

# MFWP – MAKOSHIKA WATERLINE EXTENSION

## GLENDIVE, MONTANA

### DIVISION 01 GENERAL REQUIREMENTS

#### TABLE OF CONTENTS

#### DIVISION 01 – GENERAL REQUIREMENTS

SECTION	DOCUMENT
01 21 16 .....	Contingency Allowances
01 21 19 .....	Testing and Inspecting Allowances
01 21 43 .....	Time Allowances
01 22 19 .....	Measurement and Payment
01 29 73 .....	Schedule of Values
01 31 00 .....	Project Management and Coordination
01 32 00 .....	Construction Progress Documentation
01 33 00 .....	Submittal Procedure
01 35 29 .....	Health Safety and Emergency Response Procedures
01 35 43 .....	Environmental Procedures
01 41 00 .....	Regulatory Requirements
01 42 00 .....	References
01 45 00 .....	Quality Control
01 45 16 .....	Field Quality Control Procedures
01 51 00 .....	Temporary Utilities
01 52 00 .....	Construction Facilities
01 55 26 .....	Traffic Control
01 71 00 .....	Examination and Preparation
01 71 23 .....	Field Engineering and Surveying
01 74 23 .....	Final Cleaning
01 77 00 .....	Closeout Procedures
01 78 00 .....	Closeout Submittals
01 79 00 .....	Demonstration and Training
01 88 13 .....	Special Construction Performance Requirements

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

A. This section of the Contract Documents describes the procedures for items of the work for which allowances, other than testing, are established in the Bidder's Proposal.

**01.1.02 REFERENCES**

A. This section reserved.

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 21 19 TESTING AND INSPECTING ALLOWANCES**  
**SECTION 01 22 19 MEASUREMENT AND PAYMENT**

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 ALLOWANCE ITEMS**

A. An amount may be included in the Bidder's Proposal as an allowance for each of the following items:

Miscellaneous Work – XX Units @ \$1.00/Unit

B. **Technical Provisions**

1. Reserved

**01.3.02 PAYMENT FOR ALLOWANCE ITEMS**

A. The Contractor shall pay for the allowance items and submit to the Owner invoices for these payments with the monthly payment requests.

B. The Contractor will be reimbursed from the respective allowance amount in accordance with the legitimate invoices, with no mark ups, that are submitted.

C. The final amount for each allowance item will vary from that shown in the Bidder's Proposal and will be dependent on the costs of the approved invoices.

D. **Technical Provisions**

1. The Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
2. Any and all work performed not authorized by the Owner/Engineer shall be at the Contractor's expense. (PRSP-FV<sub>19</sub>)
3. Payment for allowance items may be allowed a markup approved by the Owner/Engineer, unless otherwise specified. The final amount for each allowance item shall be the agreed upon price approved by Owner/Engineer. (PRSP-FV<sub>19</sub>)

**01.3.03 INELIGIBLE COSTS FOR ALLOWANCE ITEMS**

A. Certain costs shall not be eligible for payment under allowance items. These costs shall be considered included in the price bid for work related to the work and no additional compensation will be made therefor.

**B. Technical Provisions**

1. Miscellaneous service line fittings and/or couplings required for connection to existing water service will not be eligible for payment or reimbursement outside of the bid item provided for such connection.
2. Labor and material costs associated with utility repairs will not be eligible for payment or reimbursement.

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents defines allowances for testing and inspection performed by the Contractor in accordance with their Quality Control plan and/or Quality Assurance testing.

**01.1.02 REFERENCES**

- A. This section reserved.

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

<b>SECTION 01 21 16</b>	<b>CONTIGENCY ALLOWANCES</b>
<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 TESTING AND INSPECTION ALLOWANCES**

- A. An amount is included in the Bidder's Proposal as an allowance for each of the following items:

1. Material Testing Allowance – XX Units @ \$1.00/Unit

B. **Technical Provisions**

1. Reserved

**01.3.02 PAYMENT FOR TESTING ALLOWANCES**

- A. The Contractor will be reimbursed in accordance with testing and inspection allowances, with payments based on the submitted invoice totals only. Any additions to the original invoice totals will not be reimbursed.

1. The final amount for the testing and inspection allowance item will vary from that shown in the Bid Form.

- B. The Contractor shall pay for the allowance items and submit to the Owner original invoices for all reimbursements. Contractor shall include original invoices with monthly pay requests for all requested payments under material testing allowances.

- C. Testing that will be paid for by the Owner under the Contract shall be those tests conducted in the field during construction as specified in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.

D. **Technical Provisions**

1. Reserved

**01.3.03 INELIGIBLE COSTS FOR TESTING ALLOWANCES**

- A. Certain testing and inspection costs shall not be eligible for payment under material testing allowance items.
-

- B. These costs shall be considered included in the price bid for related work and no additional compensation will be made therefor.
- C. The costs of the following aspects of Testing Laboratory Services shall not be paid for under the Materials Testing Allowance, if provided in the Bid Form.
  - 1. Mix Designs and Job Mix Formulas: Costs for mix designs and job mix formulas shall be paid for by the Contractor and will not be reimbursed to the Contractor by the Owner.
  - 2. Source and Quality: Costs for source of supply testing for constituent materials and production for, including but not limited to, mix designs, job mix formulas, aggregates, crushing, screening or other production operations to assure material source quality meets the Specifications shall be paid for by the Contractor and will not be reimbursed to the Contractor by the Owner.
  - 3. Non-compliance: When initial tests indicate non-compliance with the Contract Documents, the costs of initial tests associated with that non-compliance shall be paid for by the Contractor and will not be reimbursed to the Contractor by the Owner.
  - 4. Retesting: When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance, shall be performed by the same testing laboratory and the costs thereof will not be reimbursed to the Contractor.
  - 5. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the contract Documents.
  - 6. Contractor's Convenience Testing: Inspection or testing performed exclusively for the Contractor's convenience or quality control shall be the sole responsibility of the Contractor.
- D. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Document describes the time allowed for the Contractor to work on the Project.

**01.1.02 REFERENCES**

- A. This section reserved.

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**GENERAL CONDITIONS**

**01.1.04 COMPLETION OF WORK**

- A. The Contractor shall complete his work within the time stated in the Agreement Form after the Notice to Proceed is issued.
- B. All references to “Days” shall be clarified to be Calendar Days.
- C. The designated off days shall be all weekends and the following national holidays:
- |                             |                              |
|-----------------------------|------------------------------|
| Memorial Day                | Thanksgiving Day             |
| Independence Day            | Christmas Day                |
| Labor Day                   | New Year’s Day               |
| Martin Luther King, Jr. Day | George Washington’s Birthday |
| Columbus Day                | Veteran’s Day                |
- D. **Technical Provisions**
1. Reserved

**01.1.05 TIME OF WORK**

- A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on Saturdays, Sundays or legal holidays, without written permission of the Owner. However, maintenance or emergency work during these hours may be done without prior permission.
- B. All work shift times of the Contractor and his Subcontractors shall coincide with each other to prevent extending the total hours of work in a single day.
- C. **Technical Provisions**
1. Reserved

**01.1.06 WORK WEEK**

- A. 50 Hour Work Week. The provisions of this contract provide 50 hours per week for Contractor and his subcontractor to complete their work. Any work in excess of 50 hours is a violation of these contract documents, unless written approval is provided by both the Owner and Engineer allowing such overtime work the basis for approval of overtime work will be: 1) the impact such overtime work will have on the public community, 2) the impact such overtime work will have on the project schedule, and 3) the extra costs to the Owner that result from such overtime work.
- B. Overtime Notice: If the Contractor for convenience should desire to carry on work at night or outside of regular working hours (7:00 a.m. - 7:00 p.m.), the Contractor shall submit written notice to the Owner and Engineer and allow ample time for satisfactory arrangements to be made for observing work in progress as specified in Supplementary Conditions. The Engineer will be the sole judge of whether onsite observation is required.

1. Contractor shall submit written notice at least two (2) work days in advance of requested time, and be approved by the Engineer
- C. Onsite observation will be required when pipe or other items of work are being buried or otherwise concealed. The Contractor's payment to the Owner for observation services exceeding 50 hours per week will be for a maximum of two observers, or one observer per active crew, whichever is larger.
- D. Costs to the Owner that will be considered are direct expenses, overtime labor costs incurred by the Owner for maintaining City staff onsite (if necessary), and expenses incurred by the Owner for additional manpower by Engineer.
- E. Work in excess of 50 hours per week will, without the approval of both the Owner and Engineer, result in liquidated damage costs charged to the Contractor. Extra engineering costs associated with this work shall be in accordance with the rates shown within this section. These costs shall be limited to the actual additional engineering costs incurred by the Owner. Should the Contractor complete the work in a period of time such that no additional engineering costs are incurred by the Owner for overall project, the Contractor will not be assessed for the overtime hours worked. In this case, the withholdings will be refunded.
  1. Liquidated Damages (for work in excess of 50 hours per week) - Engineer Standard Labor Rates for the year the work is performed.
  2. For work exceeding 50 hours per week of the Engineer or employees of the Engineer, the Engineer's hourly rate schedule in effect at the time of work shall apply to this contract with a multiplier of 1.25. The rate schedule is available upon request.
- F. For work weeks that are less than 5 days as a result of holidays or weather delays, an adjustment may be allowed, if requested by the Contractor and approved by Owner and Engineer, to work up to 10 hours per day maximum over the weekend for up to a 50 hour week.
- G. **Technical Provisions**
  1. Reserved

**01.1.07 TIME ADJUSTMENTS**

- A. Time adjustments may be considered if the Contractor's work is delayed for reasons beyond their control as specified in **SECTION 00 72 00 GENERAL CONDITIONS**, Article 4 – Commencement and Progress of the Work. **(TP-1)**
- B. Additional delays and/or disruptions that may be considered for time adjustments are as follows:
  1. Rain days
- C. **Technical Provisions**
  1. Time adjustments may be considered if the Contractor's work is delayed for reasons beyond their control as specified in **GENERAL CONDITIONS**, Article 4.3.5 – Claims for Additional Time. **(MSP)**
  2. Rain days may be considered in 0.5 day increments from 7:00 am to 1:00 pm and 1:01 pm to 7:00 pm (local time). **(SID\_OFF)**
  3. Once a rain day request notification has been submitted no further work on and/or related to progress of construction may be performed. **(SID\_OFF)**
  4. Official requests for possible time adjustments shall be submitted in writing within 48 hours of occurrence and include justification and total time requested for Owner/Engineer's review. **(SID\_OFF)**

**01.1.08 WEATHER SHUTDOWNS**

- A. In the event the Contractor feels the current weather conditions are such that further progression of the work under stated conditions will adversely affect the project, the Contractor may choose to submit a written request to the Engineer for an abnormal weather or winter shutdown based on the following definitions and criteria.

1. Abnormal weather conditions shall be defined as extreme or unusual weather for a given region, elevation, or season as determined by data derived from the National Weather Service (NWS) or another approved source for a given location.
2. Winter shutdowns shall be considered a seasonal shutdown between construction seasons due to typical winter weather conditions.
  - a. The Owner may issue a mandatory winter shutdown for various construction operations if it is in the best interest of the community or the project.
- B. Requests for an abnormal weather or winter shutdown shall be submitted to the Owner/Engineer.
- C. A resume work order will be issued when conditions are such that work can be performed in accordance with the Specifications.
- D. Contractor is advised that should he request an abnormal weather or winter shutdown, and should such a shutdown be approved by the Engineer, all work on the project shall cease with the exception of required maintenance, protection of the site and work performed, and any work required by local/state/federal regulations and permits.
  1. Any damage and costs associated with repair to the immediate or adjacent site or work caused as a result of neglected duties of the Contractor to protect the site or work shall be at the Contractor's expense.
  2. Any costs related maintenance and protection of the site will be the responsibility of the Contractor, unless otherwise specified.
- E. The Engineer will not be available for construction observation during such shutdowns and any work completed by the Contractor during such a shutdown will not be accepted by the Engineer.
- F. The Contractor shall be required to provide a written Weather Shutdown Plan to the Engineer for approval prior to the execution of a Suspend Work Order.
- G. At a minimum the Weather Shutdown Plan shall address the following:
  1. Abnormal Weather & Winter Shutdowns
    - a. Contact information
    - b. Materials for road maintenance shall be consistent with the conditions of the roadway, or as approved by the Owner.
  2. Abnormal Weather
    - a. Roadway surface protection and daily maintenance and schedule.
  3. Winter Shutdowns
    - a. Roadway surface protection and periodic maintenance schedule.
- H. **Technical Provisions**
  1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

## **PART 1 GENERAL**

### **01.1.01 DESCRIPTION**

- A. The total bid price for each item of the contract shall cover all work described in the Project Manual and required by the specifications and other Contract Documents. All costs in connection with the work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction plans, equipment and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid. No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices.

### **01.1.02 ESTIMATED QUANTITIES**

- A. All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the work and (b) for the purpose of comparing the bids submitted for the work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished.

### **01.1.03 METHOD OF MEASUREMENT**

- A. Lump Sum: The term “lump sum” when used as a unit of measurement shall mean complete payment for that item of work as shown on the Drawings and specified herein.
- B. Length: All items that are measured by the linear measurement will be measured parallel to the axis of item being measured.
- C. Individual Unit or Each: When a complete item or unit is specified as the unit of measurement, the unit will be measured by physical count and will include all necessary accessories and appurtenances.
- D. Area: Dimensions for area will be made parallel to the plane of the work that is being measured.

### **01.1.04 BASIS OF PAYMENT**

#### **A. MOBILIZATION, TAXES, BONDS AND INSURANCE**

1. *Item No(s): X01*

The lump sum (LS) price bid for **MOBILIZATION, TAXES, BONDS AND INSURANCE** shall not exceed 12% of the total project awarded and shall be considered full compensation for the work complete in place as required in **DIV 01 GENERAL REQUIREMENTS** of these specifications. This work consists of preparatory work and operation performed by the Contractor, including, but not limited to, those necessary for: preparing schedules, the movement of his personnel, equipment, supplies, and incidentals to the project site, the establishment of all offices, buildings, project sign(s) and other facilities necessary for all work in the project, and for other work and operation that must be performed or costs incurred before beginning work and throughout the project on the various items on the project site, taxes, bonds and insurance, project coordination, scheduling, submittals and quality control, construction facilities and temporary controls, safety at the site, environmental quality control, applicable permits, Storm Water Pollution Prevention Plan if required, coordinate with cultural resource archaeologist procured by Owner, product shipment, handling, storage and protection, manufacturer's services, operation and maintenance manuals, completed record drawings, final cleanup and contract closeout (all the requirements contained in the contract documents). 60% of the amount bid for **MOBILIZATION, TAXES, BONDS AND INSURANCE** shall be paid when 5% of the Contract amount is paid for the Contract items and/or invoiced material in storage. Subsequent mobilization payments shall be based on percent of construction completed and accepted, excluding previous mobilization payments.

**B. PREFABRICATED BOOSTER STATION – INSTALLED**

1. *Item No(s): X02*

The lump sum (LS) price bid for **PREFABRICATED BOOSTER STATION – INSTALLED** shall be considered full compensation for the work complete in place and ready for its intended use as required by the Contract Documents. The lump sum price for **PREFABRICATED BOOSTER STATION – INSTALLED** shall be considered full compensation for the work complete in place of one unit of **PREFABRICATED BOOSTER STATION – INSTALLED** furnished and installed, including a new factory built and tested pump station, including Building; HVAC Equipment; Electrical Equipment; Connection Equipment; and monitoring system. Applicable items include, but are not limited to: furnishing all materials, labor and equipment necessary to connect factory-supplied piping to the Class 53 ductile iron piping for the intake and discharge lines; all above-grade piping; new factory built and tested pump station to be mounted atop the concrete foundation; start-up, testing, and adjustments by factory-trained technicians knowledgeable with the piping, control valves, and control systems; installation of any materials that may be shipped with the building but not attached to the building at the time of shipment; installing any and all other materials supplied with the building but not installed at the time of shipment; furnishing and installing gutters, downspouts and splash blocks; furnishing all materials, labor and equipment necessary to secure the pump station to the completed foundation; all specified electrical and control connections; and all labor, materials, equipment, trucking, offloading, supplies, and other work necessary to perform the work as specified on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 43 PACKAGED PUMPING SYSTEMS FOR WATER UTILITY SERVICE** for additional information.

- a. This work shall be paid lump sum (LS) per the above stated specification to provide a complete and operable system. No partial payment will be made until an approved schedule of values is on file with the Engineer.

**C. BOOSTER STATION – ELECTRICAL**

1. *Item No(s): X03*

The lump sum (LS) price bid for **BOOSTER STATION – ELECTRICAL** shall be considered full compensation for the work complete in place and ready for its intended use as required by the Contract Documents. The lump sum price for **BOOSTER STATION – ELECTRICAL** shall be considered full compensation for the work complete in place of one unit of **BOOSTER STATION – ELECTRICAL** furnished and installed, including site electrical, furnishing and installing power lines from the Owner's existing main distribution panelboard to the pump station and/or all appurtenances thereto; coordination with utility company; installing wires, conduits, labor, material, equipment, and all other work necessary as specified on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **PLANS** for additional information.

- a. This work shall be paid lump sum (LS) per the above stated specification to provide a complete and operable system. No partial payment will be made until an approved schedule of values is on file with the Engineer.

**D. BOOSTER STATION – SITE IMPROVEMENTS**

1. *Item No(s): X04*

The lump sum (LS) price bid for **BOOSTER STATION – SITE IMPROVEMENTS** shall be considered full compensation for the work complete in place and ready for its intended use as required by the Contract Documents. The lump sum price for **BOOSTER STATION – SITE IMPROVEMENTS** shall be considered full compensation for the work complete in place of one unit of **BOOSTER STATION – SITE IMPROVEMENTS** furnished and installed, including building drain pipe and appurtenances; concrete foundation; vertical ductile iron piping; concrete stoop; gravel

walking path; site grading; landscape restoration; erosion control measures and any other miscellaneous items located outside of the booster station and not covered under any other items. Applicable items include, all excavation and backfill, stripping, topsoil salvage, embankment, imported fill, compaction, subgrade preparation, base course, form work, water stop, reinforcing steel, structural concrete, releasing agent, consolidation, finishing, curing, specified anchoring, jointing, conduits, grout sleeve, wall penetrations, shoring, dewatering, vertical ductile iron pipe, 90° vertical bends, fittings for connection to all booster station piping, poly wrapping, detectable warning tape, drain line, outlet structure, screen, riprap, bedding, separation fabric, and appurtenances, cleaning, and all labor, material, testing, equipment, trucking, supplies, and all other work necessary as specified on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS** and other Related Work sections of these Specifications.

2. This work shall be paid lump sum (**LS**) per the above stated specification to provide a complete and operable system. No partial payment will be made until an approved schedule of values is on file with the Engineer.

**E. XX” HDPE DR17 WATER MAIN – (HDD) “HORIZONTAL DIRECTIONAL DRILL”**

1. *Item No(s): X05, X09, X11*

One unit of **XX” HDPE DR17 WATER MAIN – (HDD)** is defined as one lineal foot (**LF**) of **XX” HDPE DR17 WATER MAIN – (HDD)** measured along the horizontal centerline of the pipe installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **XX” HDPE DR17 WATER MAIN – (HDD)** shall be considered full compensation for the work complete in place of one unit of **XX” HDPE DR17 WATER MAIN – (HDD)** furnished and installed, including bore plan submittal, pipe, HDPE wall anchor with concrete HDPE adaptor, pipe bedding material, non-shrink backfill (as required), insulation board, entrance/exit pit excavation, backfilling, and compaction, detectable warning tape, quality control testing, existing utility verification and backfill, potholing, additional fittings, removal and disposal of surplus material and drill fluid, dewatering, shoring, bracing, cleaning, testing, all labor, equipment, trucking, supplies, means of purging air from the water lines, protecting existing structures, utilities and property both public and private regardless of whether shown on the plans or not, cleaning up the site, monitoring and Record Drawings (As-Builts), and all other work necessary for the complete in place installation of one unit of water main as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 05 07.13 UTILITY DIRECTIONAL DRILLING** and **33 05 33.23 POLYETHYLENE PRESSURE PIPE AND TUBING** for additional information.
  - a. Item shall be in reference to HDPE water main installed via directional drilling methods as shown on the Drawings. Directional drilling quantities will be paid for as defined by the stationing shown on the Drawings.
  - b. Damage to existing utilities, and property (both public and private) occurring due to the work being performed shall require complete restoration to the satisfaction of the Owner. No separate payment will be made for cleanup, restoration or erosion control measures due to disturbance or damage caused by the Contractor's operations outside of specified pay limits.
3. Pre-Approved Material, unless otherwise specified:
  - a. 6” HDPE DR17 PE4710 (Water Main)
  - b. 4” HDPE DR17 PE4710 (Water Main)
  - c. 3” HDPE DR17 PE4710 (Water Main)

**F. XX” DIP WATER MAIN – (OPEN CUT)**

1. *Item No(s): X07, X08*

One unit of **XX” DIP WATER MAIN – (OPEN CUT)** is defined as one lineal foot (**LF**) of **XX” DIP WATER MAIN – (OPEN CUT)** measured along the horizontal centerline of the pipe installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **XX” DIP WATER MAIN – (OPEN CUT)** shall be considered full compensation for the work complete in place of one unit of **XX” DIP WATER MAIN – (OPEN CUT)** furnished and installed, including pipe, pipe bedding material, non-shrink backfill (as required), trenching, backfilling, compaction, quality control testing, existing utility verification, additional fittings, mechanical joint restraints, insulation board, detectable warning tape, removal and disposal of appurtenances, and surplus material, shoring, dewatering, poly wrapping, cleaning, disinfecting, testing, all labor, equipment, trucking, supplies, means of purging air from the water lines, protecting existing structures, utilities and property both public and private regardless of whether shown on the plans or not, cleaning up the site, monitoring and Record Drawings (As-Builts), and all other work necessary for the complete in place installation of one unit of water main (various sizes) as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING** for additional information.
- a. Item shall be in reference to ductile iron pipe water main installed horizontally out of the 90° bend fitting below the booster station as shown on the Drawings.
  - b. Vertical ductile iron pipe installed as part of the booster station – site improvements is not included under this bid item.
  - c. Damage to existing utilities, and property (both public and private) occurring due to the work being performed shall require complete restoration to the satisfaction of the Owner. No separate payment will be made for cleanup, restoration or erosion control measures due to disturbance or damage caused by the Contractor's operations outside of specified pay limits.
3. Pre-Approved Material, unless otherwise specified:
- a. 6” Class 53 DIP
  - b. 4” Class 53 DIP

**G. XX” HDPE DR17 WATER MAIN – (ANY METHOD)**

1. *Item No(s): X06, X10, X12*

One unit of **XX” HDPE DR17 WATER MAIN – (ANY METHOD)** is defined as one lineal foot (**LF**) of **XX” HDPE DR17 WATER MAIN – (ANY METHOD)** measured along the horizontal centerline of the pipe installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **XX” HDPE DR17 WATER MAIN – (ANY METHOD)** shall be considered full compensation for the work complete in place of one unit of **XX” HDPE DR17 WATER MAIN – (ANY METHOD)** furnished and installed, including pipe, installation plan (method) submittal, pipe bedding material, non-shrink backfill (if required), trenching, backfilling, compaction, quality control testing, existing utility verification, additional fittings, mechanical joint restraints, insulation board, detectable warning tape, removal and disposal of appurtenances, and surplus material, dewatering, cleaning, disinfecting, testing, all labor, equipment, trucking, supplies, means of purging air from the water lines, protecting existing structures, utilities and property both public and private regardless of whether shown on the plans or not, cleaning up the site, monitoring and Record Drawings (As-Builts), and all other work necessary for the complete in place installation of one unit of water main (various sizes) as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 05 33.23 POLYETHYLENE PRESSURE PIPE AND TUBING** for additional information.
  - a. The Contractor shall be responsible for choosing and executing the appropriate construction method of installation.
  - b. Damage to roadways, existing utilities, and property (both public and private) occurring due to the work being performed shall require complete restoration to the satisfaction of the Owner. No separate payment will be made for cleanup, restoration or erosion control measures due to disturbance or damage caused by the Contractor's operations outside of specified pay limits.
3. Pre-Approved Material, unless otherwise specified:
  - a. 6" HDPE DR17 PE4710
  - b. 4" HDPE DR17 PE4710
  - c. 3" HDPE DR17 PE4710
4. Pre-approved Installation Methods:
  - a. Open-Cut
  - b. Horizontal Directional Drill (HDD)
  - c. Trenching
  - d. Plowing

**H. CONNECT TO EXISTING MAIN**

1. *Item No(s): X13*

One unit of **CONNECT TO EXISTING MAIN** is defined as one each (EA) permanent connection to an existing water main, complete in place. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **CONNECT TO EXISTING MAIN** shall be considered full compensation for the work complete in place of one unit of connection of a new water main to an existing water main, including existing utility verification, all additional pipe and fittings, adaptors, couplings, mechanical joint restraints, detectable warning tape, poly wrapping, concrete support block, insulation board, all excavation, backfill, and special compaction required for installation/backfill, sidewalk replacement if removed, dewatering, cleaning, flushing, disinfection, testing and all labor, materials, equipment, trucking, supplies, and other work necessary for a complete connection to an existing water main as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

**I. XX" GATE VALVE & RISER**

1. *Item No(s): X14 - X16*

One unit of **XX" GATE VALVE & RISER** is defined as one each (EA) **XX" GATE VALVE & RISER** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **XX" GATE VALVE & RISER** shall be considered full compensation for the work complete in place of one unit of gate valve (various sizes) and valve box (various lengths), furnished and installed, including gate valve, valve box, valve box riser, extensions, trench excavation and backfill, dewatering, special compaction required for installation/backfill, thrust blocking, mechanical joint restraints, epoxy coating, concrete support block, poly wrapping, cleaning, disinfection, testing, adjustments to finish grade, all materials, tools, labor, equipment, trucking, supplies, and other work necessary for the complete in place installation of one unit of **XX" gate valve and riser** as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 19 VALVES AND HYDRANTS FOR WATER UTILITY SERVICE** for additional information.

