical joint conforming to ANSI/AWWA C509 or ANSI/AWWA C515 unless specified otherwise.
 2. Valves shall have non-rising stem, with 2 inch operating nut opening counter-clockwise.
 3. The valve wedge shall be ductile iron fully encapsulated with EPDM rubber, shall be symmetrical and seal equally well with flow in either direction.
 4. Operating nut extensions shall be provided where required by Contract drawings and/or Special Procedures.
- B. All valves for water main 2 inches in diameter or less shall meet the following minimum requirements:

1. Mueller Mark II Oriseal, or equal
- C. All valves for water main larger than 12 inches in diameter shall meet the following minimum requirements:
1. Valves shall be rubber-seated butterfly valves, mechanical joint conforming to ANSI/AWWA C504 unless specified otherwise.
 2. Valves shall have non-rising stem, with 2 inch operating nut opening counterclockwise.
- D. Valves shall be installed with the following accessories:
1. Valve Box. Valve box shall consist of a top section, bottom section, base, drop lid, and necessary extensions and all shall be cast iron. Lid shall have the word "WATER" cast on the lid.
 2. Valve Box Adaptor.
 - a. Gate Valves: All gate valves 4 inch or larger shall be installed with a Gate Valve Adaptor as manufactured by Adaptor Inc., or equal.
 - b. Butterfly Valves: All butterfly valves between 6 inch and 36-inch in diameter shall be installed with a Butterfly Valve Adapter as manufactured by Adaptor Inc., or equal.

2.05 HYDRANTS

- A. Hydrants shall be a Waterous Pacer, Model WB67 meeting the following requirements unless noted otherwise in Special Procedures - Division 01.
- B. All hydrants for water main shall meet the following minimum requirements:
1. Hydrants shall be dry barrel fire hydrant, dry top design, conforming to ANSI/AWWA C502 with mechanical joint base connection.
 2. Hydrants shall be traffic design with protective groundline coupling (traffic flange) which assures reliable fracture at traffic impact. This coupling shall also allow hydrant rotation to any position after hydrant installation.
 3. Hydrant to be furnished as standard 3-way style with two 2-1/2 inch and one 4-1/2 inch standard hose nozzles (chains on nozzle caps are required). Hydrants shall have 5-1/4 inch main valve openings.
 4. Hydrant operating nut shall be a standard two-piece pentagon (5 sided). Operating assembly shall include, as a minimum, thrust washer, revolving nut with seal for dry top design, and lifetime lubrication.
 5. Hydrant base shall contain a barrel drain operated by hydrant activator.
 6. All hydrants shall be connected to the main with a 6-inch diameter (minimum) water main pipe conforming to the requirements of this section.
 7. Upper barrel section shall be a minimum 16 inches.
 8. National standard thread, operating nut will be a standard 1-1/2 inch pentagon, CCW open
 9. Mechanical joint connections.
 10. Painted red.
 11. Maintain electrical continuity.
 12. Resilient wedge main seat.
 13. Bronze to bronze fittings.
 14. Incorporated bronze drainage system.
- C. Hydrants shall be furnished having bury depth consistent with surface grades and water main depth as shown on the Contract Drawings or as defined in Special Procedures - Division 01.

2.06 WATER SERVICES

- A. All water service lines shall be 1 inch unless shown otherwise on the contract drawings or as specified in Special Procedures – Division 01. All service lines for water main shall meet the following minimum requirements:
1. Copper.
 - a. Service lines shall be Type K copper tubing and shall conform to ASTM B88.
 2. High Density Polyethylene (HDPE).