**J. DUCTILE IRON FITTINGS**

1. *Item No(s): X17 - X22*

One unit of **DUCTILE IRON FITTINGS** is defined as one each (EA) **DUCTILE IRON FITTINGS** furnished and installed. Measurement will be to the nearest 1 unit. The unit price bid per unit for **DUCTILE IRON FITTINGS** shall be considered full compensation for the work complete in place of one unit of ductile iron fittings (various sizes/types/depths) furnished and installed including trench excavation and backfill, bedding, concrete support block, thrust blocking, poly wrap, epoxy coating, gaskets, mechanical joint restraints, shoring, bracing, dewatering, compaction, cleaning, disinfection, testing, furnishing all tools, labor, equipment, trucking, supplies, and other work necessary for the complete in place installation of one unit of ductile iron fittings (various sizes/types) as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING** for additional information.

**K. UTILITY MARKER**

1. *Item No(s): X23*

One unit of **UTILITY MARKER** is defined as one each (EA) of **UTILITY MARKER** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid for **UTILITY MARKER** shall be considered full compensation for the work complete in place of one unit of utility marker assembly furnished and installed, including utility marker, self-adhesive decal, all labor, equipment, trucking, supplies, and all other work necessary for the complete in place installation of a utility marker as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 05 97.26 UTILITY DETECTABLE MARKINGS** and **DETAIL DRAWINGS** for additional information.

**L. TRACER WIRE**

1. *Item No(s): X24*

One unit of **TRACER WIRE** is defined as one lineal foot (LF) of **TRACER WIRE** furnished and installed to provide a complete and operable system, for its intended use. Measurement will be made to the nearest 1 unit and will be measured along the horizontal centerline of water main, services, and hydrant leads. The unit price bid per unit for **TRACER WIRE** shall be considered full compensation for the work complete in place of one unit of tracer wire furnished and installed along the water mains, services and hydrant leads, regardless of installation method used, tracer wire, connectors, splices, tracer wire access box, termination points (anode/grounding rod), continuity testing and all labor, materials, equipment, trucking, supplies, and other work necessary to install tracer wire as shown on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 05 97.26 UTILITY DETECTABLE MARKINGS** for additional information.

- a. No additional compensation will be made for procedures required to install tracer wire after water mains or services have already been installed and backfilled.
- b. No payment will be made for areas where tracer wire does not function as intended.
- c. Tracer wire installed via directional drilling methods shall be furnished with (2) runs of tracer wire per run. Compensation will be made for a single length of tracer wire at these locations.

**M. AIR-VACUUM ASSEMBLY**

1. *Item No(s): X25*

One unit of **AIR-VACUUM ASSEMBLY** is defined as one each (EA) of **AIR-VACUUM ASSEMBLY** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid for

**AIR-VACUUM ASSEMBLY** shall be considered full compensation for the work complete in place of one unit of air-vacuum assembly furnished and installed, including saddle, corp. stop, pipe, meter box, reducer, valves, platform, insulation, rope, cover, trench excavation and backfill, dewatering, special compaction required for installation/backfill, thrust blocking, poly wrapping, concrete blocks, gravel, cleaning, disinfection, testing, adjustments to finished grade, all materials, tools, labor, equipment, trucking, supplies, and all other work necessary for the complete in place installation of a air-vacuum assembly as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 17 WATER UTILITY SERVICE LATERALS, 33 14 19 VALVES AND HYDRANTS FOR WATER UTILITY SERVICE** and **DETAIL DRAWINGS** for additional information.

**N. 2" FLUSHING HYDRANT ASSEMBLY**

1. *Item No(s): X26*

One unit of **2" FLUSHING HYDRANT ASSEMBLY** is defined as one each (EA) of **2" FLUSHING HYDRANT ASSEMBLY** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid for **2" FLUSHING HYDRANT ASSEMBLY** shall be considered full compensation for the work complete in place of one unit of flushing hydrant assembly furnished and installed, including flushing hydrant assembly, saddle, corp. stop, curb stop valve, valve box, valve box riser, pipe, bedding, fittings, trench excavation and backfill, drain gravel, shoring, dewatering, thrust blocking, cleaning, disinfection, testing and all labor, materials, equipment, trucking, supplies, and other work necessary for a complete 2" flushing hydrant assembly as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 19 VALVES AND HYDRANTS FOR WATER UTILITY SERVICE** and **DETAIL DRAWINGS** for additional information.

**O. FROST-FREE HYDRANT ASSEMBLY**

1. *Item No(s): X27*

One unit of **FROST-FREE HYDRANT ASSEMBLY** is defined as one each (EA) of **FROST-FREE HYDRANT ASSEMBLY** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **FROST-FREE HYDRANT ASSEMBLY** shall be considered full compensation for the work complete in place of one unit of frost-free hydrant assembly furnished and installed, including frost-free hydrant assembly, fittings, drain gravel, concrete splash pad, pipe bedding, poly wrap, detectable warning tape, field adjustments/extensions, removal and disposal of surplus material, surface restoration, trench excavation and backfill, shoring, dewatering, cleaning, disinfection, testing, all labor, equipment, trucking, supplies, and all other work necessary for the complete in place installation of a frost-free hydrant assembly as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 19 VALVES AND HYDRANTS FOR WATER UTILITY SERVICE** and **DETAIL DRAWINGS** for additional information.

**P. 1" WATER SERVICE CONNECTION**

1. *Item No(s): X28*

One unit of **1" WATER SERVICE CONNECTION** is defined as one each (EA) **1" WATER SERVICE CONNECTION** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **1" WATER SERVICE CONNECTION** shall be considered full compensation for the work necessary to complete in place one unit of water service connection furnished and installed, including existing service size/location verification, new tapping saddle, corporation stop, water main tapping and necessary equipment/technology, couplings/fittings to connect to existing service lines, connection to existing service line, adaptors, restraints, bedding

gravel, all excavation, backfill, and special compaction required for installation, dewatering, pressure/leak testing, cleaning, testing and disinfection, and all labor, materials, equipment, trucking, supplies, and all other work necessary to complete in place one unit of water service connection as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 17 SITE WATER UTILITY SERVICE LATERALS** and **DETAIL DRAWINGS** for additional information.
  - a. Item shall be in reference to installation of water service appurtenances for water services smaller than 2" nominal diameter.
  - b. Installation of water service line, curb box, and curb stop are not included under this bid item.
  - c. All water service connections shall have a minimum 1" nominal diameter.

**Q. 1" SERVICE LINE**

1. *Item No(s): X29*

One unit of **1" SERVICE LINE** is defined as one lineal foot (**LF**) of **1" SERVICE LINE** measured along the horizontal centerline of the pipe installed from center of service saddle to the termination point at yard hydrant and/or or connection to existing service. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **1" SERVICE LINE** shall be considered full compensation for the work complete in place of one unit of **1" SERVICE LINE** furnished and installed, including pipe, stiffeners, bedding gravel, insulation board, trench excavation and backfill, compaction, shoring, dewatering, pressure/leak testing, cleaning, disinfection, testing, and all labor, equipment, trucking, supplies, and other work necessary for the complete in place installation (any method) of one unit of **1" SERVICE LINE** as shown on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 17 SITE WATER UTILITY SERVICE LATERALS** for additional information.
  - a. Item shall be in reference to installation of water service lines, regardless of material type, for water services smaller than 2" nominal diameter.
    - i. Service lines shall be polyethylene as specified in **SECTION 33 14 17 SITE WATER UTILITY SERVICE LATERALS** of these Specifications.
  - b. Installation of water service appurtenances, curb stop & box are not included under this bid item.

**R. 1" CURB STOP**

1. *Item No(s): X30*

One unit of **1" CURB STOP** is defined as one each (**EA**) **1" CURB STOP** furnished and installed. Measurement will be made to the nearest 1 unit. The unit price bid per unit for **1" CURB STOP** shall be considered full compensation for the work necessary to complete in place one unit of curb stop and box furnished and installed, including curb stop, curb box, bedding gravel, all excavation, backfill, and special compaction required for installation, dewatering, pressure/leak testing, cleaning, testing and disinfection, and all labor, materials, equipment, trucking, supplies, and all other work necessary to complete in place one unit of curb stop and box as shown on the Drawings, and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 33 UTILITIES** and other Related Work sections of these Specifications.

2. Refer to **33 14 17 SITE WATER UTILITY SERVICE LATERALS** for additional information.

**S. ASPHALT RESTORATION**

1. *Item No(s): X31*

One unit of **ASPHALT RESTORATION** is defined as one square yard (SY) of **ASPHALT RESTORATION**. Measurement will be made to the nearest 0.5 unit. The unit price bid per unit for **ASPHALT RESTORATION** shall be considered full compensation for the work necessary to complete in place one unit of asphalt restoration, including removal, regardless of type or depth, or method of removal and replacement, including subgrade preparation, placement, and compaction, crushed aggregate base course and bituminous asphalt pavement as shown on the Drawings, tack, installation, placement and compaction, including all labor, materials, equipment, trucking, supplies, disposal fees, and all other work necessary for a complete asphalt restoration as shown on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 31 EARTHWORK, DIV 32 EXTERIOR IMPROVEMENTS** and other Related Work sections of these Specifications.

2. Refer to **32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** for additional information.

a. Pay limits for **ASPHALT RESTORATION** shall be as follows:

- i. Maximum 12 – foot trench width (W) along centerline of mains and 10 – foot trench width (W) along centerline of services/hydrant leads.
- ii. Asphalt restoration outside the payment limits as defined in the Plans and Specifications shall be at the Contractor's expense, unless directed by the Owner or the Owner's Representative.

b. The quantity of **ASPHALT RESTORATION** may vary from the bid form. The quantity of asphalt restoration is considered a maximum quantity and may decrease in the event that the Contractor utilizes a minimally invasive installation method from the preapproved list for **XX" HDPE DR17 WATER MAIN – (ANY METHOD)**.

**T. GRAVEL RESTORATION**

1. *Item No(s): X32*

One unit of **GRAVEL RESTORATION** is defined as one square yard (SY) of **GRAVEL RESTORATION** measurement will be made to the nearest 0.5 unit. The unit price bid per unit for **GRAVEL RESTORATION** shall be considered full compensation for the work necessary to complete in place one unit of gravel restoration including removal and/or salvage of existing gravel surface, subgrade preparation, placement and compaction, crushed aggregate base and surface courses as shown on the Drawings, including all labor, materials, equipment, trucking, supplies, disposal fees, and all other work necessary for a complete gravel restoration as shown on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 32 EXTERIOR IMPROVEMENTS** and other Related Work sections of these Specifications.

2. Refer to **32 11 23 AGGREGATE BASE COURSE** for additional information.

a. Pay limits for **GRAVEL RESTORATION** shall be as follows:

- i. Maximum 12 – foot trench width (W) along centerline of mains and 10 – foot trench width (W) along centerline of services/hydrant leads.
- ii. Gravel restoration installed outside the payment limits as defined in the Plans and Specifications shall be at the Contractor's expense, unless directed by the Owner or the Owner's Representative.

b. The quantity of **GRAVEL RESTORATION** may vary from the bid form. The quantity of gravel restoration is considered a maximum quantity and may decrease in the event that the Contractor utilizes a minimally invasive installation method from the preapproved list for **XX" HDPE DR17 WATER MAIN – (ANY METHOD)**.

**U. GRASS RESTORATION**

1. *Item No(s): X33*

One unit of **GRASS RESTORATION** is defined as one square feet (**SF**) of **GRASS RESTORATION** measurement will be made to the nearest 0.5 unit. The unit price bid per unit for **GRASS RESTORATION** shall be considered full compensation for the work necessary to complete in place one unit of grass restoration, including all work necessary to import, strip, stockpile, and reuse topsoil for areas to be excavated in grassy areas if approved by Owner/Engineer, all work necessary to restore disturbed areas, including the removal and disposal of excess materials, subgrade preparation, compaction, erosion control methods, erosion control seed blanket, removal and reinstallation or replacement of landscape features, topsoil, permanent seeding and/or sod, removal and reinstallation or replacement of irrigation systems including sprinkler heads and piping, planters, all labor, materials, equipment, trucking, supplies, disposal fees and all other work necessary for a complete grass and landscape surface restoration as shown on the Drawings and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 32 EXTERIOR IMPROVEMENTS** and other Related Work sections of these Specifications.

2. Refer to **32 92 19 SEEDING** and **DETAIL DRAWINGS** for additional information.

a. Pay limits for **GRASS RESTORATION** shall be as follows:

i. Maximum 12 – foot trench width (W) along centerline of mains and 10 – foot trench width (W) along centerline of services/hydrant leads.

ii. Grass restoration installed outside the payment limits as defined in the Plans and Specifications shall be at the Contractor's expense, unless directed by the Owner or the Owner's Representative.

b. The quantity of **GRASS RESTORATION** may vary from the bid form. The quantity of grass restoration is considered a maximum quantity and may decrease in the event that the Contractor utilizes a minimally invasive installation method from the preapproved list for **XX" HDPE DR17 WATER MAIN – (ANY METHOD)**.

**V. EXPLORATORY EXCAVATION**

1. *Item No(s): X34*

One unit of **EXPLORATORY EXCAVATION** is defined as one hour (**HR**) of **EXPLORATORY EXCAVATION**, intended for unknown items not shown on the Drawings. Measurement will be made to the nearest 0.5 unit. The unit price bid per unit for **EXPLORATORY EXCAVATION** to verify size, material, location, depth, etc. of existing buried public utilities and shall be considered full compensation for the work necessary to complete one unit of exploratory excavation considered to be above and beyond a reasonable time for utility discovery, including excavating and backfilling operations, and standby time between excavation and backfill for one backhoe/excavator, one operator, and one laborer as directed and pre-approved by the Owner's Representative and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 31 EARTHWORK** and other Related Work sections of these Specifications.

2. Refer to **01 71 00 EXAMINATION AND PREPARATION** for additional information.

**W. IMPORTED BACKFILL**

1. *Item No(s): X35*

One unit of **IMPORTED BACKFILL** is defined as one cubic yard (**CY**) imported backfill furnished and installed using the average end area method. Measurement will be made to the nearest 1 unit. Haul tickets shall be submitted to the Owner's Representative at the end of each day. Haul tickets shall include: 1) Source of material, 2) Product hauled, 3) Name of project site or location, 4) Quantity of material. The unit price bid per unit of **IMPORTED BACKFILL** shall be considered full compensation for the work complete in place of one unit of imported backfill installation, including excavation of unsuitable material, installation of imported backfill, compaction, testing, labor,

equipment, trucking, supplies, and all other work necessary for the complete in place installation of imported backfill as pre-approved and directed by the Owner's Representative and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 31 EARTHWORK**, and other Related Work sections of these Specifications.

2. Refer to **31 23 33 TRENCHING AND BACKFILL** for additional information.
  - a. Item shall be in reference to imported backfill as necessary and approved by Owner/Engineer.
  - b. Imported backfill shall not be paid for Contractor's unwillingness to reasonably moisture condition existing backfill.
  - c. The quantity of **IMPORTED BACKFILL** may vary from the bid form. The quantity of imported backfill is considered a maximum quantity and may decrease in the event that the Contractor utilizes a minimally invasive installation method from the preapproved list for **XX" HDPE DR17 WATER MAIN – (ANY METHOD)**.

**X. TYPE II BEDDING**

1. *Item No(s): X36*

One unit of **TYPE II BEDDING** is defined as one cubic yard (**CY**) **TYPE II BEDDING** furnished and installed using the average end area method. Measurement will be made to the nearest 1 unit. Haul tickets shall be submitted to the Owner's Representative at the end of each day. Haul tickets shall include: 1) Source of material, 2) Product hauled, 3) Name of project site or location, 4) Quantity of material. The unit price bid per unit for **TYPE II BEDDING** shall be considered full compensation for the work complete in place of one unit of Type II bedding installation, including excavation of unsuitable material, compaction of the area created by the excavation of the unsuitable material, installation placement, and compaction of type II bedding material, and all labor, equipment, trucking, supplies, and other work necessary for the complete in place installation of **TYPE II BEDDING** as pre-approved and directed by the Owner's Representative and as specified in **DIV 01 GENERAL REQUIREMENTS, DIV 31 EARTHWORK**, and other Related Work sections of these Specifications.

2. Refer to **31 23 33 TRENCHING AND BACKFILL** for additional information.
  - a. Item shall be in reference to Type II bedding as necessary and approved by Owner/Engineer.
  - b. Type I pipe bedding material as shown on the Drawings for water main and appurtenance is not included under this bid item.
  - c. The quantity of **TYPE II BEDDING** may vary from the bid form. The quantity of Type II bedding is considered a maximum quantity and may decrease in the event that the Contractor utilizes a minimally invasive installation method from the preapproved list for **XX" HDPE DR17 WATER MAIN – (ANY METHOD)**.

**Y. TRAFFIC CONTROL**

1. *Item No(s): X37*

One unit of **TRAFFIC CONTROL** is defined as lump sum (**LS**). Twenty-five percent (25%) of the amount bid for **TRAFFIC CONTROL** shall be paid when five percent (5%) of the Contract amount is paid for the Contract items and/or invoiced material in storage. Subsequent payments shall be based on percent of construction completed and accepted, excluding previous payments. The lump sum price bid for **TRAFFIC CONTROL** shall be considered full compensation for the work necessary to provide, maintenance, dust suppressant, replace and operate traffic control for the duration of the project, including all labor, materials, equipment, trucking, supplies, and all other work necessary per local/state/federal regulations as specified in **DIV 01 GENERAL REQUIREMENTS** and other Related Work sections of these Specifications.

2. Refer to **01 55 26 TRAFFIC CONTROL** for additional information.

**Z. MISCELLANEOUS WORK**

1. *Item No(s): X38*

This item shall be paid for by the single unit (**UNIT**), each unit representing one dollar. The unit price bid for **MISCELLANEOUS WORK** is an allowance for work to be done that may be discovered during the course of the project as directed by the Owner's Representative. Starting work before approval by the Owner's Representative may result in no payment for the work. Contractor shall submit to the Owner invoices for item(s) and/or work paid under this bid item unless otherwise approved by the Owner. Payment for work under this item will be in accordance with the provisions of **DIV 01 GENERAL REQUIREMENTS** and other Related Work sections of these Specifications.

2. Refer to **01 21 16 CONTINGENCY ALLOWANCES** for additional information.

**AA. MATERIAL TESTING ALLOWANCE**

1. *Item No: X39*

This item shall be paid for by the single unit (**UNIT**), each unit representing one dollar. The unit price bid for **MATERIAL TESTING ALLOWANCE** is an allowance to be used by the Contractor to be paid for providing the specified testing required. Payment for field testing will be for initial passing tests. The Contractor will be paid actual invoiced amounts with no mark up allowed. Quality assurance re-testing due to failing tests will be performed by the Contractor's quality assurance testing agency and then re-test costs will be responsibility of the Contractor with no reimbursement by the Owner. Payment for work under this item will be in accordance with the provisions of **DIV 01 GENERAL REQUIREMENTS** and other Related Work sections of these Specifications.

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents describes the requirements for the submittal of the Contractor's schedule of values.

**01.1.02 REFERENCES**

- A. This section reserved.

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**GENERAL CONDITIONS**

**SECTION 01 22 19 MEASUREMENT AND PAYMENT**

**01.1.04 SUBMITTAL**

- A. The Contractor shall submit a typed Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.
1. Format: For Lump Sum items, the schedule of values for all Work is to include quantities and prices of items aggregating the Contract Price, and is to subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will represent a true measure of the labor and materials required to perform the work, and include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by Contractor at the time of submission.
  2. Format: For unit cost items, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
  3. The schedule is to include an estimated monthly drawdown schedule for Contractor payment for the duration of the project.
  4. Revise schedule to list approved Change Orders, with each Application for Payment.
  5. The schedule will serve as a basis for payment when changes in quantities or the elimination of certain items are agreed upon by the Owner.

**B. Technical Provisions**

1. Reserved

**01.1.05 PAYMENT**

- A. No partial payment will be made on any lump sum item until an approved schedule of values for that item in which payment is requested is on file with the Engineer.