- a. Service lines shall be polyethylene CTS (copper tube size) meeting the requirements of ASTM D2737 and AWWA C901. Line shall be rated for use with water at 73.4°F, have a pressure class of 250 psi, and be NSF/ANSI 61 and NSF/ANSI 14 approved. Service line tubing shall be Polyflex (CTS), DriscoPlex 5100, Ultraline (SDR 9) or approved equal.
 - b. All HDPE services shall have stiffeners for connection to compression type fittings per manufacturer's recommendations.
- B.** All corporations for water services shall meet the following minimum requirements:
- 1. Ductile iron water mains
 - a. Corporation stops shall conform to ANSI/AWWA C800 for copper service lines.
 - b. Corporations larger than 1 inch and for pipe smaller than a 6-inch diameter shall be furnished and installed with service saddles.
 - c. Service saddles shall be rated for 250 psi, have a coated ductile iron body, 304 stainless steel strap and nitrile O-ring gasket. Service saddles shall meet all applicable parts of ANSI/AWWA C800.
 - d. Corporation stops shall be Mueller Ground Key Conductive Compression, or equal, or as specified in Special Procedures - Division 01.
 - 2. PVC water mains
 - a. Service line connection to PVC pipe shall be made using a saddle type connection. A simple threaded connection shall not be acceptable.
 - b. Service saddles shall be rated for 250 psi, have a coated ductile iron body, 304 stainless steel strap and nitrile O-ring gasket. Tapping saddles shall meet all applicable parts of ANSI/AWWA C800.
 - c. Corporation stops shall be Mueller Ground Key Conductive Compression or equal, as specified in the Special Procedures – Division 01. Stainless steel stiffeners are required for compression fitting connections.
 - 3. High Density Polyethylene (HDPE) water mains
 - a. Service line connection to HDPE pipe shall be made using a saddle type connection. A simple threaded connection shall not be acceptable.
 - b. Service saddles
 - 1) Service saddles shall be rated for 250 psi, have a coated ductile iron body, 304 stainless steel dual strap, nitrile O-ring gasket, and spring washers specifically designed for use on HDPE pipe. Service saddles shall meet all applicable parts of ANSI/AWWA C800.
 - 2) Service saddles shall be Smith-Blair 317, or equal for use on HDPE pipe.
 - c. Corporation stops shall be Mueller Ground Key Conductive Compression, or equal, or as specified in the Special Procedures – Division 01. Stainless steel stiffeners are required for compression fitting connections.
- C.** All curb stops for water services shall meet the following minimum requirements:
- 1. Copper water services
 - a. Curb stops shall be designed for use with copper service lines and shall conform to ANSI/AWWA C800.
 - b. Curb stops shall be Mueller Mark II Oriseal, or equal, with conductive compression fittings or as specified in Special Procedures - Division 01.
 - 2. High Density Polyethylene (HDPE) water services
 - a. Curb stops shall be Mueller Mark II Oriseal, or equal, with threaded connections or as specified in Special Procedures - Division 01.
 - b. Threaded stainless steel by HDPE transition fittings shall be supplied for each curb stop. Transition fittings shall be butt fused to the service pipe. Transition fittings shall be manufactured by Central Plastics.
- D.** All curb boxes for water services shall be Mueller, Minneapolis pattern, or equal, 1-1/4 inch upper, pentagon nut opening with stationary rod or as specified in Special Procedures - Division 01.
- E.** Curb boxes shall be furnished having bury depth consistent with water main depth as shown on the Contract Drawings or as defined in Special Procedures - Division 01.

2.07 HDPE BY MECHANICAL JOINT ADAPTERS

- A. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company or equal. The adapter shall comply with ANSI/AWWA C906 and be manufactured for use on pipe conforming ASTM D2513, D3035, F714. The adapter shall be molded from a PPI and NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a cell classification of 345464C and be compatible for heat fusion with any pipe manufactured from a like or similar resin.
 - 1. Adapters shall be tested according to ASTM D1599 and ASTM D1598.
 - 2. HDPE Adapters shall be sized for use with ductile iron pipe size HDPE pipe.
 - 3. Adapters shall be used for all transitions from HDPE to valves or ductile iron pipe.
 - 4. HDPE by MJ Adapters for pipe 12 inch or greater must be designed for use with butterfly valves. Submittals shall specifically indicate this feature.
 - 5. Adapters must provide thrust restraint.

2.08 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be polyethylene film tube, 8 mil nominal thickness, conforming to ANSI/AWWA C105/A21.5. Polyethylene film sheet conforming to ANSI/AWWA C105/A21.5 may be used at odd-shaped appurtenances where the use of tube is not practical.
- B. The polyethylene film shall be clearly marked with the information required in ANSI/AWWA C105/A21.5.
- C. Polyethylene encasement shall be repaired around all corporation/saddles and other appurtenances after initial installation. Encasement shall be neatly cut around corporations/saddles and repaired with suitable tape/adhesive to protect the pipe from native soils and bedding.

2.09 INSULATION

- A. Insulation shall be extruded polystyrene insulation (25 psi) conforming to ASTM C578, Type IV in 4 foot x 8 foot sheets with minimum thickness of 2 inches.

PART 3 EXECUTION

3.01 GENERAL

- A. All construction shall be done in conformance with ANSI/AWWA C600 unless otherwise specified.

3.02 EXCAVATION

- A. Excavation shall conform to Trenching and Backfilling - Division 31 of these specifications except as modified herein.

3.03 FIELD INSPECTION OF MATERIALS

- A. Before lowering and while suspended, the pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection. Contractor shall inspect each segment of pipe for the presence of foreign matter, rough edges or projections within the pipe. Contractor shall take care to prevent any foreign material from entering pipe prior to installation.

3.04 DIRECTION OF LAYING

- A. Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds 30 feet of rise per one hundred feet of trench, the bells shall be face upgrade.

3.05 INSTALLATION

- A. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench.
- B. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings so as to prevent breakage. Under no circumstances shall they be dropped into the trench or so handled as to receive hard blows or jolts when being moved.
- C. The Contractor shall supply and install pipe fittings, couplings, bends, and appurtenances as required to complete the project.
- D. All tees, crosses, bends, and reducers shall be cast or ductile iron. No PVC appurtenances will be allowed.
- E. Contractor shall install temporary water service to all users where water service will be interrupted for more than 4 hours. Contractor shall coordinate interruption to business and commercial users so the interruption will not cause a disruption of business or commercial activities. All users shall be given 24 hour notice of service interruption, except during emergencies.
- F. Abandonment and/or removal of existing water mains shall be completed in accordance with Section 02 42 00 "Removal, Salvage and Abandonment" in Division 02.
- G. All existing water mains being replaced are to remain in service until the new water mains are tested and accepted. The Contractor shall make arrangements with the Owner and the Engineer to sequence connection and operation of new mains and abandonment of existing mains. A minimum of 24 hours notice to residents shall be provided prior to shutting off their water.
- H. Unless pre-approved by the Owner and Engineer, the maximum allowable duration of water service interruption to water utility customers shall be typically be 4 hours. Customers to whom water service is critical, shall have service interruption limitations and accommodation needs determined on a case by case basis.

3.06 JOINING OF PIPE

- A. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.
- B. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

3.07 Transite Pipe (Asbestos-Concrete)

- A. If transite pipe is encountered during construction, contractor shall not disturb pipe and leave in the ground, if possible.
- B. If transite pipe must be disturbed during the course of the project, Contractor shall follow all applicable Federal and State laws along with all OSHA requirements for handling and disposing of pipe. Contractor shall apply for all applicable Federal and State permits for removing and handling asbestos containing material.

3.08 CUTTING OF PIPE

- A. Pipe shall be cut at right angles to the centerline of the pipe. Cutting shall be done in a neat workmanlike manner without damage to the pipe and so as to leave a smooth end.

- B. All pipes shall be cut with an approved mechanical cutter. The cut end of a pipe to be used with rubber gasket joints shall be tapered by grinding or filing about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.

3.09 OBSTRUCTIONS IN LINE OR GRADE

- A. Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor will furnish and install the required fittings.
- B. If an unknown underground structure interferes with the work to such an extent that an alteration of the plan is required, the Contractor shall notify the Engineer.

3.10 THRUST RESTRAINT

- A. Thrust restraint is required for all bends, caps, plugs, tees, and valves adjacent to tees. Thrust restraint shall be provided by use of concrete buttresses and wedge action restraining glands.
- B. Concrete buttresses shall be poured against firm, undisturbed ground. When concrete buttresses cannot be placed against undisturbed ground they shall be placed against fill material of composition conforming to the requirements of ASTM C12 or ASTM D2321 as applicable for rigid and flexible pipe respectively, compacted to 95 percent of the modified proctor density for the material. The buttresses shall be constructed to the minimum dimensions as shown on the contract drawings or as required by the Engineer. All buttresses shall be formed to keep the joints free of concrete.
- C. Solid precast concrete blocks may be used in lieu of the poured buttresses when approved by the Engineer. When concrete blocks are used, they shall be stepped-out to match the minimum dimensions required for poured concrete buttresses.
- D. Ductile iron or PVC pipe connecting to HDPE pipe must be restrained a sufficient distance upstream to prevent joint separation due to contraction of the HDPE pipe. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Procedures - Division 01. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction.
- E. Restrained joint fittings shall be used in conjunction with concrete buttresses. When restrained joint fittings are used, a sufficient length of pipe on each side of the fitting shall be restrained to resist the thrust forces. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Procedures - Division 01.
- F. Thrust restraint is not required for HDPE water mains with HDPE fittings except where transitioning to other pipe materials.

3.11 JOINT DEFLECTION

- A. The maximum allowable deflection for ductile iron pipe will be as given in ANSI/AWWA C600. If excess deflection is required, special bends shall be furnished to provide angular deflections.
- B. The maximum deflection shall be as specified by the manufacturer.

3.12 DEPTH

- A. The water main shall be placed at a depth as to prevent freezing. This depth shall provide six and one-half feet (6'-6") of cover over iron/copper pipe and one-half foot more for other materials unless otherwise shown on the contract drawings or required by Special Procedures - Division 01 of these specifications.

- B. Insulation shall be installed if ground cover is less than six and one-half feet (6'-6") or utility crossing effectively removes earthen freeze protection. Insulation shall be installed as shown on the contract drawings or as directed by the Engineer in the field.