**B. Technical Provisions**

1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents includes the Contractor's coordination of the work with Subcontractors, the Owner, and affected property and utility owners.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**INVITATION TO BID  
GENERAL CONDITIONS  
SECTION 01 33 00 SUBMITTAL PROCEDURES**

**01.1.03 SUBMITTALS**

- A. The Contractor shall submit to the Owner and Engineer the following information as applicable to coordination activities:

1. Subsurface Information and Utilities.
  - a. Records or logs of borings or test holes by the Contractor, if any.
  - b. Results of exploratory excavations made to verify locations and nature, shape, dimensions, etc., of existing utilities and facilities. Where possible, indicate this information on a clean copy of Contract Drawings.
2. Field Relocation: Clearly show proposed relocation of new and existing facilities, or related work affected by the relocation, on a clean copy of the Contract Drawings and submit in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES**, prior to performing the relocation.
3. Connecting Work: Proposed methods of connecting new work to existing facilities, where not shown or specified.
4. Leases: Copy of leases and other agreements obtained from public agencies or private owners as required for the Contractor's staging and material storage areas.
5. Temporary Operations: Detailed plans for all temporary operations necessary to construct proposed facilities.

B. **Technical Provisions**

1. Reserved

**01.1.04 CONTRACTOR COORDINATION**

- A. The Contractor shall furnish to the Owner's Representative a list of the field superintendent, foreman, those responsible for the 24-hour maintenance of traffic control devices, temporary water (if applicable), and emergency contact person(s). Providing the data to the Owner's Representative does not release the Contractor from responsibility for 24-hour maintenance and protection of the project site.

- B. This list shall include the following data:

1. Name of the individual(s).
2. Title

3. Phone numbers. In case of the person(s) responsible for emergencies and the maintenance of the traffic control devices these numbers must include one at which said person(s) can be reached 24 hours a day, 7 days a week, including Saturdays, Sundays and Holidays.

**C. Technical Provisions**

1. Reserved

**01.1.05 MEETINGS**

- A. Meetings will be scheduled by the Owner's Representative during project construction as deemed necessary.
1. The Contractor or a responsible representative who can bind the Contractor to a decision shall attend the meetings.
- B. A pre-construction meeting will be held after the Contractor has submitted signed copies of the Construction Agreement and required bonding instruments and insurance certificates. At this meeting, the Plans, Specifications and project scope and any other issues pertaining to the project shall be discussed. A Notice to Proceed date shall be established and the Notice-to-Proceed issued, the preliminary work schedule shall be agreed upon by the Engineer and Contractor and a written work schedule submitted to the Engineer immediately after the pre-construction meeting.
- C. The following meetings shall be attended by a representative of the Contractor, Owner's Representative, and Owner:
1. Pre-Bid meeting, as required in invitation to bid.
  2. Pre-construction meeting.
  3. Weekly Progress meetings.
  4. Final walk-through meetings for substantial completion and final completion.
- D. Notice of meetings to be attended by the Contractor, Owner and Owner's Representative will be sent to those required to attend and copies to interested parties such as governmental and funding agencies.
1. The Owner's Representative will send the notice of meetings and will prepare and distribute the meeting minutes.
  2. Attendees of the meeting shall be responsible for the review of meeting minutes for completeness and correctness.
  3. Comments shall be forwarded to the person that prepared the minutes.
  4. After seven days of meeting minute distribution, or a deadline set forth otherwise, the meeting minutes will become a part of the project record.
- E. Sections of the Specifications may require coordination meetings between the Contractor and the trade people performing the specified work.
1. The Contractor shall be responsible for sending notification of said meetings to the Owner's Representative and Subcontractors involved with the particular work item.
  2. Owner's Representative is not required to attend these meetings unless specifically requested by the Contractor.
  3. Contractor shall be responsible for preparation and distribution of meeting minutes.

**F. Technical Provisions**

1. Reserved

**01.1.06 USE OF SITE**

- A. This section of the Specifications describes the requirements for the Contractor's use of the site.

- B. The Contractor shall confine all operations to areas shown on the Drawings or specified herein.
  - 1. The Contractor shall not encumber any area of the site with materials or equipment.
  - 2. The Owner shall approve the use of temporary, on-site, storage areas. **(TP-1)**
- C. The Contractor shall coordinate with the Owner for the use of any field or office facilities. The Contractor shall pay all costs associated with obtaining necessary field and office facilities in connection with the project. No additional cost shall be incurred by the Owner.
- D. The protection and safekeeping of all equipment and materials stored on site or within the staging yard/area shall be the responsibility of the Contractor. No claim shall be made by the Contractor against the Owner or Engineer by reason of any act of an employee or trespasser.
- E. The Contractor shall further provide access to the staging or yard areas should it be necessary or requested by the Owner. The Contractor shall comply and provide access by moving or removing any necessary equipment or materials. Accommodation and costs associated with the access shall be the responsibility of the Contractor.
- F. Prior to placement of any equipment, materials, or facilities, the Contractor shall obtain, in writing, permission from the property owner. The Contractor shall be responsible for all costs in connection with acquisition of any additional work area, storage sites, site access, or temporary construction rights-of-way. The Contractor shall provide written evidence of permission to the Engineer when requested.
- G. Contractor shall maintain the work area during this Contract and shall proceed with his/her work in an orderly manner, maintaining the project site free of debris and unnecessary equipment and/or materials.
- H. At all times, Contractor shall maintain work areas covered by this Contract and public/private properties free from accumulations of waste, debris, and rubbish. Excavated materials shall be removed from the site in a manner that will cause the least damage to adjacent areas.
- I. Cleaning and disposal operations shall comply with local ordinances and antipollution laws. Contractor may not burn or bury rubbish and waste materials on the project site. Disposal of volatile wastes such as mineral spirits, oil, other chemical or paint thinners will not be allowed at the project site. No wastes shall be disposed of into streams, ditches, or waterways.
- J. Contractor shall provide approved containers for collection and disposal of waste materials, debris, and rubbish and shall make arrangements for appropriate periodic emptying of those containers.
- K. Contractor shall construct temporary service access roads and detours as may be required to execute the work. The roads shall meet standards with the written approval of the Owner/MDT/County/City, as applicable, and be maintained in good condition until no longer needed, at which time the temporary roads shall be removed and the area restored to its original condition or to a condition satisfactory to Owner/MDT/County/City, as applicable.
- L. **Technical Provisions**
  - 1. **Owner has provided a construction staging area, for use by Contractor, in the open field across from the Buccaneer Shelter, as located on sheet C-1 of the plans. (MSP)**
  - 2. **Construction activities shall limit the disruption of public access to the Visitor Center's Parking Lot, Cain's Campground, Buccaneer Shelter, Folf Course and Makoshika State Park Road. A minimum of one lane and/or entrance shall be open across the Project at all times throughout the construction day. Both lanes shall be opened to traffic before the Contractor leaves the site at the end of the day. The park is open to visitors year-round from 7am to 10 pm MST. (MSP)**

**01.1.07 COORDINATION WITH OTHER WORK**

- A. The Contractor is advised that other Contractors or private utility companies may be installing/relocating improvements such as power, lighting, natural gas and communications during the time this project is under construction. The Contractor will coordinate the work on this Project so as not to impede work by others.

- B. The Owner may perform additional work related to this project himself, or he may let other direct contracts therefore which shall contain General Conditions and General Requirements similar to these. The Contractor shall afford the other contractors who are parties to such direct contracts, (or Owner if he is performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and execution of work, and shall properly connect and coordinate his work with theirs.
- C. If any part of the Contractor's work depends on proper execution or results from the work of any such other Contractor (or Owner), the Contractor shall inspect and promptly report to the Owner and Engineer in writing any defects or deficiencies in such work that renders it unsuitable for such proper execution or results. His failure to so report shall constitute an acceptance of the other work as fit and proper for the execution of his work except as to defects and deficiencies which may appear in the other work after the execution of his work.
- D. The Contractor shall do all cutting, fitting, and patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of the Engineer and the other contractors whose work will be affected.
- E. If the performance of additional work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional work. If the Contractor believes that the performance of such additional work by Owner or others involves him in additional expense or entitles him to an extension of the contract time, he may make a claim therefore.
- F. The Contractor shall be responsible for all areas of the site used by him and all Subcontractors in performance of the work. He shall exert full control over the action of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to the owners or others.
- G. The Contractor and all Subcontractors shall cooperate in the coordination of their separate activities in a manner that will provide the least interference with the Owner's operations and in the interfacing and connection of the separate elements of the overall project work. If any difficulty or dispute should arise in the accomplishment of the above, the problem shall be brought immediately to the attention of the Owner and Engineer. All Contractors working on this site are subject to this requirement for cooperation, and all shall abide by the Engineer's decision in resolving project coordination problems without additional cost to the Owner.
- H. **Technical Provisions**
  - 1. Reserved

**01.1.08 COORDINATION WITH LAND OWNERS**

- A. All of this Project will be constructed on property of the Owner.
- B. Contractor shall notify property owners or tenants of the approaching work in order to arrange for the removal of parked vehicles or other items in the construction path that would interfere with construction operations. Contractor shall notify, in writing, property owners or tenants two (2) to five (5) days prior to start of work. If work is not started within the time specified, Contractor shall re-notify property owners or tenants until work has actually commenced.
- C. Access and Parking
  - 1. The Contractor must maintain ingress and egress to all camp grounds and parking lots that may be affected by the project construction. If an access needs to be blocked or closed for any reason, the Contractor will notify the Owner 24-hours prior to the closure/limited use and complete work necessary to remove the blockage as soon as possible. In no case shall the property access be obstructed for more than 24-hours. **(TP-1)**
  - 2. Access for garbage pickup and mail delivery must be provided.

**D. Technical Provisions**

1. The Contractor shall notify the Owner a minimum of 48 hours notice before any access to a parking lot or campground needs to be closed. At least one access to each campground or parking lot shall be maintained and open to the public at all times. **(MSP)**

**01.1.09 COORDINATION WITH POWER UTILITIES**

- A. When the Contractor works near electrical power lines, the Contractor may make arrangements with the power company, at no expense to the Owner, to:
1. Temporarily shut off the power or utility.
  2. Temporarily insulate the line(s).
  3. By-pass the power or utility from the work area, or
  4. Make other arrangements necessary for a safe work place.
- B. No warranty is made as to whether the utility will temporarily shut off power or insulate its line(s), or as to the fee charged for preparing a safe work area for the Contractor.
- C. Construction operations adjacent to utility property shall not be commenced until arrangements satisfactory to the utility owner have been made by the Contractor for the protection of the utility's property and continuation of service.
1. Should any of the Contractor's equipment come in contact with or damage utility property in any way, even though there may be no apparent evidence of breakage or harm, the Contractor shall promptly notify the proper authorities.
  2. The Contractor shall also cooperate with the utility owner or proper authority in determining damage and restoring interrupted services as may be needed.
  3. Where contact is made with a utility, operations should be suspended immediately.
  4. The Contractor shall vacate the site until the utility owner determines that it is safe to resume operations.
- D. The Contractor shall employ special equipment or construction methods and hand labor if necessary to accomplish the work as planned adjacent to utility properties without damage thereto.
- E. At no time shall the Contractor interfere with any persons engaged in protecting or moving utility property or in the operation of the utility.
- F. **Technical Provisions**
1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**End of Section**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents describes the requirements for construction progress documentation.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**GENERAL CONDITIONS**  
**SECTION 01 33 00 SUBMITTAL PROCEDURES**

**01.1.03 SUBMITTAL SCHEDULE**

- A. The Contractor shall submit initial submittal schedule in accordance with the **GENERAL CONDITIONS** of the Contract and as follows:
1. Coordinate submittal schedule with the Subcontractors, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
  2. Prepare the schedule in chronological order and provide the following information:
    - a. Scheduled date for the first submittal
    - b. Related Section number
    - c. Submittal category (Shop Drawings, Product Data, or Samples)
    - d. Name of the Subcontractor
    - e. Description of the part of the work covered
    - f. Scheduled date for the Owner's Representative's final release
- B. Following response to the initial submittal schedule, the Contractor shall print and distribute copies of the revised submittal schedule to the Owner's Representative, Owner, Subcontractors, and other parties required to comply with submittal dates indicated.
1. Copies shall be posted in the field office.
  2. When revisions are made, the Contractor shall distribute to the same parties and post in the same locations.
  3. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- C. Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.
- D. **Technical Provisions**
1. Reserved

**01.1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. The Contractor shall prepare and submit to the Owner's Representative prior to submission of each Application and Certificate for Payment, a construction schedule of the work activities from the Notice to Proceed until Substantial Completion.
- B. A work activity is defined as an activity that requires substantial time and resources (manpower, equipment, and/or material) to complete and must be performed before the contract is considered complete.

- C. The schedule shall indicate the sequence of work activities.
- D. Each activity shall be identified with a description, start date, completion date, and duration. It shall include, but not be limited to, the following items, as appropriate to this contract:
  - 1. Shop drawing review by the Owner's Representative
  - 2. Material and Equipment
    - a. Order
    - b. Manufacture
    - c. Delivery
    - d. Installation
    - e. Check out
  - 3. Performance tests and supervisory service activities
  - 4. Excavation and grading
  - 5. Concrete placement sequence
  - 6. Construction of various facilities
  - 7. Construction of various segments of utilities
  - 8. Subcontractor's items of work
  - 9. Allowance for inclement weather
  - 10. Contract interfaces, date of Substantial Completion
  - 11. Interfacing and sequencing with existing facilities and utilities
  - 12. Sequencing of major construction activities
  - 13. Milestones and completion dates
- E. Following response to the initial submittal, the Contractor shall print and distribute copies of the revised construction schedule to the Owner's Representative, Owner, Subcontractors, and other parties required to comply with scheduled dates.
  - 1. Post copies in the field office.
  - 2. When revisions are made, distribute to the same parties and post in the same locations.
- F. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- G. Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting and with each application for payment.
- H. Prepare and submit to the Owner's Representative within ten (10) days after substantial completion a detailed construction schedule for outstanding work and punch list items.
- I. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents includes administrative, material, and procedural requirements for submittals required for performance of the work.

**01.1.02 SUBMITTAL REQUIREMENTS SHALL BE MET**

- A. Failure to meet Submittal requirements to the satisfaction of the Engineer will constitute unsatisfactory performance of the work in accordance with the Contract Documents. The Engineer may recommend to the Owner that all or a portion of payments requested during the corresponding pay period be withheld until these requirements are met.
- B. Materials incorporated into the project without the required submittals, are done so at the Contractor's risk.
- C. **Technical Provisions**
  - 1. Reserved

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of these Specifications:

**GENERAL CONDITIONS**  
**SECTION 01 78 00 CLOSEOUT SUBMITTALS**

**01.1.04 DEFINITIONS**

- A. Shop drawings are drawings, diagrams, schedules and other data specially prepared for the work by the Contractor or Subcontractor, Sub-Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the work.
- B. Product data are illustrations, standard schedules, performance charts, instructions, brochures diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
- C. Samples are physical examples that illustrate materials, colors, equipment or workmanship and establish standards by which the work will be judged.
- D. Coordination drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- E. Manufacturer's Instructions include delivery, storage, handling, assembly, installation, adjustment, start-up, operation, maintenance, and finishing as applicable.
- F. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the work will be judged.
- G. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not samples.
- H. **Technical Provisions**
  - 1. Reserved

**01.1.05 ENGINEER'S REVIEW AND RESPONSIBILITIES**

- A. Except for submittals for the record of information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
- B. The Engineer will return unsolicited submittals to the sender without action.
- C. The Engineer will stamp each submittal with a uniform action stamp.

- D. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:
1. “No Exceptions Taken” The work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
  2. “Make Corrections Noted” The work covered by the submittal may proceed provided it complies with notations and corrections on the submittal and requirements of the Contract Documents.
  3. “Revise and Resubmit” Do not proceed with work covered by the submittal. Revise and resubmit without delay. Do not use, or allow others to use, submittals marked “Revise and Resubmit” at the Project Site or elsewhere where work is in progress.
  4. “Not Acc.(eptable)” Do not proceed with work covered by the submittal. Resubmit without delay. Do not use, or allow others to use, submittals marked “Not Acc.” at the Project Site or elsewhere the work is in progress.
- E. **Technical Provisions**
1. Engineer will review one (1) submittal for each individual submittal item, at no cost to the Contractor. Engineer will record Engineer’s costs in reviewing all subsequent re-submissions for any rejected item. Contractor shall reimburse Engineer’s Costs in reviewing all subsequent submittals. Reimbursement of Engineer’s Cost shall be deducted from the contract sum by Change Order at the Engineer’s standard labor rates for the year the work is performed. **(MSP)**

**01.1.06 ADMINISTRATIVE SUBMITTALS**

- A. The following submittals may be required and are included in other sections of the Contract Documents.
- B. This list is not meant to be all inclusive, Contractor shall be responsible for submitting all material required by the Contract Documents.
- C. Submittals not included herein:
- Administrative Submittals - Refer to **GENERAL CONDITIONS** and **DIVISION 01** for additional information.
- a. Such submittals include, but are not limited to, the following:
    - i. List of Subcontractors.
    - ii. Health and safety plan, as required.
    - iii. Schedule of values.
    - iv. Submittal Schedule.
    - v. Construction progress schedule.
    - vi. Application and Certificate for Payment.
    - vii. Requests for Change Order.
  2. Traffic Control Plan (if applicable) – Refer to **SECTION 01 55 26 TRAFFIC CONTROL** for additional information.
  3. Closeout Submittals – Refer to **SECTION 01 78 00 CLOSEOUT SUBMITTALS** for additional information.
    - a. Such submittals include, but are not limited to, the following:
      - i. Record drawings.
      - ii. O&M manuals.
      - iii. Warranties.

**D. Technical Provisions**

1. Water main testing methods and sequencing plan shall be furnished in accordance with the provisions of **SECTION 33 01 12 INSPECTION AND TESTING OF WATER UTILITIES** of these Specifications. **(PRSP)**
2. Horizontal Directional Drilling submittals shall be furnished in accordance with the provisions of **SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING** of these Specifications. **(PRSP)**

**01.1.07 SUBMITTAL PROCEDURES**

- A. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.
- B. The Contractor shall transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
  3. To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals. **(TP-1)**
- C. The Contractor shall place a permanent label or title block on each submittal for identification. Including the name of the entity that prepared each submittal on the label or title block.
  1. Assign a reference number to each submittal and re-submittal.
  2. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken by the Contractor.
  3. Include the following information on the label for processing and recording action taken.
    - a. Project name
    - b. Date
    - c. Name and address of the Owner's Representative
    - d. Name and address of the Contractor
    - e. Name and address of the Subcontractor
    - f. Name and address of the supplier
    - g. Name of the manufacturer
    - h. Number and title of appropriate Specification Section
    - i. Drawing number and detail references, as appropriate
  4. Each submittal must be stamped by the Contractor indicating that the submittal was reviewed for conformance with the Contract Documents.
  5. The Engineer will not accept nor review submittals that have not been signed and stamped by the Contractor.
  6. The Engineer will not accept nor review submittals from suppliers or Subcontractors.
- D. The Contractor shall package each submittal appropriately for transmittal and handling.
  1. Transmit each submittal from the Contractor to the Owner's Representative.

2. The Engineer will not accept submittals received from sources other than the Contractor and will return same to the sender.
3. On the transmittal, record relevant information and requests for Engineer action.
4. On the form, or separate sheet, record deviations from Contract Document requirements, including variations, limitations and justification.
5. Include Contractor's certification that information complies with Contract Document requirement.

**E. Technical Provisions**

1. **In accordance with the General Conditions, the Contractor shall submit to the Engineer within Fifteen (15) days from the date of the Notice to Proceed a minimum of Two (2) complete copies of all shop/setting drawings, schedules, cut sheets, products, product data, and samples required for the complete work. (MSP)**

**01.1.08 SHOP DRAWINGS**

Shop drawings shall be submitted in accordance with the General Conditions and the following:

- A. The Contractor shall submit a minimum of two (2) copies of shop drawings and/or manufacturer's literature as specified herein prior to commencing the fabrication, manufacture, or installation of items to be incorporated in the work.
  1. Shop drawings shall present all diagrams, illustrations, performance data, manufacturer's literature, setting diagrams, patterns, templates, schedules, and similar drawings and any other data necessary to demonstrate conformance with these Specifications.
  2. Certifications where required by these Specifications shall be included with shop drawing submittals.
- B. The Contractor shall review each shop drawing before submitting it to the Engineer to determine that it is acceptable in terms of means, methods, techniques, sequences, and operation of construction, safety precautions and programs incidental thereto, all of which are the Contractor's responsibility.
  1. The Contractor shall call to the Engineer's attention any shop drawing or detail thereon which varies from what the Specifications have called for.
  2. Shop drawings that are submitted by the Contractor, but not required by the Specifications, shall be returned to the Contractor and shall not be reviewed.
- C. Shop drawings which are reviewed by the Engineer shall be stamped with the Engineer's review action stamp prior to being returned to the Contractor.
  1. The Engineer's review shall consist of checking only for conformance with the design concept of the project and compliance with the information given in the Contract Documents.
  2. The Contractor is responsible for dimensions to be confirmed and correlated at the job site for information that pertains solely to the fabrication processes of the techniques of construction and for coordination of the work of all trades.
- D. The Contractor shall not use shop drawings without an appropriate final stamp indicating action taken.
- E. **Technical Provisions**
  1. Reserved

**01.1.09 PRODUCT DATA**

- A. The Contractor shall collect product data into a single submittal for each element of construction or system.
- B. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

- C. The Contractor shall mark each copy to show actual product to be provided.
  - 1. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information.
  - 2. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Application of testing agency labels and seals.
    - e. Notation of dimensions verified by field measurement.
    - f. Notation of coordination requirements.
- D. The Contractor shall not submit Product Data until they have confirmed compliance with all requirements of the Contract Documents.
- E. The Contractor shall submit two (2) copies of each required submittal, unless otherwise requested.
  - 1. The Engineer will retain the original copy, and will return one to the Contractor marked with action taken and corrections or modifications required.
  - 2. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the reviewed submittal.
- F. The Contractor shall furnish copies of reviewed submittals to installers, subcontractors, suppliers, manufactures, fabricators, and others as required for performance of construction activities.
  - 1. Show distribution on transmittal forms. Maintain one copy at the project site for reference.
  - 2. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
  - 3. Do not permit use of unmarked copies of Product Data in connection with construction.
- G. **Technical Provisions**
  - 1. Reserved

**01.1.10**    **SAMPLES**

- A. The Contractor shall submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed.
- B. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
- C. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated.
  - 1. Include the following:
    - a. Specification section number and reference.
    - b. Generic description of the sample.
    - c. Sample source.
    - d. Product name or name of the manufacturer.
    - e. Compliance with recognized standards.
    - f. Availability and deliver time.
  - 2. Submit samples for review of size, kind, color, pattern, and texture.
    - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three multiple units that show approximate limits of the variations.