3.13 UNSTABLE SOIL

- A. If in the opinion of the Engineer the trench bottom is of unstable material, the Engineer may direct the Contractor to excavate the unstable material and replace same with 3/4 inch washed stone. Washed stone used in such cases shall be considered incidental and included in the price bid for water main unless bid or specified otherwise. Where the condition of unstable material is unusually severe, the Engineer may order the placement of a concrete cradle. Materials used for concrete cradles, when not called for in the Contract Documents, shall be paid for by Change Order at a negotiated price.

3.14 EMBEDMENT/BEDDING

- A. Class B bedding and initial backfill shall be used for all ductile iron or HDPE pipe installed under this contract in accordance with the contract drawings and ASTM C12, or as indicated in Special Procedures - Division 01 of these specifications.
- B. Class II embedment shall be used for all PVC pipe installed under this contract in accordance with the contract drawings and ASTM D2321, or as indicated in Special Procedures - Division 01 of these specifications.

3.15 SETTING VALVES

- A. Valves in water mains shall be provided and installed in locations as shown on the contract drawings. A valve box and valve box adaptor shall be provided for every valve unless otherwise specified. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve. The box cover shall be 1/4 inch to 1/2 inch lower than the surface of the finished pavement.
- B. HDPE by mechanical joint adapters must be used at all valves installed on HDPE pipe.

3.16 SETTING HYDRANTS

- A. Hydrants shall be located as shown on the contract drawings or as directed by the Engineer. All hydrants shall stand plumb and shall have the pumper nozzle facing the curb. Hydrants shall be set to the established grade, which shall be hereinafter considered as with nozzles at least 18 inches above the ground such that the following one or more conditions apply:
 1. Nozzle center is 18-24 inches above the top of proposed curb.
 2. Nozzle center is 18-24 inches above the existing ground line.
 3. Nozzle center is 18 inches above the proposed ground surface elevation for that hydrant location.The above hydrant vertical placement may be accomplished by adding hydrant extensions. The unit price bid for the hydrant shall include the cost of extensions.
- B. All hydrant drainport shall be plugged in the following conditions:
 1. Hydrant drainport would be installed below groundwater table.
 2. Hydrant is placed in area with known soil contamination.
 3. Soil materials and coloration indicate groundwater may be above hydrant drainport.
 4. Plugging is shown on the contract drawings or is directed by the Engineer the field.
- C. Wherever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand, from the bottom of the trench to at least 6 inches above the waste opening in the hydrant and to a distance of 1 foot around the elbow. The drainage material shall be wrapped with non-woven geotextile fabric Type SAS conforming to the requirements of Geosynthetics for Earthwork - Division 31 of these specifications.

- D. All hydrants shall be provided with drainage at the base of the hydrant by placing compacted coarse gravel or compacted crushed stone mixed with coarse sand, under and around the elbow of the hydrant to a level of 6 inches above the waste opening in the hydrant and to a distance 3 feet along the trench back toward the main.
- E. All hydrants shall be constructed with a minimum of six and one-half feet (6'-6") of cover over the lead, or as shown on the contract drawings or specified in Special Procedures - Division 01, and be set on a solid concrete block.
- F. All hydrants shall be installed with thrust restraint utilizing concrete buttresses and joint restraint, see thrust restraint this section.

3.17 INSTALLING SERVICES

- A. All corporations shall have proper sized tapping saddle furnished with them if used with PVC/plastic water main. All costs related to tapping saddles shall be included in the corporation unit price. Taps shall be cut-in using a "shell cutter" tapping device to capture all loose materials. All services taps shall be made "hot" or with the main under pressure unless authorized by the Engineer and Owner.
- B. Contractor shall connect to existing services with a proper manufactured fitting. Contractor shall have various sized fittings/coupling in order to connect existing services with different sizes and materials.

3.18 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be installed where shown in the contract drawings or as required in the Special Procedures - Division 01. Installation of polyethylene encasement shall conform to ANSI/AWWA C105/A21.5I.
- B. The polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as joints or fittings, and to prevent damage to the polyethylene caused by backfilling operations. Overlaps and ends shall be secured with adhesive tape or plastic tie straps. For installations below the water table, circumferential wraps of tape shall be placed at two foot intervals along the barrel of the pipe.
- C. All fittings and valves shall be fully wrapped with polyethylene.
- D. Exposure to sunlight of the polyethylene film shall be kept to a minimum.

3.19 TRACER WIRE

- A. Trace wire shall be installed in conjunction with all PVC, HDPE, or non-conductive water main and services in accordance with Tracer Wire – Division 33 and with the Contract Drawings and the Special Procedures – Division 01.

3.20 DISINFECTING WATER MAIN

- A. All water main and services shall be disinfected in conformance with ANSI/AWWA C651. The main will not be accepted or placed in service until two consecutive satisfactory tests are taken 24 hours apart from samples from the new main following the final flushing.
- B. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set of samples from the end of the main and a minimum of one set from each water main branch.
- C. The testing lab shall furnish copies of lab results from the bacteriological tests run on the water mains to the Engineer.

3.21 WATER SUPPLY DECHLORINATION

- A. Chlorinated water discharged directly or indirectly to surface waters as a result of flushing newly installed water mains, discharging water tanks or reservoirs, hydrant flushing, test pumping wells, or any other circumstance shall be dechlorinated in accordance with the current "Hydrostatic Test Water or Water Supply System Water General Permit, WPDES Permit No. WI-0057681". The free chlorine residual of discharged water shall be reduced to 0.1 parts per million or less, or to the normal operating concentration of the chlorine residual maintained in the water supply system.
- B. The concentration of free chlorine residual shall be measured at the point of surface water entrance.

3.22 TESTING

- A. All equipment required for hydrostatic testing shall be furnished and operated by the Contractor subject to the approval of the Engineer. This equipment shall include all sampling taps and necessary flushing appurtenances.
 - 1. Hydrostatic tests shall consist of pressure and leakage test in accordance with ANSI/AWWA C600, Hydrostatic Testing. The hydraulic tests shall be conducted at 150 percent of normal operating pressure or 150 psi, whichever is greater.
 - a. Water shall not be added during the pressure test. No pipe section will be accepted if the test pressure drops more than 5 psi within the two-hour test duration.
 - b. The leakage is the amount of water required to bring the pressure back up to the starting pressure once the pressure test passes. Contractor shall know and follow the procedures in AWWA C600 for the leakage test and have all required material and equipment necessary to complete this test.
 - 2. Hydrostatic tests shall be conducted on sections of water main recommended as ready by the Contractor and approved by the Engineer. No section shall be less than one block (approximately 400 feet) of water main unless conditions warrant such testing of smaller sections.
 - 3. Where water services are installed to facilities which may include fire sprinkler systems, a pressure test and leakage test shall be performed on the water service in accordance with NFPA 24.
- B. Where ductile iron water main is installed, a random section of completed main will be selected by the Engineer for a continuity test. This random section shall be subjected to 300 amps DC for 15 minutes. All equipment necessary to make the test and to establish a closed circuit with the test section of water main providing one leg of the circuit shall be provided by the Contractor at no additional cost to the Owner. The Contractor shall take whatever precautions he deems necessary such as filling the water main with water prior to testing to protect the gaskets and building the amperage up slowly while watching an ammeter.
 - 1. If the random section passes the test, the electrical continuity for the entire water main installation will be considered acceptable.
 - 2. Should the random section fail the test, it shall be repaired by and at the expense of the Contractor until it can pass the test. Also, the remainder of the project will be divided into test sections by the Engineer and tested for compliance by and at the expense of the Contractor.
- C. All tracer wire must be tested for electrical continuity. All equipment necessary to make the test and to establish continuity of all tracer wire shall be provided by the Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Water main shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 WATER MAIN

- A. Water Main, Size, Type, Lineal Foot. Measurement for water mains shall be per lineal foot of a specific diameter water main installed. Payment shall be made at the contract unit price bid per lineal foot of the respective diameter for furnishing, installing and testing of water main.