- b. Refer to other specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
  - c. Refer to other sections for samples to be returned to the Contractor for incorporation in the special requests regarding disposition of sample submittals.
  - d. Samples not incorporated into the work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
- D. Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, the Contractor shall submit two (2) samples for review.
- 1. The Engineer will return one sample marked with the action taken.
- E. The Contractor shall prepare and distribute additional samples to Subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work.
- 1. Show distribution on transmittal forms.
  - 2. Maintain reviewed samples at the project site for quality comparisons throughout the course of construction.
- F. The Contractor shall comply with submittal requirements to the fullest extent possible and process transmittal forms to provide a record of activity.
- G. **Technical Provisions**
- 1. Reserved

**01.1.11**    **QUALITY CONTROL SUBMITTALS**

- A. The Contractor shall submit quality-control data, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the specifications.
- B. Certifications: Where other sections of the specifications require certification that a product, material, or installation complies with specified requirements, the Contractor shall submit a notarized certification from the manufacturer certifying compliance with specified requirements.
- 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: The Contractor shall submit, as required by other sections of the specifications, inspection and test records.
- D. **Technical Provisions**
- 1. Reserved

**01.1.12**    **MIX DESIGNS**

Mix designs shall be submitted in accordance with the General Conditions and the following:

- A. When specified in individual Specification Sections, the Contractor shall submit two (2) copies of the manufacturer's product mix design to the Engineer for review.
- 1. Mix designs shall include either a mix report by a certified testing laboratory or the specified number of laboratory test results.
- B. The Contractor shall review each mix design before submitting it to the Engineer to determine that it meets the requirements of these Specifications.
- 1. The Contractor shall call to the Engineer's attention any mix design which varies from what the Specifications have called for.
  - 2. Mix designs that are submitted by the Contractor, but not required by the Specifications, shall be returned to the Contractor and shall not be reviewed.

- C. Mix designs which are reviewed by the Engineer shall be stamped with the Engineer's review action stamp prior to being returned to the Contractor.
  - 1. The Engineer's review shall consist of checking only for conformance with the design concept of the project and compliance with the information given in the Contract Documents.
  - 2. The Contractor is responsible for the application or installation of the subject materials in conformance with the Specifications.
- D. The Contractor shall not use any material requiring the review of a mix design without an appropriate final stamp indicating action taken.
- E. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**



**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents describes the Contractor responsibilities for health, safety, and emergency response. This description is not intended to be comprehensive.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 33 00 SUBMITTAL PROCEDURES**

**01.1.03 ON-SITE HEALTH AND SAFETY REQUIREMENTS**

- A. General
1. The Contractor is responsible for implementation and enforcement of safe Work practices including, but not limited to, trenching, materials handling, operation of equipment; and safety of the public during progress of the Work.
  2. Payment
    - a. Included in Bid: Cost for Work performed in OSHA Level of protection deemed necessary by the Contractor and any protection required due to means, methods and materials utilized by the Contractor.
    - b. Work specified in this section shall be included as part of the cost for the work for which protection is required.
- B. Quality Assurance
1. Regulatory Requirements
    - a. The Contractor shall plan for and ensure personnel comply with basic provisions of OSHA Safety and Health Standards (29 CFR 1910) and General Construction Standards (29 CFR 1926) as appropriate.
    - b. The Contractor shall comply with applicable laws and regulations of any public body having jurisdiction for safety of persons or property.
- C. Operations and Equipment Safety
1. The Contractor is responsible for initiating, maintaining, and supervision of safety precautions and programs in connection with the Work.
    - a. The Contractor shall take necessary precautions for safety of employees on Project site and other persons and organizations who may be affected by the Project.
  2. The Contractor's duties and responsibilities for safety in connection with the Work shall continue until such time as the Work is complete and the Owner has issued notice to the Contractor that the Work is complete.
- D. Health & Safety
1. The Contractor is responsible for implementation and enforcement of health and safety requirements and shall take necessary precautions and provide protection for the following:
    - a. Personnel working on or visiting the Project site, irrespective of employer.
    - b. Work and materials or equipment to be incorporated in the Work area on or offsite.
    - c. Other property at or adjacent to the Project site.

- d. Public exposed to job related operations or potential release of toxic or hazardous materials.
- 2. The Contractor shall hold harmless the Owner and Engineer from any claims made as a result of the Contractor's responsibilities included herein.
- 3. The Contractor is responsible for maintaining a visitor's log.
  - a. All Contractor's visitors must sign in and out indicating their name(s), the date and time.
- E. Submittals
  - 1. The Contractor shall submit three (3) copies of a Health and Safety Plan (HASP) to the Owner within (3) days after Notice to Proceed. The Work on-site shall not proceed until HASP has been submitted to the Owner.
    - a. Submittal of the Contractor's HASP to the Owner is to inform the Engineer and the Owner so they can comply with HASP during the performance of their on- site responsibilities as described in the Contract Documents.
    - b. Submittal of the Contractor's HASP shall neither impose on the Owner responsibility for adequacy of HASP nor release the Contractor from full responsibility therefor.
- F. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Specifications describes the procedures for environmental protection of the site.
- B. The Contractor shall provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK**  
**SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES**

**01.1.03 PROTECTION OF AIR QUALITY**

- A. The Contractor shall minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment and encourage shutdown of motorized equipment not in use.
- B. The Contractor shall not burn trash on construction site.
- C. If temporary heating devices are necessary for protection of work, they shall not cause air pollution.
- D. Contractor shall minimize the amount of dust pollution caused by construction operations. Dust control shall be performed in accordance with the provisions of **SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK** of these Specifications.
- E. **Technical Provisions**
  - 1. Reserved

**01.1.04 FUELS AND LUBRICANTS**

- A. The Contractor is to comply with all local, state, and federal regulations concerning transportation and storage of fuels and lubricants.
- B. Fuel storage area and equipment shall be approved by the Owner prior to installation. Containment requirements shall be submitted by the Contractor for approval in writing by the Owner.
- C. All spills or leakage shall be reported to the Owner and cleanup by the Contractor shall be commenced immediately upon discovery of the spill.
- D. The Owner shall reserve the right to order damaged or leaking equipment off site.
- E. **Technical Provisions**
  - 1. Reserved

**01.1.05 CONTAMINATED SOILS**

- A. If the Contractor encounters hydrocarbon-contaminated soils during work operations, the Contractor is required to immediately stop all work activity in the contaminated area. The Contractor shall be responsible for contacting the **Montana Department of Environmental Quality Hotline at: 1-800-457-0568**, or after hours and holidays at: **1-406-324-4777** for further guidance.
- B. **Technical Provisions**
  - 1. Reserved

**01.1.06    NOISE CONTROL**

- A.    The Contractor shall conduct operations to cause the least annoyance to neighbors in the vicinity of work, and comply with applicable local ordinances.
- B.    The Contractor shall equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. The Contractor shall equip compressors with silencers on intake lines.
- C.    The Contractor shall equip gasoline or oil operated equipment with silencers or mufflers on intake and exhaust lines.
- D.    **Technical Provisions**
  - 1.    Reserved

**PART 2    PRODUCTS (NOT USED)**

**PART 3    EXECUTION (NOT USED)**

**END OF SECTION**

## **PART 1 GENERAL**

### **01.1.01 DESCRIPTION**

- A. This section of the Specifications includes reference to regulatory requirements that affect the Project.
- B. The buildings that are constructed will be used for human occupancy by the Owner's staff.
- C. All federal, state, and local regulatory requirements shall be complied with by the Contractor.

### **01.1.01 REFERENCES**

- A. This section reserved.

### **01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. This section reserved.

### **01.1.03 REQUIRED PERMITS, APPROVALS AND LICENSES**

- A. The Contractor shall obtain all necessary local and/or state permits for plumbing, electrical, site and building construction. **(TP-1)**
- B. For new building construction and interior remodeling projects the Contractor shall complete the work and obtain a Certificate of Occupancy for the Owner.
- C. The Contractor shall be responsible for the payment of all permit and application fees, the cost of which shall be included in the price bid for which the permit or application is required.
- D. The Contractor shall be responsible for scheduling all inspections as required by the permit.
- E. **Technical Provisions**
  - 1. **The Contractor will be required at a minimum to obtain a building and electrical permit as a part of this project. (MSP)**

### **01.1.04 STORM WATER MANAGEMENT AND EROSION CONTROL (SWPPP)**

- A. The Contractor shall make note that this project is subject to **Montana Department of Environmental Quality Storm Water General Discharge Permit authorization (MPDES)**. The Contractor is responsible for the preparation of the Storm Water Pollution Prevention Plan and for submittal to the State, in the event that it is necessary.
- B. The Contractor will be responsible for determining if his/her construction operations/dewatering will warrant the permit, unless otherwise specified.
- C. The Contractor shall pay the application fee and all additional annual fees necessary until the termination of the permit has been granted by the State. The Contractor is responsible for securing and administering the permit and installation and maintenance of the erosion control structures.
- D. The Contractor shall comply with all requirements and conditions of the General Permit and the Storm Water Pollution Prevention Plan (SWPPP). Failure to do so will result in the issuing of an order to suspend work in addition to the potential fines that may be assessed by the State.
- E. The General Permit for Storm Water Discharges Associated with Construction Activities, NOI, SWPPP, NOT, and the most recent fee schedule can be found on the internet at the following location:  
  
<http://deq.mt.gov/wqinfo/MPDES/StormwaterConstruction.mcp>
- F. The Contractor's responsibilities regarding maintenance of erosion control structures, after final project acceptance, will be limited to the areas disturbed by the utility construction for these projects only. The Contractor will not be responsible for erosion control beyond the disturbed areas of

these projects due to adjacent construction or any other construction activities not associated with this project. It is the Contractor's responsibility to document the extent of disruption due to construction activities directly related to this project. The documentation should include pictures with a date stamp that is concurrent with the date of final project acceptance.

**G. Technical Provisions**

1. Contractor shall submit an Erosion Control Plan to the Engineer for approval. Contractor is encourage to follow MDT's Erosion and Sediment Control Best Management Practices Manual (December 2016). **(MSP)**

**01.1.05 HISTORICAL FINDINGS**

A. In the event that any historical, archaeological, or other cultural artifacts, vestiges, or remains are found prior to, during, or after any earth disturbances or construction activity in the proposed project area, the State Historical Preservation Office will be notified immediately and the site and the materials will be protected from further disturbance until a professional examination of them can be made or until some other clearance to proceed is given by the State Historical Preservation Office.

**B. Technical Provisions**

1. Archaeological monitoring is provided by the Owner and is not the responsibility of the Contractor. However, any archaeological or other cultural artifacts, vestiges, or remains are found during or after any earth disturbances or construction activity in the proposed project area, SHPO and the Owner will be notified immediately and the site and the materials will be protected from further disturbance until a professional examination of them can be made or until some other clearance to proceed is given by the SHPO and the Owner. **(MSP)**
2. Archaeological finds shall be brought to the Engineers attention immediately. **(MSP)**

**01.1.06 BUILDING CODE**

A. 2018 International Building Code as adopted by the State of Montana.

**B. Technical Provisions**

1. Reserved

**01.1.07 PLUMBING CODE**

A. 2018 Uniform Plumbing Code as adopted by the State of Montana.

**B. Technical Provisions**

1. Reserved

**01.1.08 ELECTRIC CODE**

A. 2017 National Electric Code as adopted by the State of Montana.

**B. Technical Provisions**

1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**PART 1 GENERAL**

**01.1.01 DEFINITIONS**

- A. These specifications use “Article 1 - Definitions” of the Standard General Conditions of the Construction Contract, Form No. C-700 prepared and issued by the Engineer’s Joint Contract Documents Committee (EJCDC) 2013, for the definition of terms herein. **(TP-1)**
- B. **Technical Provisions**
  - 1. **Delete Part A of this subsection in its entirety. (MSP)**

**01.1.02 REFERENCES**

- A. This section lists some of the construction industry organizations, professional and technical associations, societies and institutes, and government agencies issuing, promoting, or enforcing standards in the Contract Documents along with the abbreviations commonly used for those references. Also included are general requirements for using industry standards specified, and for applying quality control standards.

**01.1.01 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**GENERAL CONDITIONS**

**01.1.02 USE OF REFERENCE STANDARDS**

- A. Work specified by reference to a published standard or specification of a government agency, technical association, trade association, professional society or institute, testing agency, or other organization must meet or exceed the minimum quality standards for the material and workmanship in the designated standard or specification.
- B. Where specified, assure products or workmanship meet the prescriptive or performance requirements in the Contract Documents when it is a more stringent standard than the referenced standard.
- C. Where the specific issue date of the standard is not identified in the standard, the edition and all published amendments available on the date of the Invitation to Bid applies.
- D. If two or more standards are specified, provide the product and workmanship meeting or exceeding the requirements of the most stringent standard.
- E. Where both a standard and a brand name are specified, assure the proprietary product names meet or exceed the specified reference standard. The listing of a trade name in a Contract Document does not warrant that the product meets the referenced standard.
  - 1. Copies of applicable referenced standards are not bound in this Contract Document.
  - 2. Where the contractor needs copies of standards for work superintendence and quality control, obtain a copy or copies directly from the publication sources and maintain copies at the job site, making them available to Contractor personnel, subcontractors, Owner, and Engineer.
- F. **Technical Provisions**
  - 1. Reserved

**01.1.03 ABBREVIATIONS**

- A. Abbreviations for Trade Organizations and Government Agencies: Following is a list of construction industry organizations and government agencies commonly referenced in the Contract Documents, with abbreviations used.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers' Association
AGA	American Gas Association
AGMA	American Gear Manufacturers' Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALS	American Lumber Standards
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWPB	American Wood Preservers' Bureau
AWPI	American Wood Preservers' Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers' Association
CBMA	Certified Ballast Manufacturers' Association
CDA	Copper Development Association
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers' Association of America
CRSI	Concrete Reinforcing Steel Institute
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
Fed Spec.	Federal Specifications
FS	Federal Specification
GA	Gypsum Association
HI	Hydraulic Institute
HMI	Hoist Manufacturers' Institute
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers' Association
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IES	Illuminating Engineering Society of North America
ISA	Instrument Society of America
JIC	Joint Industry Conferences of Hydraulic Manufacturers
MIA	Marble Institute of America
Mil. Sp.	Military Specification
MS	Military Specifications
MMA	Monorail Manufacturers' Association
NAAMM	National Association of Architectural Metal Manufacturers
NBHA	National Builders' Hardware Association

NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NLMA	National Lumber Manufacturers' Association
NTMA	National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers' Association
OECI	Overhead Electrical Crane Institute
OSHA	Occupational Safety and Health Act (both Federal and State)
PEI	Porcelain Enamel Institute
PS	Product Standards Section - U.S. Department of Commerce
RLM	RLM Standards Institute, Inc.
RMA	Rubber Manufacturers' Association
SAE	Society of Automotive Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
SWI	Steel Window Institute
TEMA	Tubular Exchanger Manufacturers' Association
TCA	Tile Council of America
UBC	Uniform Building Code
UFC	Uniform Fire Code
UL	Underwriters' Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau

**B. Technical Provisions**

1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**End of Section**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section defines the obligations of the Contractor's Quality Control requirements and the Owner's Quality Assurance obligations. The program provides a method to monitor quality of the Work including but not limited to suppliers, manufacturers, products, services, site conditions, and workmanship.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated.
  - 1. These services do not relieve Contractor of responsibility for compliance with Contract Documents requirements.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by the Owner's Representative or authorities having jurisdiction are not limited by provisions of this Section.

**01.1.02 REFERENCES**

- A. This section reserved.

**01.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

<b>SECTION 01 21 16</b>	<b>CONTIGENCY ALLOWANCES</b>
<b>SECTION 01 21 19</b>	<b>TESTING AND INSPECTING ALLOWANCES</b>
<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

- A. Refer to **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** for minimum frequencies and requirements for field testing and verifications.
- B. Refer to **SECTION 01 21 19 TESTING AND INSPECTING ALLOWANCES** for allowable reimbursement and payment procedures for testing and verifications, if provided.
- C. **Technical Provisions**
  - 1. Reserved

**01.3.02 DEFINITIONS**

- A. Quality Control – Shall be defined as planned and specific actions or operations necessary to produce a product that complies with the Contract Documents. Quality Control consists of action, inspections, sampling and testing necessary to ensure the Work is in compliance with the Contract Documents and to control production and construction processes. Quality Control is keyed to the construction sequence to quickly determine when the Work is out of compliance with the Contract

Documents and to respond to correct the situation and bring the Work into compliance. Quality Control is the responsibility of the Contractor.

- B. Quality Assurance – Planned and systematic observations of the Work. The Owner or Engineer will provide Quality Assurance as necessary.
- C. Verification/Compliance Testing – Sampling and testing that is carried out independent of the Contractor's Quality Control testing to confirm or verify that the Work complies with the Contract Documents. The frequency of compliance or verification testing shall be determined by the Owner and may not be adequate for Contractor's production and placement needs. Verifications and compliance testing will not be used to determine construction procedures or operations. Verifications/Compliance testing will be provided by the Owner as necessary.
- D. **Technical Provisions**
  - 1. Reserved

**01.3.03**    **QUALITY CONTROL**

- A. Contractor shall provide the quality-control services specified within the Contract Documents.
- B. Contractor shall engage a qualified, Owner-approved testing agency to perform quality-control services. Testing agency shall have access to the Work at all times.
- C. Contractor shall establish testing schedules in advance of any testing with the testing agency, determine the time required for the testing agency to perform any tests. Contractor shall submit schedule to the Owner's representative.
  - 1. When changes of construction schedule are necessary during construction, Contractor shall coordinate all such changes of schedule with the testing agency as required.
  - 2. When the testing agency is ready to test according to the determined schedule but is prevented from testing due to incompleteness of the Work, Contractor shall be responsible for all extra costs for testing attributable to the delay.
- D. Contractor shall submit to the Owner, or Owners representative a certified written report, in duplicate, of each quality-control service.
- E. Testing and inspecting requested by Contractor and not required by Contract Documents are Contractor's responsibility.
- F. **Technical Provisions**
  - 1. Reserved

**01.3.04**    **TESTING AGENCY (LABORATORY)**

- A. Testing agency shall notify Owner's Representative and Contractor promptly of irregularities and deficiencies observed in the Work during performance of their services.
- B. Testing agency shall submit a certified report of each test, inspection, and similar quality-control service to Owner's Representative with copy to Contractor. **(TP-1)**
- C. Testing Agency shall submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
- D. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- E. Testing agency will retest and reinspect corrected work.
- F. Qualifications of Laboratory Personnel: Laboratory personnel involved in field and laboratory testing shall be certified to conduct the tests specified herein by the American Concrete Institute or the State Department of Transportation. The Lab shall be accredited by the AASHTO Materials Reference Laboratory (AMRL) or similar.

**G. Technical Provisions**

1. As specified in part B of this subsection, the testing agency shall submit certified reports at the end of each week at a minimum unless otherwise approved by the Engineer. (PRSP-SID<sub>20</sub>)

**01.3.05 SOURCE & QUALITY OF MATERIALS**

- A. All materials incorporated in the work are subject to verification from the manufacturing plant that the materials comply in all respects with the requirements of these Specification.
- B. Verification may be in the form of a certificate of compliance, lab analysis, or both. These certifications shall clearly identify the material being certified and shall be signed by a person having legal authority to bind the suppliers or manufacturer.
- C. The Contractor shall be responsible for any testing necessary to analyze the materials for certification.

**D. Technical Provisions**

1. Reserved

**01.3.06 CONTRACTOR QUALITY CONTROL**

- A. Contractor shall submit a Quality Control Plan defining a program and the documentation proposed to ensure that all materials and work conform to the Contract Documents. The plan shall identify personnel, procedures, controls, tests, frequency of tests and records, and forms to be used. The Owner reserves the right to reject personnel to perform Quality Control for lack of experience.
- B. The Contractor shall inspect all materials delivered to the site to determine their suitability to be incorporated into the work and conformance with the Drawings and Specifications.
- C. The Contractor shall inspect the installation of all materials to determine conformance with the Drawings and Specifications.
- D. The Contractor shall have the job superintendent on-site at all times work is being performed by work forces of the Contractor or Subcontractors.
- E. The Contractor shall comply fully with manufacturers' instructions, including each step in sequence. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- F. The Contractor shall cooperate with other agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested.
- G. The Contractor shall comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- H. The Contractor shall perform work by persons qualified to produce workmanship of specified quality.
- I. The Contractor shall secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- J. Regardless of whether original tests or inspections were Contractor's responsibility, Contractor shall provide quality-control services, including retesting and reinspection, for construction that revised or replaced Work that failed to comply with requirements established by Contract Documents.

**K. Technical Provisions**

1. Reserved

**01.3.07 CONTRACTOR COOPERATION WITH QUALITY ASSURANCE**

- A. Contractor shall assure that the Owner's personnel, Engineer's personnel and quality assurance personnel have unrestricted access to the Work at all times work is in progress. Contractor shall

provide incidental labor, equipment, and facilities necessary to facilitate test and inspections at Contractor's expense.

- B. The Engineer or their representative must have access to ready mix production facilities, asphalt batch plants, or any other associated production facility for sampling constituent materials during production to assure the materials meet these Specifications and represent those stated on the approved mix design.
- C. Notification to the Engineer shall be given 24 - hours prior to when work is ready for observation or quality assurance testing. The Contractor shall routinely update the construction schedule to provide the Engineer with estimated sampling, testing, and verification dates and times.
- D. Sampling of materials shall be split between the Contractor and Engineer and from the same source. The Engineer shall be notified 24 - hours prior to any sampling and shall be present to collect samples. Contractor provided results of a sample without a split will not be approved and deemed unacceptable.
- E. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Document gives a project summary for the Contractor's quality control requirements to be performed in the field with the aid of an independent testing agency.
- B. The information included within this Specification is not meant to be all inclusive. Contractor shall be responsible for providing all testing, verifications, and quality control procedures required to verify the Work is in compliance with the Contract Documents.

**01.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.

Standards

AASHTO T191	ASTM D1556	Sand Cone Method
AASHTO T310	ASTM D6938	Nuclear Densometer Method
ASTM C31		Making and Curing Concrete Test Specimens in the Field for Laboratory and Field Curing
ASTM C39		Compressive Strength of Cylindrical Concrete Specimens
ASTM C138		Method of Test for Unit Weight, Yield and Air Content (Gravimetric) of Concrete
ASTM C143		Slump of Hydraulic-Cement Concrete
ASTM C172		Sampling Freshly Mixed Concrete
ASTM C173		Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231		Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C1064		Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1097		Hydrated Lime for Use in Asphaltic Concrete Mixtures
ASTM D979	ASSHTO T168	Sampling Bituminous Paving Mixtures
ASTM D1557		Modified Proctor
ASTM D2041	AASHTO T209	Theoretical Maximum Specific Gravity and Density of Asphalt Mixes
ASTM D2726	AASHTO T166	Bulk Specific Gravity of Compacted hot Mix Asphalt Using Saturated Surface-Dry Specimens
ASTM D2950	AASHTO T355	Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3203	AASHTO T269	Percent Air Voids in Compacted Asphalt Mixtures
ASTM D3549		Thickness or Height of Compacted Asphalt Mixture Specimens
ASTM D5361		Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing
ASTM D5444	AASHTO T30	Mechanical Size Analysis of Extracted Aggregate
ASTM D6307	AASHTO T308	Asphalt Content of Asphalt Mixture by Ignition Method
ASTM D6925	ASSHTO T312	Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyration Compactor

**CONTINUED**

---

**01.1.03      RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

<b>SECTION 01 21 19</b>	<b>TESTING AND INSPECTING ALLOWNACES</b>
<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 03 00 00</b>	<b>CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 13</b>	<b>SUBGRADE MODIFICATIONS</b>
<b>SECTION 32 11 23</b>	<b>AGGREGATE BASE COURSES</b>
<b>SECTION 32 12 16</b>	<b>ASPHALT PAVING</b>

**PART 2    PRODUCTS (NOT USED)**

**PART 3    EXECUTION**

**01.3.01    GENERAL**

- A. The following materials and control tests shall be made by the Contractor to determine the Contractor's compliance with the specifications: (Some tests may not apply to the work to be completed during this project).
1. Proctor analysis and in-place density tests for trench compaction for all underground utilities installed by the Contractor.
  2. In-place density test of subgrade, embankment, backfill, subbase, base courses, and asphalt paving courses.
  3. Gradation, liquid limit and plasticity index tests of subbase, base and surfacing aggregates. Tests of subbase and base course materials shall be made from material in place. Tests of plant mix aggregates shall be made from samples obtained from the hot bins of the hot mix plant. Tests of concrete aggregates shall be made from samples at the batch site.
  4. Stripping tests, volume swell tests, fracture tests, wear tests and soundness tests shall be made prior to or during the Contractor's crushing operations.
  5. Concrete cylinders and beams.
  6. This list is not meant to be all inclusive, testing may also be subject to additional testing per the respective Specifications.
- B. The Contractor is responsible for obtaining and providing to the Engineer, the necessary proctor determinations prior to commencement of the work.
- C. The Contractor will provide additional proctor analysis when so directed by the Engineer or at the Contractor's sole discretion when soil conditions appear to have changed. The proctor analysis must be completed prior to compaction testing being accepted.
- D. The Contractor, at the Contractor's sole risk, may test the compaction of trenches, embankments, subgrade, and aggregates, prior to the completion of a proctor analysis, realizing that the Engineer has the right to reject the work and require that compaction efforts be re-done until the compaction meets the requirements of the specification.
- E. Refer to **SECTION 01 21 19 TESTING AND INSPECTING ALLOWANCES** for information related to payment of quality control testing performed by the Contractor.

**F. Technical Provisions**

1. Where the provisions of the Geotechnical Report, if included, are more stringent than those included herein, the provisions of the Geotechnical report shall govern. **(PRSP)**

**01.3.02 CONCRETE – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the testing of all concrete material furnished and installed in relation to the Work.
- B. Design standards for concrete mixtures including but not limited to, air content, compressive strength, slump, etc. may be found with the following Specification(s) if provided:
  1. **SECTION 03 00 00 CONCRETE**
  2. **SECTION 31 23 23.33 FLOWABLE FILL**
- C. The Contractor shall be responsible for obtaining the necessary material and test results to meet the minimum testing standards and frequencies included herein.
- D. All testing shall be performed by an Owner-approved independent testing agency. Testing shall be performed by an ACI Grade I or equivalent certified testing technician.
- E. Unless otherwise specified, all testing during the on-site placement of the concrete, shall be subject to acceptance or rejection by the Engineer.
- F. Air content testing shall be performed in accordance with the following standard(s):
  1. ASTM C231 (Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method)
  2. ASTM C173 (Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method)
  3. ASTM C138 (Method of Test for Unit Weight, Yield and Air Content (Gravimetric) of Concrete)
- G. Temperature tests shall be performed in accordance with the following standard(s):
  1. ASTM C1064 (Temperature of Freshly Mixed Hydraulic-Cement Concrete)
  2. Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.
- H. Standard slump tests shall be performed in accordance with the following standard(s):
  1. ASTM C143 (Slump of Hydraulic-Cement Concrete)
- I. Concrete cylinders for strength tests shall be collected, molded, and cured, in accordance with the following standard(s):
  1. ASTM C172 (Sampling Freshly Mixed Concrete)
  2. ASTM C31 (Making and Curing Concrete Test Specimens in the Field for Laboratory and Field Curing)
- J. Concrete cylinders shall be compression tested in accordance with the following standard(s):
  1. ASTM C39 (Compressive Strength of Cylindrical Concrete Specimens)
- K. The following shall establish the minimum frequency for sampling and testing of concrete including, air, temperature, slump, and cylinders for strength. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
  1. One (1) cylinder set for every 30 CY;
  2. Or, one (1) cylinder set per pour if less than 30 CY
  3. Cylinder set shall consist of a minimum three (3), 4 – inch or 6 - inch diameter concrete cylinders. **(TP-1)**

4. Cure cylinders under laboratory conditions except that additional test cylinders cured entirely under field conditions may be required by the Engineer to check the adequacy of curing and protection of the concrete.
- L. Concrete mixture field samples shall meet the following minimum requirements.
1.  $\pm 1.5\%$  - air content
- M. Concrete strength tests of cylinders shall be performed for verification and acceptance at the following times:
1. One (1) cylinder at 7 days – information strength
  2. Minimum two (2) cylinders at 28 days – acceptance strength
- N. To meet this Specification, average strength of two cylinders from the same sample (cylinder set), tested at 28 days or the specified earlier age, is required for each strength test. Strength level of an individual class of concrete is considered satisfactory if both of the following requirements are met:
- a. The average of all sets of 3 consecutive tests equal or exceeds the specified strength.
  - b. No individual strength test (average of two cylinders) falls below specified strength by more than 500 psi (3400 kPa).
- O. If field cured cylinders are required or requested by the Engineer the following provisions shall apply: **(TP-2)**
1. Mold field cured test cylinders at the same time and from the same samples as laboratory cured test cylinders.
  2. The strengths of any specimens cured on in the field are to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed or the structure placed in service.
  3. When the strengths of the job cured specimens are below those specified above, the Contractor must improve the procedures for protecting and curing the concrete.
    - a. Improve procedures for protecting and curing concrete when strength of field cured cylinders at the test age designated for measuring specified strength is less than 85% of the companion laboratory cured cylinders.
    - b. When laboratory cured cylinder strengths are appreciably higher than the specified strength, field cured cylinder strengths need not exceed the specified strength by more than 500 psi (3400 kPa) even though the 85% criterion is met.
- P. When concrete fails to meet the requirements above or when tests of field cured cylinders indicate deficiencies in protection and curing, the Owner/Engineer may order tests on the hardened concrete under Chapter 17.3 of ACI-301-84 or order load tests in Chapter 20 of the ACI Building Code (ACI 318-83) for that portion of the structure where the questionable concrete has been placed.
1. In the event the load or core tests indicate that the structure is unsatisfactory, make all modifications as directed by the Engineer to make the structure sound. If the load or core tests indicate the concrete is satisfactory, all cost of testing shall be paid by Owner.
- Q. **Technical Provisions**
1. If concrete mixes contain aggregate that would be retained on a 1 1/4 – inch sieve the concrete cylinders as specified in part K.3 of this subsection shall be cast using a 6 – inch by 12 – inch mold. **(PRSP)**
  2. Contractor shall collect (2) full cylinder sets as specified in part O of this subsection, when concrete is placed during cold weather as specified in **SECTION 03 05 00 COMMON WORK RESULTS FOR CONCRETE** of these specifications. **(PRSP)**

**01.3.03     EMBANKMENT / FILL – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the Work provided under the following section(s), if provided.
  - 1.     **SECTION 31 23 00 EXCAVATION AND FILL**
- B. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships of representative samples of the materials to be used and for providing field density tests to meet the minimum compaction and frequency requirements included herein.
- C. All testing shall be performed by an Owner-approved independent testing agency.
- D. In-place field density tests shall be performed in accordance with the following standards(s):
  - 1.     AASHTO T310 / ASTM D6938 (Nuclear Densometer Method)
  - 2.     AASHTO T191 / ASTM D1556 (Sand Cone Method)
- E. Laboratory maximum density values and optimum compaction moisture content shall be in accordance with the following standard(s):
  - 1.     ASTM D698 (Standard Proctor)
- F. Embankment shall be categorized into the following “Types” based on location, primary use, projected use, and adjacent features.
  - 1.     Type A – Surface Improved Areas – Generally consisting of streets, alleys, sidewalks, driveways, curbs, traveled surfaces, etc.
  - 2.     Type B – Unimproved Areas – Generally consisting of lawn areas, cultivated areas, etc.
  - 3.     Type S – Structural – Generally consisting of bridges, abutments, foundations, box culverts, etc.
- G. Minimum in-place density for embankment shall be as follows.
  - 1.     Type A – 95%
  - 2.     Type B – 92%
  - 3.     Type S – 98%
- H. In-place moisture content shall be within the following range of laboratory optimum moisture:
  - 1.     ± 3% of optimum
- I. The following shall establish the minimum frequency for in-place density tests to be provided. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
  - 1.     One (1) test per 200 CY
- J.     **Technical Provisions**
  - 1.     Reserved

**01.3.04     TRENCH BACKFILL – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the Work provided under **SECTION 31 23 33 TRENCHING AND BACKFILL** if provided within these Specifications.
  - B. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships of representative samples of the materials to be used in all trenches and providing field density tests to meet the minimum compaction and frequency requirements included herein.
  - C. All testing shall be performed by an Owner-approved independent testing agency.
  - D. In-place field density tests shall be performed in accordance with the following standards(s):
    - 1.     AASHTO T310 / ASTM D6938 (Nuclear Densometer Method)
-

2. AASHTO T191 / ASTM D1556 (Sand Cone Method)
- E. Laboratory maximum density values and optimum compaction moisture content shall be performed in accordance with the following standard(s):
  1. ASTM D698 (Standard Proctor)
- F. Trenches shall be categorized into the following “Types” based on location, primary use, projected use, and adjacent features.
  1. Type A – Surface Improved Areas – Generally consisting of streets, alleys, sidewalks, driveways, curbs, traveled surfaces, etc. **(TP-1)**
  2. Type B – Unimproved Areas – Generally consisting of lawn areas, cultivated areas, borrow pits, etc. **(TP-2)**
  3. Type S – Structural – Generally consisting of manholes, utility structures, culvert crossings, etc.
- G. Minimum in-place density for trench backfill shall be as follows.
  1. Type A – 95%
  2. Type B – 92%
  3. Type S – 98%
- H. In-place moisture content shall be within the following range of laboratory optimum moisture:
  1. ± 3% of optimum
- I. The following shall establish the minimum frequency for in-place density tests to be provided. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
  1. One (1) test per 2 - vertical feet for every 300 LF of trench;
  2. Or, one (1) test every excavation pit within traveled roadways;
  3. Or, one (1) test every 4 excavation pits outside traveled roadways
- J. **Technical Provisions**
  1. Type A trench backfill as specified in part F.1 of this subsection, may also be categorized as a material which does not exhibit a typical well-defined moisture-density curve, 70% relative density as determined by ASTM D4253 and D4254. **(PRSP-SID\_MOD)**
  2. Type B trench backfill as specified in part F.2 of this subsection, may also be categorized as a material which does not exhibit a typical well-defined moisture-density curve, 50% relative density as determined by ASTM D4253 and D4254. **(PRSP-SID\_MOD)**

**01.3.05 SUBGRADE – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the testing of subgrade material as it relates to the installation of items such as, but not limited to, roadways, sidewalks, curbs, structures, etc. and/or repairs to subgrades as specified in **SECTION 32 11 13 SUBGRADE MODIFICATIONS** of these Specifications.
- B. Subgrade is generally described as native material left in-situ and/or scarified and compacted prior to the placement of overlying material or structures related to the Work.
- C. All testing shall be performed by an Owner-approved independent testing agency..
- D. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships of representative samples of the materials to be used and for providing field density tests to meet the minimum compaction and frequency requirements included herein.

- E. In-place field density tests shall be performed in accordance with the following standards(s):
  - 1. AASHTO T310 / ASTM D6938 (Nuclear Densometer Method)
  - 2. AASHTO T191 / ASTM D1556 (Sand Cone Method)
- F. Laboratory maximum density values and optimum compaction moisture content shall be performed in accordance with the following standard(s):
  - 1. ASTM D698 (Standard Proctor)
- G. Subgrade shall be categorized into the following “Types” based on location, primary use, projected use, and adjacent features.
  - 1. Type A – Surface Improved Areas – Generally consisting of streets, alleys, sidewalks, driveways, curbs, traveled surfaces, etc.
  - 2. Type S – Structural – Generally consisting of manholes, utility structures, box culverts, foundations, etc.
- H. Minimum in-place density for subgrade shall be as follows.
  - 1. Type A – 95%
  - 2. Type S – 98%
- I. In-place moisture content shall be within the following range of laboratory optimum moisture:
  - 1. ± 3% of optimum
- J. The following shall establish the minimum frequency for in-place density tests to be provided. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
  - 1. One (1) Test per 200 SY
- K. **Technical Provisions**
  - 1. Reserved

**01.3.06 SUBBASE COURSE – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the Work provided under **32 11 16 SUBBASE COURSES** if provided within these Specifications.
- B. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships of representative samples of the materials to be used and for providing field density tests to meet the minimum compaction and frequency requirements included herein.
- C. All testing shall be performed by an Owner-approved independent testing agency.
- D. In-place field density tests shall be performed in accordance with the following standards(s):
  - 1. AASHTO T310 / ASTM D6938 (Nuclear Densometer Method)
  - 2. AASHTO T191 / ASTM D1556 (Sand Cone Method)
- E. Laboratory maximum density values and optimum compaction moisture content shall be performed in accordance with the following standard(s):
  - 1. ASTM D698 (Standard Proctor)
- F. Subbase material shall be categorized into the following “Types” based on location, primary use, projected use, and adjacent features.
  - 1. Type A – Surface Improved Areas – Generally consisting of asphalt paving, etc.
  - 2. Type S – Structural – Generally consisting of concrete paving, airfield runways, etc.
- G. Minimum in-place density for subbase shall be as follows.

1. Type A – 95%
  2. Type S – 98%
- H. In-place moisture content shall be within the following range of laboratory optimum moisture:
1.  $\pm 3\%$  of optimum
- I. The following shall establish the minimum frequency for in-place density tests to be provided. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
1. One (1) Test per 200 SY
- J. **Technical Provisions**
1. Reserved

**01.3.07**    **AGGREGATE BASE & SURFACE COURSE– FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the Work provided under **32 11 23 AGGREGATE BASE COURSE** if provided within these Specifications.
- B. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships of representative samples of the materials to be used and for providing field density tests to meet the minimum compaction and frequency requirements included herein.
- C. All testing shall be performed by an Owner-approved independent testing agency.
- D. In-place field density tests shall be performed in accordance with the following standards(s):
1. AASHTO T310 / ASTM D6938 (Nuclear Densometer Method)
  2. AASHTO T191 / ASTM D1556 (Sand Cone Method)
- E. Laboratory maximum density values and optimum compaction moisture content shall be performed in accordance with the following standard(s):
1. ASTM D698 (Standard Proctor)
- F. Aggregate base course material shall be categorized into the following “Types” based on location, primary use, projected use, and adjacent features.
1. Type A – Surface Improved Areas – Generally consists of streets, alleys, sidewalks, driveways, curbs, traveled surfaces, etc.
  2. Type S – Structural – Generally consists of bridges, abutments, foundations, etc.
- G. Minimum in-place density for aggregate base course shall be as follows.
1. Type A – 95%
  2. Type S – 98%
- H. In-place moisture content shall be within the following range of laboratory optimum moisture:
1.  $\pm 3\%$  of optimum
- I. The following shall establish the minimum frequency for in-place density tests to be provided. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
1. One (1) Test per 200 SY
- J. **Technical Provisions**
1. Reserved

**01.3.08 ASPHALT – FIELD VERIFICATIONS**

- A. This subsection shall be in reference to the Work provided under **32 12 16 ASPHALT PAVING** if provided within these Specifications.
- B. Design standards for asphalt mixtures including but not limited to, HMA content, aggregate gradation, slump, etc. may be found in the following Specification(s) if provided:
  - 1. **SECTION 32 12 16 ASPHALT PAVING**
- C. The Contractor shall be responsible for obtaining the necessary material and test results to meet the minimum testing standards and frequencies included herein.
- D. All testing shall be performed by an Owner-approved independent testing agency.
- E. Asphalt mixture field samples and/or cores shall be collected in accordance with the following standard(s):
  - 1. ASTM D979 / AASHTO T168 (Sampling Bituminous Paving Mixtures)
  - 2. ASTM D5361 (Sampling Compacted Asphalt Mixtures for Lab Testing)
- F. Asphalt mixture field samples and/or cores shall have aggregates, asphalt binder content, and constituent material tested in accordance with the following standard(s):
  - 1. ASTM D5444 / AASHTO T30 (Mechanical Size Analysis of Extracted Aggregate)
  - 2. ASTM D6307 / AASHTO T308 (Asphalt Content of Asphalt Mixture by Ignition Method)
  - 3. ASTM D3203 / AASHTO T269 (Percent Air Voids in Compacted Asphalt Mixtures)
- G. Asphalt mixture field samples and/or cores shall have average bulk specific gravity and theoretical maximum specific gravity performed in accordance with the following standard(s):
  - 1. ASTM D6925 / AASHTO T312 (Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor)
  - 2. ASTM D2726 / AASHTO T166 (Bulk Specific Gravity of Compacted hot Mix Asphalt Using Saturated Surface-Dry Specimens)
  - 3. ASTM D2041 / AASHTO T209 (Theoretical Maximum Specific Gravity and Density of Asphalt Mixes)
    - a. “Rice Density” is determined from Theoretical Maximum Specific Gravity multiplied by the density of water.
- H. In-place field density tests shall be performed in accordance with the following standards(s):
  - 1. ASTM D2950 / AASHTO T355 (Density of Bituminous Concrete in Place by Nuclear Methods)
- I. Asphalt cores shall be tested for thickness in accordance with the following standard(s):
  - 1. ASTM D3549 (Thickness or Height of Compacted Asphalt Mixture Specimens)
- J. Asphalt mixture field samples shall meet the following minimum requirements.
  - 1.  $\pm 0.4\%$  - oil content
  - 2. Job mix gradation requirement for specified type of asphalt.
- K. Minimum compacted density of asphalt shall be as follows.
  - 1. In-Place – 93% of “Rice Density” – informational strength **(TP-1)**
  - 2. Cores - 93% of “Rice Density” – acceptance strength **(TP-1)**
    - a. Cores shall be 4 – inch diameter, and tested for thickness as specified above.

- L. The following shall establish the minimum frequency for sampling and testing compacted asphalt for densities and thickness if specified. The Contractor is solely responsible to perform adequate testing to assure the work is in compliance with Contract Documents.
  - 1. One (1) Test per 300 SY – density / thickness;
  - 2. And, one (1) test per 1500 TN – mix design
- M. Asphalt mat density for an individual class or type of asphalt is considered satisfactory if all of the following requirements are met:
  - 1. The average mat density shall be equal to or greater than the specified density.
  - 2. No individual sample shall be less than 1% below the specified density.
- N. Asphalt mat thickness is considered satisfactory if the following requirements are met:
  - 1. All asphalt cores are within 1/4 – inch of the specified mat thickness.
    - a. When the measurement of any core is less than the plan thickness by more than the allowable deviation, the actual thickness of the pavement in this area may be determined by taking additional cores at intervals parallel to the centerline in each direction from the affected location. Continue in each direction until a core is found which is not deficient by more than the allowable deviation.
    - b. The Engineer will evaluate areas found deficient in thickness and determine which areas warrant removal. Remove and replace the areas with asphaltic concrete of the thickness shown on the plans.
    - c. Additional coring is considered as re-testing of failing areas.
- O. Correct all pavement composition, field density, or thickness, deficiencies at Contractor expense.
- P. **Technical Provisions**
  - 1. **In-place density tests performed via nuclear gauge as specified in part K of this subsection, will be used for acceptance testing of asphalt patches for utility trenches. Cores will not be required. (PRSP)**

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. The Contractor shall provide temporary services addressed in this section and:
1. Include costs for temporary services in the total price of contract.
  2. Maintain temporary services until final completion of Project and final acceptance by the Owner.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. This section reserved.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 TEMPORARY UTILITY SERVICES**

- A. Temporary Services
1. The Contractor shall be responsible for coordinating the installation of temporary utilities as required for the construction.
  2. The costs of installing, maintaining and utilizing temporary utilities shall be included in the price bid for other portions of the Work and no additional compensation will be made therefor.
  3. Temporary utilities shall remain in service and use until such time the Project is substantially completed and ready for use and occupancy by the Owner.
  4. The Contractor shall not utilize utilities which are to be paid for by the Owner for heating or construction without the expressed written consent of the Owner.
  5. Failure on the part of the Owner to provide said consent shall not relieve the Contractor of the responsibility to protect the work or any part of the facility from damage due to freezing or other causes.
  6. The cost of utilities and fuel use and maintenance necessary for start-up and testing of equipment shall be included in the price bid for the equipment and no additional compensation shall be made therefor.

B. **Technical Provisions**

1. Reserved

**01.3.02 TEMPORARY ELECTRICAL SERVICE**

- A. When a field office is required, the Contractor shall provide a temporary, weatherproof, grounded electric service and distribution system of size and capacity needed for the mobile field office.
- B. The Contractor shall be responsible for the costs of consumed power furnished through temporary or permanent service until final acceptance of Project by the Owner.

C. **Technical Provisions**

1. Reserved

**01.3.03 TEMPORARY HEAT**

- A. The Contractor shall provide temporary heat required by construction activities for:
1. Curing or drying of completed installations.