4.03 APPURTENANCES

- A. Fittings (Type), Size, Each. Measurement for fittings shall be for each size and type installed as indicated in the Bid Schedule or Special Procedures - Division 01. Payment shall be made at the contract price bid per each size and fitting installed.
- B. Fittings, Inclusive. If no bid items are included with the project, all fittings shall be included in a related bid item. Contractor is responsible for verifying types and numbers of fittings required for the project to include in the bid.
- C. Valves (Type), Size, Each. Measurement for valves shall be for each size as indicated in the Bid Schedule or Special Procedures - Division 01. Payment shall be made at the contract price bid per each size valve installed. All costs for HDPE by mechanical joint adapters shall be incidental for valve installation.
- D. Hydrants, Each. Measurement for hydrants shall be for each installed. Payment shall be made at the contract price bid per each hydrant installed. All hydrant extensions and appurtenances required to set hydrants to the established grade per this Specification shall be included in the contract price bid per each hydrant installed.
- E. Water Services, Size, Lineal Foot. Measurement for services shall be per lineal foot of a specific size services installed. Payment shall be made at the contract unit price bid per lineal foot of each size services installed.
- F. Corporation, Curb Box, and Stop, Size, Each. Measurement for these items are included as one bid item and shall be paid per each set of these items installed. The bid price for this item shall include; corporation stop, curb stop, curb box, stationary rod (when required) and all costs necessary to connect new services to the existing curb stop or to connect to the existing water service.
- G. Polyethylene Encasement, Lineal Foot. Measurement for polyethylene encasement shall be per lineal foot installed. Payment shall be made at the contract unit price bid per lineal foot of polyethylene encasement.
- H. Insulation, Square Foot. Measurement for insulation shall be per square foot of insulation installed. Payment shall be made at the contract unit price bid per square foot of insulation installed.
- I. Connect to Existing Water Main, Each. All costs related to connection to existing water mains shall be included in the contract unit price bid per each connection. When a cut-in tee is required, only one connection to the existing main will be paid. The other connection shall be included under a related item and considered inclusive to the project. Valves will be paid separately unless otherwise specified. When HDPE by mechanical joint adapters are required, the cost for the adapters shall be incidental to this item.
- J. Transite Pipe Removal, Connection, Handling, and Disposal, Lump Sum. All costs related to removing, connecting to, handling and disposing of transite pipe, shall be included in this item. This includes, but is not limited to, permit fees, specialized asbestos contractors to perform work, bagging, labeling and transporting materials to a certified landfill, tipping fees, and all other applicable construction items related to asbestos containing material handling.

4.04 TESTING

- A. Mains shall be installed and pass test for pressure, leakage and safe sample before any water main installation payments shall be made.
 - 1. The Contractor is responsible for furnishing and operating all water main testing equipment including sampling taps and necessary flushing appurtenances.
 - 2. After removal, any temporary fittings, valves, and plugs shall become the Contractor's property.

- B. Payment for water main requiring tracer wire will not be issued until an accepted continuity test has been performed and approved by the Engineer.

END OF SECTION

SECTION 33 41 13
PUBLIC STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
 1. American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications, Latest Edition.
 2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
 3. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

- A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to install the public storm utility drainage piping for this project.

1.04 RELATED WORK ELSEWHERE

- A. Procurement and Contracting Requirements - Division 00 (All Sections)
- B. Removal, Salvage and Abandonment – Division 02
- C. Trenching and Backfilling - Division 31
- D. Storm Drainage Manholes, Frames, and Covers - Division 33

1.05 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 REINFORCED CONCRETE PIPE (RCP)

- A. Reinforced concrete pipe shall conform to the requirements of Section 608 of the State of Wisconsin, Department of Transportation, Standard Specifications.
- B. Reinforced concrete apron endwalls shall conform to the requirements of Section 522 of the State of Wisconsin, Department of Transportation, Standard Specifications. All endwalls 24-inches and larger in diameter require trash guard.

2.02 CORRUGATED METAL PIPE (CMP)

- A. Steel corrugated metal pipe and steel apron endwalls shall conform to the requirements of Sections 520 and 521 of the State of Wisconsin, Department of Transportation, Standard Specifications. All endwalls 24-inches and larger in diameter require trash guard.
- B. Aluminum corrugated metal pipe and aluminum apron endwalls shall conform to the requirements of Sections 520 and 525 of the State of Wisconsin, Department of Transportation, Standard Specifications. All endwalls 24-inches and larger in diameter require trash guard.

2.03 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- A. High density polyethylene pipe shall conform to the requirements of Section 530 of the State of Wisconsin, Department of Transportation Standard Specifications. Pipes which are between 42 inch diameter and 48 inch diameter shall meet the requirements of AASHTO M252 and M294, Type D.
- B. Couplings and fittings for 4-36 inch pipe shall be suitable for the specific project application and as recommended by the pipe manufacturer. The joint for 42-48 inch pipe shall consist of a bell and spigot, integrally welded to the barrel of the pipe, utilizing a suitable profile gasket located on the spigot end.
 - 1. The fittings shall not reduce or impair the overall integrity or function of the pipe line. Fittings may be either molded or fabricated. Common corrugated fittings include in-line joint fittings, such as couplers and reducers, and branch or complimentary assembly fittings such as tees, wyes, and end caps. These fittings may be installed by various methods, such as snap-on, screw-on, bell and spigot, and wrap around.
 - 2. Couplings shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints.
 - 3. Only fittings supplied or recommended by the pipe manufacturer shall be used. Where designated on the contract drawings, a neoprene or rubber gasket shall be supplied.

2.04 POLYVINYL CHLORIDE PIPE (PVC)

- A. Four-inch to 15-inch diameter pipe shall be Type PSM SDR-35 and meet the requirements of ASTM D3034. Pipe over 15-inch diameter shall meet the requirements of ASTM F679. Pipe shall be of the bell and spigot type.