2. Protection of installed construction from adverse effects of low temperatures or high humidity.
  3. Maintain a minimum temperature of 60°F in permanently enclosed portions of the building and areas where finished work has been installed.
- B. The Contractor shall select safe equipment that will not have harmful effects on completed installations or elements being installed.
- C. The Contractor shall coordinate ventilation requirements to produce ambient conditions required.
- D. Except where use of the permanent system is authorized, the Contractor shall provide vented, self-contained liquid propane gas or fuel oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open flame or salamander type heating units is prohibited.
- E. When the permanent heating system is tested and ready for operation, it may be used on a temporary basis for heating and building until final acceptance only if approved in writing by the Owner:
1. The Contractor shall be responsible for cost of operation and fuel.
  2. The Owner will assume responsibility for operation and fuel costs on the date of final acceptance of the contract.
- F. **Technical Provisions**
1. Reserved

**01.3.04**    **SANITARY FACILITIES**

- A. The Contractor shall provide self-contained, single occupant toilet units of the chemical, aerated recirculation or combustion type, properly vented and fully enclosed with a fiberglass reinforced polyester shell or similar nonabsorbent material.
- B. **Technical Provisions**
1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Specifications describes the temporary facilities to be provided by the Contractor as necessary to complete the work as specified herein and shown on the Drawings.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 51 00 TEMPORARY FACILITIES**

**01.1.03 USE CHARGES**

- A. The cost or use charges for temporary facilities shall be considered incidental to the cost for other items of the work and no additional compensation will be made therefor.
- B. Other entities shall be allowed to use temporary services and facilities without cost, including, but not limited to, testing and inspecting agencies and personnel of authorities having jurisdiction over the work.
- C. **Technical Provisions**
1. Reserved

**01.1.04 PROJECT CONDITIONS**

- A. The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Temporary services and facilities shall be kept clean and neat.
  2. Temporary services and facilities shall be relocated as required by progress of the Work.
- B. Facilities shall be located where they will serve the Project adequately and result in minimum interference with performance of the Work.
1. Coordinate location(s) with the Owner's Representative.
  2. Relocate and modify facilities as required.
- C. **Technical Provisions**
1. Reserved

**01.1.05 SUPPORT FACILITIES INSTALLATION**

- A. Field offices (where required), storage sheds, sanitary facilities, and other temporary construction and support facilities shall be located for easy access and security.
- B. **Technical Provisions**
1. Reserved

**01.1.06 FIRST AID**

- A. The Contractor shall provide first aid equipment in accordance with governing regulations.
- B. **Technical Provisions**
1. Reserved

**01.1.07    FIRE EXTINGUISHERS**

- A.    The Contractor shall provide temporary fire extinguishers at the project site until Owner occupation or final acceptance, whichever comes first.
- B.    The Contractor shall provide hand-carried portable UL rated, Class “A” fire extinguishers for temporary offices and similar spaces.
  - 1.    In other locations provide hand carried portable UL rated, Class “ABC” dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classed for the exposures.
  - 2.    Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.
- C.    **Technical Provisions**
  - 1.    Reserved

**PART 2    PRODUCTS (NOT USED)**

**PART 3    EXECUTION (NOT USED)**

**END OF SECTION**

---

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents includes work related to the furnishing, installing, and maintaining, traffic control as it relates to completion of the Work.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 33 00 SUBMITTAL PROCEDURES**

**01.1.03 SUBMITTALS**

- A. Contractor shall prepare a Construction Traffic Control Plan and submit three (3) copies of the plan to the Engineer for approval.
- B. The Engineer will review the Traffic Control Plan and submit it to the Owner on behalf of the Contractor for approval.
- C. The Traffic Control Plan shall include the following:
1. Names of all roads affected by the work
  2. Anticipated dates of all road and lane closures or disruptions
  3. Detour routes for road closures
  4. Dates and methods of public notification of road and lane closures
  5. A description of the temporary traffic control devices to be used including the type as defined by MUTCD, the location where they will be used, and the dates they will be in place
  6. Schematic drawings showing the roads and lanes to be closed, the detour routes, and the location of temporary signing and other traffic control
- D. **Technical Provisions**
1. **Submit a Traffic Control Plan at least two weeks before anticipated start of construction, or during the pre-construction meeting if requested, and before changes in segments or phases of the work on the project. Staging area(s), haul routes, and pedestrian access routes shall be denoted on all Traffic Control Plans. The Owner and Engineer will review for general layout of the Traffic Control Plan considering known off-site activities and may require modification to the plan or construction timing to coordinate events. Work shall not commence until said plan is approved. (PRSP)**
    - a. **Refer to SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION for additional information that may affect the Traffic Control Plan.**

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

- A. The Contractor shall be responsible for traffic control on the Project, and shall furnish, erect and maintain all necessary traffic control devices required to provide safe movement of vehicular traffic through the Project, in accordance with the Drawings and these Specifications.

- B. The Contractor shall also be responsible for protection of pedestrian traffic during construction.
- C. Prior to the start of any construction operations that necessitate traffic control signing that is the Contractor's or Subcontractor's responsibility, the Contractor shall make available for inspection (24 hours prior to installation) all traffic control devices to be furnished and used by the Contractor in order to insure conformance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), American with Disability Act (ADA), and the contract requirements. The Contractor shall have full responsibility for meeting the requirements of the MUTCD.
- D. The Contractor shall modify his proposed traffic control devices as deemed necessary by the Owner's Representative.
- E. Traffic control devices include, but are not limited to barricades, warning signs, lane marking, trailers, flashers, cones and drums as required, and sufficient barricade weights to maintain barricade stability.
- F. No hand-lettered signs will be approved for installation.
- G. **Technical Provisions**
  - 1. Reserved

**01.3.02 NOTIFICATIONS**

- A. The Owner will be notified of ALL road, public access, drives, and complete direction of travel closures and openings.
- B. The County Highway Department will be notified of ALL County street/intersection and complete direction of travel closures and openings.
- C. Sanitation Department or others, as appropriate, will be notified of all alley and drive closures.
- D. News releases/handouts and personal contact requirements will be determined by the Owner.
- E. **Technical Provisions**
  - 1. Reserved

**01.3.03 DAILY INSPECTIONS**

- A. The Contractor shall provide surveillance at least once every 24 hours of the traffic control devices to insure that they are properly placed and in good condition.
- B. The Contractor shall immediately repair or replace any traffic control device that is damaged, moved, stolen, or destroyed.
- C. Traffic control devices shall be maintained in such a manner that the cleanliness, reflectorization and position is acceptable to the Owner's Representative.
- D. The Contractor shall submit to the Owner's Representative a checklist certifying that the daily inspection of the traffic control devices has been taken.
- E. The checklist shall be in a form approved by the Owner's Representative.
- F. **Technical Provisions**
  - 1. Reserved

**01.3.04 CONTACT PERSONS**

- A. The names, addresses and telephone numbers of at least two local individuals who will be available during non-working hours to maintain or replace traffic control devices shall be furnished to the Owner's Representative. These individuals shall have some knowledge of the maintenance and the proper placement of traffic control signs and devices.

B. **Technical Provisions**

1. Reserved

**01.3.05 FAILURE TO MAINTAIN**

- A. If at any time, the Contractor fails to adequately maintain any of the traffic control devices, the Owner may proceed to perform the maintenance and deduct the cost thereof from any monies due or coming due the Contractor. The Contractor shall be solely liable for any damages caused by a failure to maintain the traffic control devices.

B. **Technical Provisions**

1. Cost incurred by Owner for maintenance specified in this subsection shall be the responsibility of the Contractor. Payment shall be withheld as a Set-off on the Contractor's next application for payment. **(SID\_OFF)**

**01.3.06 SIGNAGE**

- A. Signs supports, barricades, and other devices placed in or near the roadway shall be crash worthy and meet the applicable requirements of the AASHTO Roadside Design Guide (latest edition). **(TP-1)**

- B. Only sandbags resting on the ground should be used if ballast is required to keep signs or barricades upright.

C. **Technical Provisions**

1. All traffic control devices as specified in part A of this subsection shall be clean, legible, reflective for night-time use, and operable. Signs and devices must meet standards outlined in the current ATSSA "Quality Guidelines for Temporary Traffic Control Devices" to be measured for payment. Failure to adequately maintain and clean traffic control devices in use renders the traffic control operation unacceptable. **(PRSP-SID\_MOD)**

**01.3.07 FLAG PERSONS**

- A. The Contractor shall provide flaggers when their operations may constitute a hazard to traffic and at any other time required by MUTCD.

- B. The use of flaggers shall be as necessary to meet the requirements of the MUTCD and the cost of which shall be included in the price bid for the work that requires traffic control and no direct compensation will be made therefor.

- C. Qualified flag persons shall be provided by the Contractor in conformance with provisions set forth in Chapter 6E of the Manual on Uniform Traffic Control Devices and as modified herein:

1. Flag persons, while on duty shall wear a fluorescent orange hard hat and vest.
2. The vest shall be reflectorized if worn at night.
3. Flag persons shall be fully clothed when on duty (shirt or blouse, slacks or trousers and sturdy shoes).

- D. Flag persons shall use an approved "stop-slow" paddle or standard when directing traffic.

E. **Technical Provisions**

1. Reserved

**01.3.08 ACCESS MAINTENANCE**

- A. The Contractor shall maintain access to all abutting properties, especially for emergency vehicles, and minimize inconvenience to abutting property owners.

- B. Providing access maintenance shall be included in the price bid for work affecting access and no additional compensation will be made therefor.

C. **Technical Provisions**

1. Reserved

**01.3.09 PROTECTION OF PEDESTRIANS**

- A. The Contractor shall be responsible for the protection of pedestrian and bicycle traffic on sidewalks and bike/walking paths and at intersections by providing a temporary gravel surface after the sidewalk or path designated for removal has been removed.
- B. Providing protection for pedestrians as specified herein shall be included in the price bid for the work that requires the protection of pedestrians and no additional compensation will be made therefor.
- C. **Technical Provisions**
  1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Specifications includes the Contractor's coordination of the work with Subcontractors, the Owner, and affected property and utility owners.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION**  
**SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS**

**01.1.03 NOTICE TO UTILITIES**

- A. The Contractor shall notify public and private utility companies and municipalities as to any of their properties (such as pole lines, conduits, gas pipes, water pipes, sewers and tile lines) located within the project site that must be removed or relocated to complete the Project.
- B. The notice will specify the locations to which their properties are to be relocated.
- C. No warranty is made or implied by the Owner that the utility owners will remove or relocate their properties prior to commencement of construction operations or in sufficient time or manner to prevent interference with the Contractor's operations.
- D. The Contractor shall give notice to the owners of all known utilities at least 48 hours (excluding Saturdays, Sundays and Holidays) before starting any operations affecting those properties.
- E. If, during the course of their operations, the Contractor discovers utility property whose existence was not known, the Contractor shall immediately notify the utility company and the Owner's Representative.
- F. Montana One-Call: 811 or (800) 424-5555.
- G. Utilities known to exist in the project area are:

<u>UTILITY</u>	<u>OWNER</u>	<u>TELEPHONE</u>
Water/Sewer/Storm Sewer	City of Glendive	406-377-3318
Communication	Century Link	800-283-4237
Communication	Mid-Rivers	406-274-4149
Electrical/Natural Gas	MDU	800-636-3278

- H. This list is not meant to be inclusive and other utilities may exist within the project area. The Contractor shall be cautioned that all utilities may not be subject to the One-Call system and should take necessary precautions.
- I. **Technical Provisions**
  - 1. Reserved

**01.1.04 PROTECTION OF EXISTING UTILITIES**

- A. Known utilities and facilities adjacent to or within the work area are shown on the Drawings. The locations shown are taken from existing records and the best information available from existing utility plans; however, it is expected that there may be some discrepancies and omissions in the locations and the number and type of utilities shown. The Contractor's request for additional compensation or contract time resulting from encountering utilities not shown will be considered as set forth in the General Conditions. The Contractor is solely responsible for locating and

avoiding conflicts with all existing utilities. The Contractor shall pay all costs associated with having utility company representatives on the site for this work and shall include these costs in the price bid for related items of work.

- B. No attempt has been made to include information regarding service lines or private underground utilities beyond the responsibility of public utilities.
- C. The Contractor shall locate and protect all underground utilities in or near the work whether they are private or public and regardless of whether or not they are shown on the Drawings.
- D. Where the Contractor's operations could cause damage or inconvenience to telephone, television, power, oil, gas, water, sewer, or irrigation systems, the Contractor shall make arrangements necessary for the protection of these utilities and services. The Contractor shall replace existing utilities removed or damaged during construction with equal or better material, unless otherwise provided for in these Contract Documents.
  - 1. Coordination with power utilities shall be performed in accordance with **SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION** of these Specifications.
- E. Special attention shall be paid to crossings of fiber optics cables and where the carrier pipes have been capped with concrete. In some cases, the bottom portion of the piping is not supported by the concrete cap. The Contractor shall take special precautions in supporting and excavating under these crossings.
- F. The Contractor shall notify utility offices that are affected by construction operations at least 48 hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for the utilities.
- G. The Contractor shall protect all utility poles from damage. If interfering utility poles will be encountered, notify the utility company at least 48 hours in advance of construction operations to permit necessary arrangements with the utility company for protection or relocation of the interfering poles. Relocation of utility poles not specified in the contract documents for the Contractor's convenience shall be at the Contractor's expense. Damage cost associated with damage to overhead utilities shall be the full responsibility of the Contractor.
- H. The Contractor shall be solely and directly responsible to the owner and operator of such properties for damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of injuries or damage which may result from construction operations under this Contract.
- I. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.
- J. The Contractor shall maintain a legible log of all utility crossings showing type, depth, date of crossing, location referenced to project stationing, and a notation if the utility was damaged, type of repair, and who made the repair. The Contractor will work with the Engineer to maintain an accurate and complete log which will become part of the as-constructed Contract Drawings. A utility crossing log has been included herein for convenience, **SCHEDULE 01 71 00 – A**.
- K. Immediate and adjacent areas where excavations are to be made shall be thoroughly checked by visual examination for indications of underground facilities and also checked with electronic metal and pipe detection equipment. Where there is reasonable cause to verify the presence or absence of any underground facility, the Contractor shall make exploratory excavations prior to proceeding with major construction in the area. Where information on buried facilities is required to verify their nature, shape, configuration, dimensions, materials, or other properties, make exploratory excavations as required to ensure avoidance of conflicts and as acceptable to the Owner and Engineer.
- L. The Contractor is advised that there is a One-Call utilities locate number in use for utility location requests within the State of Montana for buried gas and electrical lines, buried telecommunication lines, and underground water, sewer, and storm drains. **The One-Call number is 1-800-424-5555. It is mandatory to use this system before any excavation work in Montana.**

- M. The Contractor shall assume full responsibility for reimbursing the utility owners for any damages caused by their operations to utility properties whose existence and approximate locations were made known to them before the damage was done.
- N. The Contractor shall be responsible for providing buried utility locations for areas on the site which are beyond the responsibility of utility owners.
- O. The utility lines beyond the area of responsibility of the utility owners may include but are not necessarily limited to the following:
  - 1. Site specific electrical distribution lines
  - 2. Site specific control wiring
  - 3. Site specific water, sewer and process lines
  - 4. Site specific natural gas lines
- P. Nothing in these Specifications shall make the Contractor liable for damage to utility property located below the ground surface, in the absence of negligence, if the owner of the utility property, after reasonable notice from the Contractor, fails to advise the Contractor of its location and approximate depth below the ground surface.
- Q. **Technical Provisions**
  - 1. Reserved

**01.1.05 INTERFERING STRUCTURES**

- A. The Contractor shall take necessary precautions to prevent damage to existing structures, whether on the surface, above ground, or underground. An attempt has been made to show major structures on the Drawings. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed.
- B. Existing features, fences, retaining walls, mail boxes, decorative pillars, yard décor, culverts, storm sewers, utility poles, rip rap, etc., that are in conflict or adjacent to the project site shall be protected and if they are disturbed they will be replaced or repaired to equal or better conditions, and the cost shall be incidental to the item of work affecting the features unless specifically itemized in the bid form.
- C. The Contractor may remove and replace in equal or better than original condition, small structures such as fences, mailboxes, and sign posts that interfere with the Contractor's operations. Replacement of these small structures will be incidental to the work. The Contractor shall obtain permission from the small structure owner prior to removal and replacement. Comply with all regulatory requirements, and provisions of **SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** of these Specifications.
- D. **Technical Provisions**
  - 1. Reserved

**01.1.06 INFORMATION FOR ON SITE CONDITIONS**

- A. Information obtained by the Owner regarding site conditions, topography, existing construction of site facilities as applicable, and similar data is included in the Contract Documents. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for its accuracy or completeness or for the Contractor's interpretation of such information.
- B. Soil moisture and ground water levels will fluctuate due to seasonal changes, weather, irrigation and other variations in conditions. Methods and procedures related to differing soils could include adjusting the means and methods of excavation, installation or removal of soils encountered. The Contractor is responsible to determine construction methods and include these costs in the bid unit prices.
- C. Methods and procedures related to wet soils could include adjusting the moisture content of the material or removal of wet material and replacement with another suitable material.

- D. Methods and procedures related to HDD may require the use of different and or specialized drilling bits best suited to perform the work in the soil conditions present. Contractor will be responsible for determining the equipment necessary to perform the work in an efficient and effective manner, and verifying for his/her self the present on-site conditions. No additional compensation, or leniency to HDD specifications, will be allotted based on soil conditions unless otherwise approved by the Owner or Engineer.
- E. Groundwater may be present in the project area and may be encountered during construction. All Bidders are strongly encouraged to visit the site of the work and conduct all field investigations at their disposal to become acquainted with the nature of the work. Written authorization shall be obtained from the Owner, utilities, and others who may be directly affected prior to entering the property; conducting field tests, drilling, boring, excavating, or test pumping.
- F. **Technical Provisions**
  - 1. Reserved

**01.1.07 SIGNS AND MAIL BOXES**

- A. Existing signs and mail boxes found within the construction limits shall be relocated and/or replaced in accordance with the provisions of **SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** of these Specifications.
- B. The cost of removing and reinstalling street signs and mail boxes and providing flag persons when stop signs and yield signs are temporarily removed shall be incidental to the price bid for the work that required the relocation and no direct payment will be made for such work.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**CONTINUED**



**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Document includes work related to furnishing, installing, and maintaining survey control and construction staking as it relates to the completion of the Work.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 33 00 SUBMITTAL PROCEDURES**  
**SECTION 01 78 00 CLOSEOUT SUBMITTALS**

**01.1.03 SUBMITTALS**

- A. The Contractor shall provide one (1) copy of survey notes to the Engineer within 24 hours of staking in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

- A. When required, the Contractor shall employ a Land Surveyor registered in the State of Montana, an experienced party chief, or an Engineering technician versed in construction layout and construction staking. The person employed must be suitable for the work proposed.
- B. **Technical Provisions**
  - 1. Reserved

**01.3.02 EXAMINATION**

- A. Available survey information is provided on the construction plan drawings. Topographic elevations are included in the Drawings.
- B. The Contractor shall check existing vertical and horizontal survey control points on structures and improvements located in the vicinity of the work prior to beginning work. He may establish new vertical and horizontal survey control points, if desired. The Contractor shall check the points for movements when directed by the Engineer or when the Contractor feels it necessary to verify these control points.
- C. The Contractor shall verify locations of survey control points prior to starting work.
- D. The Contractor shall promptly notify the Engineer of any discrepancies discovered.
- E. **Technical Provisions**
  - 1. Reserved

**01.3.03**    **SURVEY REFERENCE POINTS**

- A. The Contractor shall protect survey control points prior to starting site work; preserve permanent reference points during construction.
- B. The Contractor shall promptly report to the Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- C. The Contractor shall replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Engineer.
- D. **Technical Provisions**
  - 1. Reserved

**01.3.04**    **ENGINEER SURVEYS & STAKING**

- A. The plan sheets have the basic primary horizontal control and a series of benchmarks for use in design and detailed staking of this project for construction. The contractor shall use these control points and provide the required construction staking for the completion of the project.
- B. The Engineer can provide construction staking, if requested by the Contractor, on an hourly fee basis. An estimated fee for construction staking will be provided upon request, using the Engineer's current standard rates. **(TP-1)**
- C. **Technical Provisions**
  - 1. **If construction staking is requested and provided by the Engineer as specified in part B of this subsection, absolutely no "second time" or "re-staking" work will be performed by the Engineer. Costs for re-staking work shall be based on the Engineer's current standard rates and will be deducted from the next progressive pay estimate. (SID\_OFF)**

**01.3.05**    **CONTRACTOR SURVEYS & STAKING**

- A. Contractor shall provide laser and/or other line and grade establishment techniques acceptable to the Engineer, to establish line and grade for the work involved within the tolerances specified including, as a minimum, laser control or hub and tack at 25-foot intervals. When using laser control for pipe laying, the Contractor shall verify the accuracy of the laser at least every 200 feet. Accuracy shall be checked using a transit level.
- B. In addition, the Contractor shall be responsible for, but not limited to the following:
  - 1. The Contractor shall coordinate construction staking with their work.
  - 2. Protecting and using the construction control stakes that have been set by the Engineer.
  - 3. Any surveys prior to the excavation/embankment to establish the original grade or cross section condition for calculation of quantities, if necessary.
  - 4. Giving an advance request (at least three working days) of any construction staking needs, in writing by completing and submitting the "Request for Staking" form included in this Section.
  - 5. Provide all monument materials, all excavation and backfill, street restoration, etc. relative to the restoration of monuments. The Contractor shall install these in the position identified by the Engineer.
  - 6. All other surveys necessary for construction that are not identified above.
- C. **Technical Provisions**
  - 1. Reserved

**01.3.06**    **PROTECTION OF SURVEY MARKERS AND MONUMENTS**

- A.    Protect all survey markers and monuments. Protection includes marking with flagged high lath and supervising work near markers and monuments. Do not disturb monuments without prior approval from the Engineer.
- B.    **Technical Provisions**
  - 1.    Reserved

**01.3.07**    **ENGINEERING FORMS**

- A.    The following form is included in this Section:
  - 1.    Request for Staking Form
- B.    The Contractor shall complete and submit the appropriate forms to the Engineer during the course of work. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- C.    **Technical Provisions**
  - 1.    Reserved

**01.3.08**    **PROJECT RECORD DOCUMENTS**

- A.    The Contractor shall maintain a complete and accurate log of control and survey work as it progresses.
- B.    The Contractor shall submit Record Documents under provisions of **SECTION 01 78 00 CLOSEOUT SUBMITTALS** of these Specifications.
- C.    **Technical Provisions**
  - 1.    Reserved

**CONTINUED**



# STAKING REQUEST FORM

IEI Project No. \_\_\_\_\_

Project: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

SUBMIT TO: \_\_\_\_\_ @interstateeng.com

**FORM REQUIREMENTS**

- Contractor to transmit completed form to Interstate Engineering at email address or fax number shown at least (72) hours in advance of the desired staking. (72) hour period shall not include weekends or holidays.
- Contractor shall fill out all information required below. Failure to provide information requested may result in delays in staking.

Drawing Ref. No.	Type of Staking Requested (Grade Stakes, Offset Stakes, Corner Stakes, Blue Tops, etc) and Specific Location (Street, MH to MH, curb and gutter, etc.)	Offset Position (side or direction)	Offset Distance (Ft.)	Staking Interval (Ft.)	Date Area will be ready for Staking	Date Staking is Desired	Date Staking Completed

Contractor's Representative Making Request: \_\_\_\_\_ Phone # \_\_\_\_\_ Date \_\_\_\_\_

Received By: \_\_\_\_\_ Date/Time \_\_\_\_\_

Comments: \_\_\_\_\_

Requested Work is Under Contract

Requested Work constitutes ADDITIONAL SERVICES, the cost for which is to be paid to Interstate Engineering, Inc. by: \_\_\_\_\_

CLIENT'S Authorization to provide ADDITIONAL SERVICES \_\_\_\_\_

Survey Crew Assigned: \_\_\_\_\_

Comments: \_\_\_\_\_

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

A. This section of the Specifications describes the requirements for final site cleaning.

**01.1.01 REFERENCES**

A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

A. This section reserved.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

A. This section reserved.

**01.3.02 FINAL CLEAN UP**

- A. The Contractor shall conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution regulations.
- B. The Contractor shall employ experienced workers or professional cleaners for final clean up.
- C. The Contractor shall complete the following cleanup operations before requesting review for certification of Final Completion:
  - 1. Clean the Project site, and all areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - 2. Remove all construction debris and surplus materials from the site.
  - 3. Restore turf and gravel areas in staging areas and all areas disturbed by the construction.
  - 4. Remove all temporary traffic control devices.
  - 5. Sweep paved areas broom clean.
  - 6. Remove petrochemical spills, stains, and other foreign deposits.
  - 7. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - 8. Remove tools, construction equipment, machinery, and surplus material from the site.
  - 9. Remove debris from limited access spaces, including equipment vaults, manholes, and similar spaces.
- D. The Contractor shall comply with safety standards for cleaning.
  - 1. Do not burn waste materials.
  - 2. Do not bury debris or excess materials on Owner's property.
  - 3. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
  - 4. Remove waste materials from Project site and dispose of lawfully.
- E. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Contract Documents includes the submittals and procedures which must be completed before Final Payment can be considered by the Owner.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**GENERAL CONDITIONS**  
**SECTION 01 78 00 CLOSEOUT SUBMITTALS**

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

- A. The Contractor shall submit Record Documents per **SECTION 01 78 00 CLOSEOUT SUBMITTALS** of these Specifications.
- B. Where applicable, the Contractor shall submit operation and maintenance data to the Owner's Representative per **SECTION 01 78 00 CLOSEOUT SUBMITTALS** of these Specifications.
- C. Where applicable, the Contractor shall provide products, spare parts, maintenance, and extra materials in quantities specified in individual Specification Sections.
- D. Where applicable, the Contractor shall deliver and place spare parts and materials in a location as directed by the Owner and obtain receipt prior to final payment.
- E. **Technical Provisions**
1. Reserved

**01.3.02 SUBSTANTIAL COMPLETION**

- A. Before requesting a review for determining date of Substantial Completion, the Contractor shall complete the following:
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Complete final clean up requirements.
  3. Touch up and otherwise repair and restore damaged portions of the work to eliminate visual defects.
  4. Contractor shall furnish the Owner written releases from property owners and/or public/private agencies where staging activities, or work within easements has been undertaken.
  5. In the event the Contractor is unable to secure written releases, inform the Owner for reasons.
  6. The Owner or its representatives will examine the site, and the Owner will direct the Contractor to complete work that may be necessary to satisfy terms of the easements.

7. Should the Contractor refuse to do this work, the Owner reserves the right to have it done by a separate contract and deduct the cost of same from the Contract amount, or require the Contractor to furnish a satisfactory bond in a sum to cover legal claims for damages.
  8. When the Owner is satisfied that work has been completed in agreement with the Contract Documents and term of easements, the right is reserved to waive the requirement for written release if Contractor's failure to obtain such statement is due to the grantor's refusal to sign, and this refusal is not based upon any legitimate claims that Contractor has failed to fulfill the terms of the easement or the Contractor is unable to contact or has had undue hardship in contacting the grantor.
- B. The Contractor shall submit a written request for review for Substantial Completion.
1. Upon receipt of request, the Owner's Representative, the Owner, and the Contractor's Representative will agree upon a time to proceed with the review.
  2. The Owner's Representative will prepare a deficiency list of items found to be incomplete or incorrect, and will prepare the Certificate of Substantial Completion. The warranty period for the work deemed to be substantially complete shall begin on the date identified on the completed certificate. Contract time will continue to run until the Certificate of Substantial Completion for all work has been issued.
  3. The Contractor shall request a subsequent review when the Work identified in previous reviews as incomplete is completed or corrected.
  4. Results of completed reviews will form the basis of requirements for Final Completion.
- C. **Technical Provisions**
1. Reserved

**01.3.03**     **WARRANTY PERIOD**

- A. A (1) - year warranty period will begin on all work performed by the Contractor once the Certificate of Substantial Completion is issued as required in Article 15.08 of **SECTION 00 72 00 GENERAL CONDITIONS** of these Specifications. **(TP-1)**
- B. The Contractor shall remedy any defects in the work performed and in the materials furnished, and pay for any damage to other work resulting therefrom, which shall appear within a period of one (1) - year from the date of Substantial Completion.
- C. Trench settlement is a key warranty item which the Contractor shall be solely responsible for preventing and/or repairing should settlement occur. If at any time, work is performed during the warranty phase, that work will be warrantied for an additional period of one (1) - year from the completion of the fix/correction. Written notice of completion indicating the warrantied item fixed and date completed must be submitted to the Owner and Engineer.
- D. **Technical Provisions**
1. A (1) - year warranty period will begin on all work performed by the Contractor once the Certificate of Substantial Completion is issued as required in Article 3.5 of **GENERAL CONDITIONS** of these Specifications. **(MSP)**
  2. There will be a mandatory 11 – month walkthrough with the Contractor, Owner and Engineer prior to ending of warranty period as specified in part A of this subsection. All expenses associated with coordination and travel for Contractor to make said walkthrough, shall be at the Contractor's expense. **(SID\_OFF)**

**01.3.04**     **FINAL COMPLETION**

- A. Before requesting final review for determining date of Final Completion, the Contractor shall complete the following:
1. Submit a final application for payment.

2. Submit a certified copy of the Owner's Representative's Substantial Completion review list of items to be completed or corrected (punch list), endorsed and dated by Owner's Representative.
    - a. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit a written request for final review for acceptance.
    - a. Upon receipt of request, the Owner's Representative, the Owner, and the Contractor will either proceed with the review or the Owner's Representative will notify the Contractor of unfulfilled requirements.
  4. The Owner's Representative will accept the final Certificate for Payment after the review or will notify Contractor of any remaining deficiencies.
- B. **Technical Provisions**
1. Reserved

**End of Section**

**PART 1 GENERAL**

**01.1.01 GENERAL**

- A. This section of the Specifications describes the administrative and procedural requirements for closeout submittals.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 33 00 SUBMITTAL PROCEDURES**  
**SECTION 01 71 00 EXAMINATION AND PREPARATION**  
**SECTION 01 77 00 CLOSEOUT PROCEDURES**

**01.1.03 RECORD DRAWINGS**

- A. The Contractor shall submit one set of marked-up Record Prints to the Owner's Representative at the conclusion of construction.
- B. If Contractor is unable to supply a complete set of Record Drawings at the completion of the project, a set of Record Drawings will be provided by the Engineer to the Owner, at the Contractor's expense. Costs associated with Engineer's services to complete these documents will be withheld from his final progress payment.
- C. Record drawings shall be maintained by the Contractor and comply with the following:
- D. The Contractor shall maintain one set of prints of the Contract Drawings and Shop Drawings.
1. The Contractor shall mark record prints to show the actual installation where installation varies from that shown on the Drawings.
    - a. The mark ups should be made by the individual or entity that obtained the record data, whether the individual or entity is the installer, Subcontractor, or similar entity.
    - b. Give particular attention to information on concealed elements that will be difficult to identify or measure and record after completion of the work.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    - d. Record locations of underground pipes, fittings, corporation stops, and valves.
    - e. Record Drawings shall also include changes in pipe length, depths, stations, type/size of material, fittings, notes, etc.
  2. The Contractor shall mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately.
    - a. If Shop Drawings are marked, the cross-reference on the Contract Drawings shall be shown.
  3. The Contractor shall mark record sets with erasable, red-colored pencil.
    - a. The use of other colors to distinguish between changes for different categories of the Work at same location is permissible.
    - b. Record sets shall be made available for review by the Owner's Representative throughout the Project.

- 4. The Contractor shall note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- E. The Contractor shall maintain one copy of each submittal during the construction period for Project Record Document purposes.
- F. The Contractor shall post changes and modifications to Project Record Documents as they occur.
- G. **Technical Provisions**
  - 1. Reserved

**01.1.04**    **OPERATION AND MAINTENANCE DATA**

- A. The Contractor shall submit three (3) Operation and Maintenance Manuals to the Owner's Representative prior to start-up of any equipment for which said manual are to be provided.
- B. These manuals shall be received by the Owner's Representative seven (7) days before the first scheduled day of operator training, if required.
- C. The Contractor shall review each O & M Manual before submitting it to the Owner's Representative to ascertain that it is acceptable in terms of providing sufficient information and data to the Owner to instruct the Owner as to how to properly and safely operate and maintain the equipment to minimize operation and maintenance costs and down time.
- D. The manuals shall include:
  - 1. Factory catalog cuts on all mechanical equipment installed indicating specific model number and detailed parts lists.
  - 2. Shop drawings on all installed equipment bearing the Owner's Representative's stamp of acceptance.
  - 3. Specific handwritten instructions on start-up, operation, maintenance, adjustment, trouble shooting and shut-down.
  - 4. Maintenance schedules which describe daily, weekly, monthly, semi-annual, and annual maintenance work required for each component of the equipment.
- E. The Contractor shall submit the bound copies of the Operation and Maintenance Manual (O & M) Manuals to the Owner's Representative for review and acceptance.
- F. Upon acceptance, the manuals will be given to the Owner by the Owner's Representative.
- G. **Technical Provisions**
  - 1. Reserved

**PART 2**    **PRODUCTS (NOT USED)**

**PART 3**    **EXECUTION (NOT USED)**

**END OF SECTION**

---

**PART 1 GENERAL**

**01.1.01 DESCRIPTION**

- A. This section of the Specifications includes services related to demonstration and training for operation and maintenance of new equipment to the Owner's operating staff.

**01.1.01 REFERENCES**

- A. This section reserved.

**01.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of this Project Manual:

**SECTION 01 78 00 CLOSEOUT SUBMITTALS**

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**01.3.01 GENERAL**

- A. The Contractor shall arrange for an experienced and authorized manufacturer's representative to provide operator training for the equipment listed in **SCHEDULE 01 79 00 A** at the end of this section.
1. Sales Representatives shall not be considered experienced and authorized Manufacturer's Representative unless they deliver a certification for training and authorization from the equipment manufacturer to the Owner's Representative prior to the commencement of the training.
- B. The number of days of operator training for each piece of equipment to be provided at the time of start-up is shown in **SCHEDULE 01 79 00 A** at the end of this section.
- C. The Owner reserves the right to record any and all portions of the operator training sessions by means of an audio/visual recorder.
- D. The Operation and Maintenance Manuals shall be furnished to the Owner at least seven (7) days prior to the first training session.
- E. The number of days shown in **SCHEDULE 01 79 00 A** at the end of this section for Operator/ Resident Project Representative (RPR) training shall include the amount of time on-site and shall not be used for travel time, start-up services, callback or warranty services. **(TP-1)**
- F. Demonstration and Training shall be scheduled based on the Owner's or Engineer's availability.
- G. **Technical Provisions**
1. Time on site as specified in part E of this subsection, shall follow these guidelines. One half (1/2) day shall be considered to include no less than four (4) hours and one full day (1) shall be considered to include no less than eight (8) hours of demonstration and training, including future maintenance. **(BIL\_OFF)**

**01.3.02 CALLBACK SERVICES**

- A. Callback services shall be included by the equipment manufacturer and Contractor to assist in operational adjustments, checking calibrations, and providing further operator training.
- B. Call back time is based upon the start of the warranty period, and callback work is to be performed as part of the warranty.
- C. At one (1) month after use of the facility by the Owner, the Contractor shall arrange to provide a minimum of three (3) hours of on-site call back services.

- D. All of these times are minimums required and additional time to adjust the equipment furnished by the Contractor shall be provided as required at no additional cost to the Owner.
- E. **Technical Provisions**
  - 1. Reserved

**SCHEDULE 01 79 00 A**

**ITEMS REQUIRING OPERATOR/RESIDENT PROJECT REPRESENTATIVE TRAINING**

<b>Division or Section</b>	<b>Description</b>	<b>No. of Days</b>
33 14 43	Booster Station	2 - Start Up, 1 – Eleven Month Warranty

**END OF SECTION**

## **PART 1 SPECIAL PERFORMANCE REQUIREMENTS**

**SP-1.** In the preparation of Drawings and Specifications, the Engineer or Engineer's Consultants relied upon the following reports of exploration and test of subsurface conditions at the Site:

- A. *Geotechnical Exploration*, prepared by American Engineering Testing, Inc. Dated, March 18, 2020. Located in Appendix 1 of this Project Manual.
- B. These reports and drawings are not part of the Contract Documents, but "technical data" contained therein upon which the Contractor may rely as identified and the above are incorporated therein by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer and Engineer's Consultant's in the preparation of Drawings and Specifications.

**SP-2.** The City of Glendive has a bulk water station available to purchase construction water for compaction. If this is the route that the Contractor prefers to obtain water for compaction purposes, the Contractor shall contact the PWD and set up an account with the City.

**SP-3.** The term "Engineer" may be substituted for "Owners Representative" in the Contract Documents and is hereby defined as Interstate Engineer, Inc.

### **SP-4. CONTROLLING DOCUMENTS**

- A. The Special Construction Performance Requirements stated hereinafter shall supersede any conflicting variances stated in these specifications or clarify non-standard bid items. The specifications governing this contract are included herein.
- B. References made to Standard Drawings, shall be in reference to Standard Drawings provided by Montana Public Works Standard Specifications (MPWSS), Sixth Edition, April 2010, but shall be superseded by the following documents.
- C. The following provision items are included to supplement the Standard Specifications, the General Conditions and to clarify items specific to this project. These provisions are part of the overall specifications and, as such, shall be regarded in a like manner during the bidding process and during the construction phase and shall supersede items of like nature in the standard specification.
- D. Precedence shall be given in the following order:
  - 1. Any revised drawing issued after the bidding period
  - 2. Any Addenda issued during the bid and advertisement period
  - 3. Plan Sheets
  - 4. Special Construction Performance Requirements (**01 88 13 SPECIAL CONSTRUCTION PERFORMANCE REQUIREMENTS**)
  - 5. **Technical Provisions** as incorporated within these Specifications
  - 6. Specifications included herein
  - 7. General Conditions
  - 8. Standard Specifications and Drawings as adopted from the Montana Public Works Standard Specifications (MPWSS), Sixth Edition, April 2010.

- C. Any subsequent addenda issued after these specifications have been prepared shall supplement and/or superseded any article of these specifications.

**SP-5.** **CONTRACT TIME:**

- A. All Construction Schedules shall be substantially complete and ready for OWNER's use and pre-final inspection by **March 31<sup>st</sup>, 2021**. A winter shutdown is expected in 2020 with a resume work order to be issued in 2021 for the booster station installation/start-up, at a minimum.
- B. All construction schedules shall be finally complete and ready for final payment within **(30)** calendar days of Substantial Completion.
- C. Base Bid:
  - 1. Construction shall be substantially complete and ready for OWNER's use and pre-final inspection within **(75)** calendar days from the Notice to Proceed.
- D. Additive Alternate #1
  - 1. If awarded, an additional **(15)** calendar days shall be added to the contract time. Construction shall be substantially complete and ready for OWNER's use and pre-final inspection within the cumulative **(90)** calendar days from the Notice to Proceed for the Base Bid and Additive Alternate #1.
- E. Additive Alternate #2
  - 1. If awarded, an additional **(20)** calendar days shall be added to the contract time. Construction shall be substantially complete and ready for OWNER's use and pre-final inspection within the cumulative **(110)** calendar days from the Notice to Proceed for the Base Bid, Additive Alternate #1 and Additive Alternate #2.
- F. Additive Alternate #3
  - 1. If awarded, an additional **(10)** calendar days shall be added to the contract time. Construction shall be substantially complete and ready for OWNER's use and pre-final inspection within the cumulative **(120)** calendar days from the Notice to Proceed for the Base Bid, Additive Alternate #1, Additive Alternate #2 and Additive Alternate #3.

**END OF SECTION**

# MFWP – MAKOSHIKA WATERLINE EXTENSION

## GLENDIVE, MONTANA

### DIVISION 03 CONCRETE

#### TABLE OF CONTENTS

#### DIVISION 03 – CONCRETE

---

SECTION	DOCUMENT
03 00 00 .....	Concrete
03 05 00 .....	Common Work Results for Concrete
03 20 00 .....	Concrete Reinforcing
03 39 00 .....	Concrete Curing

**DIVISION - 03**

**PART 1 GENERAL**

**03.1.01 DESCRIPTION**

- A. This section of the Contract Documents includes furnishing cast-in-place and structural concrete composed of Portland cement, aggregates, and water meeting all specified requirements.

**03.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |             |  |
|-------------|--|
| ASTM C31    | Making and Curing Concrete Test Specimens in the Field   |
| ASTM C33    | Concrete Aggregates  |
| ASTM C39    | Compressive Strength of Cylindrical Concrete Specimens   |
| ASTM C94    | Ready-Mixed Concrete   |
| ASTM C138   | Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete                                      |
| ASTM C143   | Slump of Hydraulic-Cement Concrete   |
| ASTM C150   | Portland Cement  |
| ASTM C173   | Air Content of Freshly Mixed Concrete by the Volumetric Method   |
| ASTM C231   | Air Content of Freshly Mixed Concrete by the Pressure Method   |
| ASTM C260   | Air-Entraining Admixtures for Concrete   |
| ASTM C595   | Blended Hydraulic Cements  |
| ASTM C618   | Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete  |
| ASTM C989   | Slag Cement for Use in Concrete and Mortars  |
| ASTM C1017  | Chemical Admixtures for Use in Producing Flowing Concrete  |
| ASTM C11575 | Hydraulic Cement   |
| AASHTO M213 | Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction |
| AASGTI T260 | Standard Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials               |
| AASHTO M148 | Standard Specification for Liquid-Forming Compounds for Curing Concrete                                      |
| ACI         | American Concrete Institute  |

**03.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>

**03.1.04 SUBMITTALS**

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs.
- B. Mix designs for each class of concrete shall be submitted to the Engineer in accordance with the requirements of **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. Submit written reports of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved.

- D. Concrete producers are to allow access to their facilities by Engineer or their representatives for inspecting their facilities and/or sampling materials. All facilities should meet the requirements of the "National Ready-Mix Concrete Association" check list for concrete production facilities.
1. Items directly affecting a facility's ability to properly proportion, transport and deliver concrete may be reason for disqualifying that facility as a source of supply until such deficiencies are corrected. Examples would include cement and aggregate scales that will not accurately weight materials or mixer units that will not thoroughly mix concrete materials.
- E. Submittals for a concrete mix design shall meet the mix proportions specified in ACI 301, Chapter 3, and include the following information.
1. Cement in lbs (kgs) – Type and source of supply
  2. Coarse aggregate – Size and source of supply
  3. Fine aggregate – Source of supply
  4. Water, gallons(liters) – City or well
  5. Admixtures, Oz/yd<sup>3</sup>(g/M<sup>3</sup>) – Brand and description\*
    - a. (\*) Description as retarder, accelerator, air entraining, etc.
- F. Submittals for concrete constituent material as a source of supply shall include the following information at the stated frequencies.
1. Aggregate gradations –With mix design / Updated monthly
  2. L.A. abrasions – With mix design
  3. Soundness – With mix design
  4. Deleterious substances – With mix design
  5. Water quality (if well) –With mix design / Updated twice yearly
  6. Cube strength and time of set – With mix design
  7. Cement mill certificates – With mix design / Updated monthly
  8. Organic impurities – With mix design
- G. Submittals for concrete constituent material as a source of supply shall include testing information and properties included in the following information.
1. Current chemical analysis of mixing water (if well)
  2. Specific Gravity (Saturated Surface Dry) of coarse and fine aggregate
  3. ASTM C33 quality tests including the following:
    - a. Fine Aggregate
      - i. Gradation - AASHTO T27 and T11
      - ii. Deleterious substances soundness - AASHTO T104
      - iii. Organic impurities - AASHTO T21
      - iv. Mortar-making properties - AASHTO T71
    - b. Course Aggregate
      - i. Gradation - AASHTO T27 and T11
      - ii. Deleterious substances soundness - AASHTO T104
      - iii. Percentage of wear - AASHTO T96
      - iv. Absorption of course aggregate - AASHTO T85

- H. Submittals for concrete mix designs shall include the following for field verification and compliance testing.
  - 1. Slump
  - 2. % Air
  - 3. Unit weight
  - 4. 7 and 28 day compressive strength
- I. The following variations will be cause for submittal of a new mix design:
  - 1. Change of aggregate source
  - 2. Change of cement content
  - 3. Addition or exclusion of certain admixtures including, but not limited to, pozzolans, accelerators, retarders and water reducers
  - 4. Change in aggregate size
  - 5. Change in type of cement
  - 6. Failure to attain strength requirements as outlined in ACI 214 or ASTM C94
- J. **Technical Provisions**
  - 1. Reserved

**03.1.05 TESTING**

- A. Testing shall include; but not limited to, air content, slump, temperature, and cylinders for strength tests.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**03.2.01 GENERAL**

- A. Furnish Ready-mixed concrete meeting ASTM C94 unless otherwise specified.
- B. The codes and standards referred to in this section are declared to be part of this Specification as if fully set forth herein. In addition, the following ACI Standards are incorporated in their entirety, unless specifically required otherwise:
  - 1. ACI Standard 301, "Specifications for Structural Concrete for Buildings," American Concrete Institute, Edition.
  - 2. ACI Standard 318, "Building Code Requirements for Reinforced Concrete", American Concrete Institute, current edition.
  - 3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
  - 4. International Building Code of I.C.B.O.
- C. When brand, type, size, or source of cementitious materials, aggregates, water, ice or admixtures are requested to be changed, submit new field data or data from new trial mixtures or furnish evidence that indicates that the change will not adversely affect the relevant properties of the concrete for acceptance before using the concrete.

- D. Contractor shall provide a batch ticket for each batch of concrete discharged and used in the work, indicating project identification name and number, date, mixt type, batch quantities, and amount of water introduced. **(TP-1)**
- E. **Technical Provisions**
  - 1. **Batch tickets as specified in part D of this subsection, shall include the amount of water included at the plant as well as the amount of water added at the construction site. Contractor shall be responsible for assuring concrete delivered and placed meets the requirements as specified herein. (SID\_OFF)**

**03.2.02 CONCRETE CLASSIFICATIONS**

- A. Concrete is classified as set forth below. Place the specified class of concrete for each structure element as specified. Concrete with prefixes "C" contain 1 1/2 - inch size aggregate and those with "M" contain 3/4 - inch size aggregate. Concrete with prefixes "M" may be substituted for concrete with prefixes "C."
  - 1. Use M-4000 concrete for;
    - a. Curb and gutter, sidewalks, stoops, driveways, approaches, curb turn fillets and valley gutters, structural concrete, and slabs.
  - 2. Use M-3000 concrete for;
    - a. Manholes, storm drain inlets and miscellaneous or C-3000 Concrete Construction class.
  - 3. M-3000 is concrete with 3/4 - inch (19-05 mm) maximum aggregate and a 28-day compressive strength of 3000 pounds per square inch (psi) (20.7 Mpa).
  - 4. M-4000 is concrete with 3/4 - inch (19-05 mm) maximum aggregate and a 28-day compressive strength of 4000 pounds per square inch (psi) (27.6 Mpa).
  - 5. C-3000 is concrete with 1 1/2 - inch (38.1 mm) maximum aggregate and a 28-day compressive strength of 3000 psi (20.7 Mpa).
- B. If concrete strength or durability requirements established by design exceed the above strength classifications, the Engineer may specify additional concrete classifications to meet those requirements.
- C. **Technical Provisions**
  - 1. Reserved

**03.2.03 CONCRETE PERFORMANCE AND DESIGN REQUIREMENTS**

- A. Assure the cementitious material content is adequate to meet the specified requirements for strength, water-cement ratio and finishing requirements. For concrete used in floors, assure the cement content is at least that indicated in Table 2.1. For concrete exposed to freezing and thawing or concrete exposed to deicers, assure a maximum water-cement ratio of 0.45.

**TABLE 2.1  
MINIMUM CEMENT CONTENT REQUIREMENTS**

Nominal Maximum size of aggregate, in(mm)	Minimum cement content lb/yd <sup>3</sup> (kg/m <sup>3</sup> )
1-1/2 (38-1)	470* (163.0)
1 (25.4)	520 (180.3)
3/4 (19-05)	540 (187-3)
3/8 (9-5)	641 (222.3)

- B. Furnish concrete at the point of delivery having a slump of 4 - inches (max) determined by ASTM C 143. Meet slump tolerances in ACI 117. When a plasticizing admixture is used meeting ASTM C 1017 or when a Type F or G high range water reducing admixture meeting ASTM C494 is

approved to increase the concrete slump, assure the concrete has a slump of 2 to 4 - inches before the admixture is added and a maximum slump of 8 - inches at the point of delivery after the admixture is added.