2.05 TRASH GUARDS FOR ENDWALLS

- A. Trash guards shall be constructed of painted or galvanized steel bars and pipes, spaced no more than 8-inches on center and welded into the configuration shown on the contract drawings. Fasteners shall be zinc-coated stainless steel.

2.06 CONCRETE BRICK OR BLOCK

- A. Concrete brick and block masonry units shall conform to the requirements of Section 519 of the State of Wisconsin, Department of Transportation, Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Construction of the public storm utility drainage piping shall include all excavation, backfilling, compacting of trenches and breaking into existing manholes, inlets or storm sewers required to provide a completed storm sewer at the locations shown on the contract drawings.

3.02 PROTECTION OF EXISTING UTILITIES

- A. Utility locations shown on contract drawings are approximate. Contractor shall contact all utility companies at least three working days prior to excavation for locations of all buried utilities owned by them. Should utilities be unexpectedly encountered during excavation, consult Engineer immediately for directions as to procedure.

Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner. Contractor shall be responsible for the cost of repairing damaged utilities.

3.03 CONCRETE STORM SEWER

- A. Concrete storm sewer shall be constructed as shown on the contract drawings and in accordance with Section 608 of the State of Wisconsin, Department of Transportation, Standard Specifications, with the following exceptions and additions:
1. Joints shall be of flexible watertight rubber gaskets installed as per manufacturer's instructions and in accordance with Section 608 of the State of Wisconsin, Department of Transportation Standard Specifications.
 2. Joints for elliptical storm sewer shall be mortar, gasket, mastic or combination in accordance with Section 608 of the State of Wisconsin, Department of Transportation Standard Specifications.
 3. Backfill shall be as indicated on the contract drawings and specified in Trenching and Backfilling - Division 31 and Special Procedures - Division 01. Backfill shall be incidental to storm sewer construction.
 4. If no embedment class is specified, then Class B embedment with a shaped subgrade shall be used.
 5. Joint ties shall be installed on apron endwall joints and the adjacent two pipe joints.

3.04 CORRUGATED METAL PIPE (CMP) STORM SEWER

- A. Corrugated metal pipe shall be constructed as shown on the contract drawings and in accordance with the Special Procedures and Sections 520, 521, and 529 of the State of Wisconsin, Department of Transportation, Standard Specifications, with the following exceptions and additions:
1. Joints shall be of watertight bolted bands installed as per manufacturer's instructions.
 2. Backfill and embedment shall be as noted in the Special Procedures and shall be incidental to storm sewer construction.
 3. Basis of payment will be per lineal foot in place. Miscellaneous bends, fittings and bands shall be included in the unit bid price of the associated pipe. The footage to be paid for shall not include the construction into or through catch basins, manholes, and inlets.

3.05 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- A. High density polyethylene pipe shall be constructed as shown on the contract drawings and, in accordance with the Special Procedures - Division 01 and Section 608 of the State of Wisconsin, Department of Transportation, Standard Specifications, and in accordance with "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications" (ASTM D 2321) with the following exceptions and additions:
1. Joints for sewer pipe shall be sealed to be watertight in accordance with AASHTO Standard Specifications for Highway Bridges, Division II, Section 30.4.2.1
 2. Embedment shall be Class II or as indicated in Special Procedures - Division 01 and shall be incidental to storm sewer construction.
 3. Backfill shall be Type II as specified in Trenching and Backfilling - Division 31 or as indicated in Special Procedures - Division 01. Backfill shall be incidental to storm sewer construction.

3.06 POLYVINYL CHLORIDE PIPE (PVC)

- A. PVC pipe shall be constructed as shown on the contract drawings and in accordance with the Special Procedures - Division 01 and in accordance with "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications" (ASDM D2321) with the following exceptions:
1. Joints for sewer pipe shall be sealed to be water tight in accordance with AASHTO Standard Specifications for Highway Bridges, Division II, Section 30.4.2.1
 2. Embedment shall be Class II or as indicated in Special Procedures - Division 01 and shall be incidental to storm sewer construction.

3. Backfill shall be Type II as specified in Trenching and Backfilling - Division 31 or as indicated in Special Procedures - Division 01. Backfill shall be incidental to storm sewer construction.

3.07 LAYING SEWER PIPE FOR CURVES

- A. Sewers laid on curves shall be one of the following types:
 1. Deflection of pipe joints will be permitted when the joint opening is less than 1/2 the length of the tongue for mortar joints or 1/4 the length of the tongue with rubber gasket joints; otherwise use cut-off pipe or miter pipe.
 2. Cut-off pipe shall be molded with the difference between the longest and shortest sides, measured along the outside of the pipe, conforming to the values given in Table 1. Lengths of pipe other than that shown may be used only with approval of the Engineer.
 3. Miter pipe shall be manufactured by the removal of a wedge from the center of the pipe to provide for the required angle of deflection. Sufficient additional reinforcement shall be added at the spring lines and top and bottom of the pipe to prevent shearing after installation. Repairs to complete the pipe shall be such that the concrete shall have the same strength as that of the remainder of the pipe barrel and shall not spall or separate. Miter pipe shall be used for all elliptical pipe laid on a curve. Miter pipe for circular sewers shall be used only with the approval of the Engineer.

Table 1
Cut-Off of Pipe for Curved Sewer (inches)
(4-foot long pipe sections)

Pipe I.D. Inches	Radius of Curve in Feet							
	40	50	57.3	60	70	80	90	100
21	2-5/8	2-1/8	1-3/4	1-3/4	1-1/2	1-3/8	1-1/4	1/1/8
24	2-7/8	2-3/8	2	2	1-3/4	1/1/2	1-3/8	1-1/4
27	3-1/4	2-5/8	2-1/4	2-1/8	1-7/8	1-5/8	1-1/2	1-3/8
30	3-1/2	2-7/8	2-1/2	2-3/8	2-1/8	1-7/8	1-5/8	1-1/2
36	4-1/4	3-3/8	3	2-7/8	2-1/2	2-1/8	1-7/8	1-3/4
42	--	3-7/8	3-3/8	3-1/4	2-7/8	2-1/2	2-1/4	2
48	--	4-3/8	3-7/8	3-3/4	3-1/4	2-7/8	2-1/2	2-1/4
54	--	--	4-3/8	4-1/8	3-5/8	3-1/8	2-7/8	2-1/2
60	--	--	--	--	4	3-1/2	3-1/8	2-3/4
66	--	--	--	--	4-3/8	3-3/4	3-3/8	3-3/8
72	--	--	--	--	--	4-1/8	3-5/8	3-3/8
78	--	--	--	--	--	4-3/8	4	3-5/8
84	--	--	--	--	--	4-3/4	4-1/4	3-7/8
96	--	--	--	--	--	--	4-7/8	4-3/8

3.08 TESTING

- A. Leakage Testing. All storm sewers shall be tested for excessive infiltration and sand leakage. All sand leaks shall be repaired by the Contractor at his expense. If in the judgment of the Engineer the infiltration will cause a continued maintenance problem, the sewer shall be repaired by the Contractor at his expense.
- B. Alignment and Grade shall be checked by lamping method to detect poor alignment, offset joints, sags, kinks, or open joints; defects shall be corrected by the Contractor before final acceptance. If closer inspection is warranted, the Owner may arrange for a televised inspection. The Owner will assume the cost of televised inspection if no serious defect is found. If defects are found which the Engineer attributes to the failure of proper installation or sound materials, the Contractor shall pay for the test. Defects shall be promptly corrected.
- C. Deflection Limitation. Deflections in corrugated metal pipe shall be limited to 5 percent of the nominal pipe diameter. If visual inspection indicates a greater deflection, the Contractor shall supply and pull a rigid ball or

mandrel with a diameter 5 percent less than the nominal pipe size through the sewer. Failure of the ball to freely pass through shall be cause for rejection of the sewer.

- D. Deflection Test. All HDPE and PVC pipe installations shall be tested for deflection by using a rigid ball or mandrel and shall be performed in accordance with ASTM D2321 and without the use of mechanical pulling devices. Deflection may not exceed 5 percent if tested within 30 days of placement of final backfill or 7.5 percent if tested more than 30 days after final backfill is placed. Final backfill must be in place prior to testing.
- E. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective work.

3.09 PROTECTING OPENINGS

- A. Fences shall be provided around all openings and whenever required for the protection of the public. They shall be neat and substantial. All openings, fences, and surface obstructions shall be guarded and shall be indicated at night by suitable flashers.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Public storm utility drainage piping shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 PUBLIC STORM UTILITY DRAINAGE PIPING

- A. Storm Sewer, (Material), (Diameter), Lineal Foot. Measurement for the public storm utility drainage piping shall be for the lineal foot of storm sewer installed, measured to the center of inlets, catch basins and manholes. Payment shall be made at the contract unit price bid per lineal foot of storm sewer installed. Contractor shall furnish and install all bedding, fittings and appurtenances required to complete the project. All said costs shall be included in the respective storm sewer bid items.
- B. Apron Endwalls, Each. Measurement for apron endwalls will be for each endwall installed in accordance with the contract drawings and specifications. Endwall will not be included in lineal foot measurement of storm sewer pipe. Payment will be made at the contract price bid per each.

END OF SECTION