- C. Assure the nominal maximum size of coarse aggregate does not exceed three fourths of the minimum clear spacing between reinforcing bars, one fifth of the narrowest dimension between sided of forms or one-third of the thickness of slabs or toppings.
- D. Concrete must be air entrained. Measure air content under ASTM C138, C173 or C231. Unless otherwise specified, ASTM C231 shall be used.

**TABLE 2.2**  
**TOTAL AIR CONTENT\* OF CONCRETE**  
**FOR VARIOUS SIZES OF COARSE AGGREGATE**

Nominal maximum Size of aggregate mm, (in.)	Total air content, percent		
	Severe exposure	Moderate exposure	Mild exposure
Less than 9.53(3/8)	9	7	8
9.53 (3/8)	7.5	6	4.5
12.5(1/2)	7	5.5	4
19 (3/4)	6	5	3.5
25.4(1)	6	4.5	3
12.7(1-1/2)	5.5	4.5	3
50.8(2)	5	3.5	1.5
76.2(3)	4.5	3.5	1.5
152.4(6)	4	3	1

\* Measure in accordance with ASTM C 138, C 173, or C 231.  
Air content tolerance is +/- 1 1/2 percent

- E. When admixtures are specified in the Contract Documents for particular parts of the work, use types specified. ~~Use of calcium chloride or other admixtures containing chloride ions is subject to the limitations in Table 2.3 Chloride Ion Concentration. When approved, use calcium chloride in solution form only, when introduced into the mixture. (TP-1)~~
  - 1. ~~Assure the maximum water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days attributed to the ingredients including water, aggregates, cementitious materials and admixtures do not exceed the limits of Table 2.3. Use tests to determine water soluble chloride ion content meeting AASHTO T260. The type of member described in Table 2.3 applies to the work as indicated in the Contract Documents. (TP-2)~~

**TABLE 2.3**  
**MAXIMUM ALLOWABLE CHLORIDE ION CONTENT**

Type of Member	Maximum water soluble chloride (CI) Content in concrete, percent by weight of cement
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.15
Reinforced concrete that will be dry or protected from moisture in service	1.00
Other reinforced concrete construction	.30

- F. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40°F for more than three successive days, deliver concrete in accordance with ASTM C94.
- G. Furnish the compressive strength and the water-cement or water cementitious, material ratio of concrete for each portion of the work as specified in the Contract Documents.

1. If cementitious or pozzolanic mineral admixtures meeting, ASTM C618 or ASTM C989 are used, the cement portion of the water-cement ratio must be the total weight of cementitious material.
2. The maximum weight of fly ash, pozzolan or ground granulated blast-furnace slag included in the calculation of water-cementitious material ratio cannot exceed the following percentages of the total weight of Portland cement plus fly ash, pozzolan and ground granulated blast-furnace slag:
3. The combined weight of fly ash and pozzolan meeting ASTM C618 cannot exceed limits in ACI 318. The fly ash and pozzolan present in an ASTM Type IP or IPM blended cement meeting ASTM C595 must be included in the calculated percentage.
4. The weight of ground granulated blast-furnace slag meeting ASTM C989 cannot exceed 50 percent of the total weight of cementitious material. The slag used in manufacture of a Type IS or ISM blended hydraulic cement meeting ASTM C595 must be included in the calculated percentage.
5. If fly ash or pozzolan is used in concrete with ground granulated blast-furnace slag, the portland cement constituent meeting ASTM C150 cannot be less than 50 percent of the total weight of cementitious material. Fly ash or pozzolan must not constitute more than 25 percent of the total weight of cementitious material.

**H. Technical Provisions**

1. ~~Strikeout the last two sentences of Section 03 00 00, Subsection 03.2.03, Part E. (MSP)~~
2. ~~Strikeout Section 03 00 00, Subsection 03.2.03, Part E.1 in its entirety, along with Table 2.3 "Maximum Allowable Chloride Ion Content". (MSP)~~

**03.2.04 CEMENTITIOUS MATERIAL**

- A. Cementitious material consists of Portland cement meeting ASTM C150, with or without the addition of cementitious or pozzolanic mineral admixtures meeting, ASTM C618 or ASTM C989, or blended hydraulic cement meeting ASTM C595 or hydraulic cement meeting ASTM C1157.
- B. Unless otherwise specified, assure cementitious material meets ASTM C150 Type I or Type II. **(TP-1)**
- C. Assure cementitious material used in concrete is the same brand and type and from the same plant of manufacture as the cementitious material used in the concrete represented by the submitted field test date or used in the trial mixtures.
- D. **Technical Provisions**
  1. ~~Cementitious material as specified in part B of this Subsection, shall be Type I-II-V or Type-V. (BIL\_OFF)~~

**03.2.05 AGGREGATES**

- A. Assure aggregates meet ASTM C33. When a single size or a combination of two or more sizes of coarse aggregates are used, assure the final gradation meets the grading requirements of ASTM C33.
- B. Obtain concrete aggregates from the same source and use the same size ranges as the aggregates used in the concrete represented by submitted historical data, or used in trial mixtures.
- C. **Technical Provisions**
  1. Reserved

**03.2.06 WATER AND ICE**

- A. Use concrete mixing water and water to make ice meeting requirements of ASTM C94.
- B. **Technical Provisions**
  1. Reserved

**03.2.07    ADMIXTURES**

- A.    Use admixtures meeting the following requirements:
1.    Air entraining, admixtures - ASTM C260
  2.    Chemical admixtures - ASTM C494
  3.    Chemical admixtures for use in producing, flowing concrete - ASTM C1017
  4.    ~~Calcium Chloride – ASTM D98~~ **(TP-1)**
  5.    Use admixtures in the concrete that are the same as those used in the concrete represented by submitted field test data or in trial mixtures.
- B.    **Technical Provisions**
1.    **Strikeout Section 03 00 00, Subsection 03.2.07, Part A.4 in its entirety. (MSP)**

**PART 3    EXECUTION (NOT USED)**

**END OF SECTION**

---

**PART 1 GENERAL**

**03.1.01 DESCRIPTION**

- A. This Specification includes common work results for concrete construction including, but not limited to; curb and gutters, sidewalks, driveways, valley gutters and other concrete construction complete in place.

**03.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |             |  |
|-------------|--|
| ASTM C31    | Making and Curing Concrete Test Specimens in the Field   |
| ASTM C33    | Concrete Aggregates  |
| ASTM C39    | Compressive Strength of Cylindrical Concrete Specimens   |
| ASTM C94    | Ready-Mixed Concrete   |
| ASTM C138   | Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete                                      |
| ASTM C143   | Slump of Hydraulic-Cement Concrete   |
| ASTM C150   | Portland Cement  |
| ASTM C172   | Standard Practice for Sampling Freshly Mixed Concrete  |
| ASTM C173   | Air Content of Freshly Mixed Concrete by the Volumetric Method   |
| ASTM C231   | Air Content of Freshly Mixed Concrete by the Pressure Method   |
| ASTM C260   | Air-Entraining Admixtures for Concrete   |
| ASTM C595   | Blended Hydraulic Cements  |
| ASTM C1064  | Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete                              |
| ASTM C11575 | Hydraulic Cement   |
| AASHTO M213 | Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction |
| AASGTI T260 | Standard Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials               |
| ACI         | American Concrete Institute  |

**03.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 01 74 23</b>	<b>FINAL CLEANING</b>
<b>SECTION 03 0 00</b>	<b>CONCRETE</b>
<b>SECTION 03 20 00</b>	<b>CONCRETE REINFORCING</b>
<b>SECTION 03 39 00</b>	<b>CONCRETE CURING</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**03.1.04 SUBMITTALS**

- A. Refer to Related Work sections for applicable submittals required in these Contract Documents if not included herein.
- B. Shop drawings and product data shall be submitted for concrete, reinforcing bars, expansion material, and other pertinent items in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.

C. **Technical Provisions**

1. Reserved

**03.1.05 TESTING**

- A. Testing shall include; but not limited to, air content, slump, temperature, and cylinders for strength tests.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  1. Reserved

**PART 2 PRODUCTS**

**03.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
  1. Reserved

**03.2.02 PRE-FORMED EXPANSION JOINT MATERIAL**

- A. Furnish joint material meeting the requirements of AASHTO M213.
- B. **Technical Provisions**
  1. Reserved

**PART 3 EXECUTION**

**03.3.01 GENERAL**

- A. Thoroughly compact concrete into its final position. Assure it is thoroughly consolidated around fittings and embedded items. Assure all reinforcement and embedded items are accurately placed as shown on the plans and are clean and free from coatings of dried mortar, detrimental rust, scale, oil or foreign matter.
- B. All concrete placed shall be cured in accordance with the provisions of **SECTION 03 39 00 CONCRETE CURING** of these Specifications.
- C. Cleanup
  1. As work progresses, remove debris, excess concrete, and complete to finish grade each portion of the work. Once the work is complete, clear debris and finish the entire site to smooth, uniform slopes presenting a neat and workmanlike appearance.
  2. Concrete waste material shall be disposed of at a suitable location designated by the Contractor. Contractor may furnish a concrete waste disposal container for onsite use at no expense to the Owner. Local, state, and federal regulations for disposal shall be upheld.
  3. Before final acceptance cleanup of the site shall be completed in accordance with the provisions of **SECTION 01 74 23 FINAL CLEANING** of these Specifications.
  4. Cleanup shall include the removal and disposal of all unsuitable/excess materials.
  5. All equipment shall be removed from the site.
  6. The site shall be left in a manner so as to present a clean and neat appearance, in an equal or better state prior to construction.

**D. Technical Provisions**

1. Reserved

**03.3.02 CONCRETE CONSISTENCY**

- A. Assure concrete is of such consistency that it will flow around reinforcing steel, but individual particles of the coarse aggregate, when isolated, show a coating of mortar containing its proportionate quantity of sand. The consistency of the concrete will be gauged by the ability of the equipment to properly place the concrete in its final position and not by the difficulty in mixing or transporting. Use the minimum quantity of mixing water necessary to provide workability within the ranges of slump specified.

**B. Technical Provisions**

1. Reserved

**03.3.03 CONCRETE MIXING**

- A. For Ready-Mix Concrete, Comply with requirements of ASTM C94, and as herein specified.
- B. For Job-Site Concrete, mix materials for concrete in appropriate drum type batch match mixer. For mixers of one (1) CY, or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one (1) CY, increase minimum 1-1/2 minutes of mixing time by 2-1/2 minutes for each additional CY, or fraction thereof.
- C. Thoroughly mix concrete to assure a uniform distribution of the materials throughout the mass. Mix concrete only in quantities required for immediate use and place it within the time limits specified. Waste all concrete which initial set has begun. Retempering of concrete is prohibited. Aggregates, or bags of cement containing lumps or crusts of hardened material shall not be used. Mix concrete in an approved truck mixer meeting the requirements of ASTM C94 herein.
- D. The capacity of the plant and the transportation equipment must ensure delivery at a rate that will permit proper handling, placement and finishing at the point of delivery. Maintain the concrete delivery rate to provide for the continuous operation of placing, handling and finishing concrete as is practical. Maintain the interval between delivery of loads so that layers or lifts of concrete in place do not harden before succeeding layers or lifts are placed. In general, no lift or layer of concrete can remain exposed for more than 20 minutes before being covered by fresh concrete.
- E. The volume of mixed concrete in the mixing drum shall not exceed the manufacturer's rating, on the capacity plate.
- F. During freezing weather, other approved methods of measuring water will be permitted.
- G. A recording water metering device is always required at the primary point of the batching operation.
- H. Do not add water to concrete in transit. Water may be introduced into the mixer at the job site if the specified water-cement ratio is not exceeded. Water shall be added in accordance with ASTM C94. Assure the drum revolves continuously after the introduction of the cement and water until the concrete is discharged.
- I. Begin mixing immediately after introduction of the cement and water and continue for at least 70 revolutions of the drum at mixing speed. This minimum revolution count will be waived when the concrete is produced at a central mixing plant. Not more than 100 drum revolutions can exceed 6 revolutions per minute. All other revolutions must be at agitating speed of not less than 2 or more than 6 revolutions per minute.
- J. Discharge the concrete at the job and place in its final position within 1-1/2 hours after the introduction of the mixing water and cement. When the air temperature is 90°F or above, place the concrete in its final position within 1 hour after the introduction of the mixing, water and cement. Concrete mixes with an approved set retarding admixture may be held an additional 1/2 hour beyond limits specified above.
- K. No mixed or agitated concrete that has remained in the drum of the truck mixer more than 10 minutes without agitation can be used.

- L. Provide a revolution counter on each truck that registers the number of revolutions of the drum.
- M. Mount the counter so it can be easily read by both the operator and the Engineer.

N. **Technical Provisions**

- 1. Reserved

**03.3.04 CONCRETE CONSOLIDATION**

- A. This section reserved.

**03.3.05 VISIBILITY LIMITATIONS**

- A. Stop concreting operations when darkness prevents obtaining the specified placing, and finishing work. Night operations may be conducted with written approval and when approved artificial lighting is provided.

B. **Technical Provisions**

- 1. Reserved

**03.3.06 HOT WEATHER CONCRETING**

- A. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ANSI/ASTM C94 may be required.
- B. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.
- C. Hot weather concreting shall be performed in accordance with ACI 305.

D. **Technical Provisions**

- 1. Reserved

**03.3.07 COLD WEATHER CONCRETING**

- A. Cold weather concreting shall be performed in accordance with ACI 306.
- B. Except by specific written authorization, stop concreting operations when a descending air temperature in the shade and away from artificial heat falls below 40°F, or do not resume until an ascending air temperature in the shade and away from artificial heat reaches frozen foundation course or subgrade.
- C. Assume all risk of placing concrete in cold weather. Placing concrete during cold weather does not relieve the Contractor of the responsibility for obtaining the specified results. Remove and replace all concrete injured by frost at Contractor expense.
- D. Before any concrete is placed, remove all ice, snow and frost completely from the formwork receiving the concrete.
- E. Heating and Placing Concrete
  - 1. When concreting is authorized during cold weather, assure concrete temperature meets ASTM C94.
- F. Protection of Concrete
  - 1. During the curing period, if the air temperature is anticipated to fall below 32°F, provide an approved blanket type insulating material along the work for covering all concrete that has been in place for 7 days or less. If, at any time, the ambient temperature drops to 32°F or less, protect the concrete using a method approved by the Engineer. The minimum method of protection under such conditions is as follows: between two layers of plastic sheeting, the insulating materials, with the exception of commercial blankets, must be spread loosely to a minimum depth of 6 - inches, but in all cases, to the depth required to prevent freezing of, or frost damage to, the concrete. Maintain the blanketing material at least until the end of the regular specified curing, period which is not less than 7 days. The Engineer may direct leaving the blanketing material in place for an additional period if the recorded temperatures

indicate that additional curing may be necessary. If during the construction period the mean daily temperature is expected to fall below 40°F for 3 consecutive days, furnish approved heating enclosures and devices capable of maintaining the surface temperature of the concrete in place between 55°F and 80°F. The curing, period under these conditions is 7 days when Type I-II-V cement is used and 5 days when a pre-approved "high early strength" mix is used. At the close of the curing period, the heat may be reduced so that the temperature inside the housing does not decrease faster than 15° per hour until the temperature inside the housing is the same as outside.

2. A Contractor may, at their own expense, field cure concrete cylinders with their in-place concrete and discontinue protection when those field cylinders reach 70 percent of design strength as indicated by the 28-day requirement of these Specifications.
3. Perform all concrete protection using methods consistent with ACI 306 and approved by the Engineer.

**G. Technical Provisions**

1. Reserved

---

**END OF SECTION**

## **PART 1 GENERAL**

### **03.1.01 DESCRIPTION**

- A. This Specification includes work for furnishing and placing reinforcing steel or wire fabric meeting the quality, type and size specified in the Contract Documents.

### **03.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |            |  |
|------------|--|
| ASTM A615  | Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement  |
| ASTM A705  | Age-Hardening Stainless Steel                                    |
| AASHTO M31 | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement  |
| AASHTO M32 | Cold Drawn Steel Wire for Concrete Reinforcement                 |
| AASHTO M55 | Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement     |
| AASHTO M54 | Fabric Deformed Steel Bar or Rod Mats for Concrete Reinforcement |
| ACI        | American Concrete Institute                                      |

### **03.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of related work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 03 00 00</b>	<b>CONCRETE</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>

### **03.1.04 SUBMITTALS**

- A. Shop drawings and product data for concrete reinforcement shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. Technical Provisions
- Reserved

### **03.1.05 TESTING**

- A. This section reserved.

## **PART 2 PRODUCTS**

### **03.2.01 GENERAL**

- A. This section reserved.

### **03.2.02 BAR REINFORCEMENT**

- A. Furnish deformed reinforcement steel meeting ASTM A615, (AASHTO M31) or ASTM A705, Grade 40 or Grade 60.
- Small quantities purchased from warehouses may, at the Engineer's direction, be accepted if bend tested under ASTM A615 or AASHTO M31. The test specimen must cold bend around a pin without cracking on the outside of the bent portion.
- B. Technical Provisions
- Reserved

**03.2.03    WIRE AND WIRE MESH**

- A.    Furnish wire meeting cold-drawn steel wire AASHTO M32 (ASTM A82) requirements.
- B.    Furnish wire mesh for concrete reinforcement meeting AASHTO M55 (ASTMA A85).
- C.    Furnish bar mats meeting AASHTO M54 (ASTM A184).
- D.    **Technical Provisions**
  - 1.    **Wire and mesh reinforcement will not be required for this project. (PRSP)**

**PART 3    EXECUTION**

**03.3.01    GENERAL**

- A.    This section reserved.

**03.3.02    PROTECTION**

- A.    Protect steel reinforcement from damage at all times. Place steel free from dirt, detrimental scale, paint, oil and other foreign substance. Clean steel reinforcement having easily removed rust, loose scale, and dust using an approved method.
- B.    **Technical Provisions**
  - 1.    Reserved

**03.3.03    FABRICATION**

- A.    Furnish four copies of shop details and placing drawings for all reinforcing steel to the Engineer for approval. Once checked, the Engineer will return two marked up sets of prints or drawings for correction. The Engineer's review is only for general conformity with the plans. Checking the detailed dimensions is the Contractor's responsibility. The Engineer's review does not relieve the Contractor's responsibility to furnish all material meeting the Contract requirements. Detail Reinforcing, steel meeting the ACI "Standard Details and Detailing of Concrete Structures" and the "Manual of Engineering and Placing Drawings for Reinforced Concrete Structures" published by the American Concrete Institute (ACI 315).
- B.    Assure all bars are bent cold. Do not field bend any bar partially imbedded in concrete except as specified on the plans.
- C.    Ship bar reinforcement in standard bundles, tagged and marked meeting the "Details and Detailing of Concrete Structures" (ACI 315) requirements.
- D.    Concrete reinforcement and accessory details, not covered herein or on the drawings, must meet "Details and Detailing of Concrete Structures" and the "Manual of Engineering and Placing Drawings for Reinforced Concrete Structures" (ACI 315 and 315R) requirements.
- E.    **Technical Provisions**
  - 1.    Reserved

**03.3.04    PLACING AND FASTENING**

- A.    Accurately place and hold firm all steel reinforcement in the plan locations as concrete is being placed.
- B.    Support and fasten together all reinforcement to prevent displacement due to construction loads. It is permissible to use on ground, where necessary, concrete support blocks having a minimum 4 - square inches (2580 MM<sup>2</sup>) bearing area and having a compressive strength equal to the concrete being placed. Use approved bar chairs and spacers over form work. For concrete surfaces exposed to the weather in the finished structure, assure the portions of all accessories within 1/2 - inch of the concrete surface are noncorrosive or protected against corrosion.
- C.    Offset vertical bars in columns at least one bar diameter at lap splices. Furnish templates for all column dowels.



**PART 1 GENERAL**

**03.1.01 DESCRIPTION**

- A. This Specification includes work for furnishing and applying concrete cure and protection for cast-in-place, slip formed and other concrete construction as specified in the Contract Documents.

**03.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards  
AASHTO M148      Standard Specification for Liquid-Forming Compounds for Curing Concrete

**03.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 03 00 00</b>	<b>CONCRETE</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>

**03.1.04 SUBMITTALS**

- A. Shop drawings and product data for curing and protective compounds shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. Technical Provisions  
1. Reserved

**03.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**03.2.01 GENERAL**

- A. This section reserved.

**03.2.02 LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE**

- A. Furnish liquid membrane-forming compound meeting the requirements of AASHTO M148, Type 1, clear or translucent.
- B. Technical Provisions  
1. Reserved

**03.2.03 EMULSIFIED LINSEED OIL COMPOUND**

- A. Assure it meets all requirements of AASHTO M148 and contains at least 2.7 pounds of linseed oil per gallon. Furnish a manufacturer's certification showing that the formulated weight of linseed oil per gallon equals or exceeds this limit.
- B. Technical Provisions  
1. Reserved

## **PART 3 EXECUTION**

### **03.3.01 GENERAL**

- A. Thoroughly cure concrete surfaces subject to premature drying by covering as soon as possible with canvas, plastic sheets with sealed joints, burlap and sand or other satisfactory materials and keep concrete moist. If the concrete surfaces are not covered, keep them moist by flushing or sprinkling. Continue curing for at least 7 days after placing the concrete. Concrete surfaces placed against forms may be cured by leaving the forms in place for at least 7 days, when approved.
- B. Protect concrete against freezing or other conditions detrimental to strength development meeting the applicable requirements of this Specification.
- C. To aid finishing, side forms on ornamental work, curbs and sidewalks, railing and parapets may be removed after 12 hours, not to exceed 48 hours, depending on weather conditions. Continue moist curing during the concrete finishing operation.
- D. Untreated forms and existing concrete must be kept continuously wet for at least 1 hour before any concrete is placed. Keep wet until covered with concrete except that adequately treated forms must be thoroughly washed with a water spray immediately before placing the concrete.
- E. The curing of concrete, by either water curing or membrane curing, must be as included herein unless otherwise approved by the Engineer.
- F. **Technical Provisions**
  - 1. Reserved

### **03.3.02 WATER CURING**

- A. Keep all concrete top surfaces continuously moist after finishing, with a fine water spray, until the concrete has set. Cover the moist concrete with water or an approved curing covering.
- B. Cure concrete deck slabs and concrete floors for at least 7 days. Cure by placing burlap, cotton mats or other absorptive material as close behind the finishing operation as possible without marring the finished surface. Keep the absorptive material continuously moist for the full time it is used. The absorptive material may be kept in place for the entire curing period or it may be removed as soon as practical and the entire surface covered with approximately 1-1/2 inches of sand, kept continuously moist for the entire curing period.
- C. Remove forms and repair surface irregularities without interfering with any of the curing requirements. As soon as the vertical forms have been removed and the surface irregularities repaired, cover the concrete with absorptive material, kept continuously wet for the balance of the curing period.
- D. **Technical Provisions**
  - 1. Reserved

### **03.3.03 IMPERVIOUS MEMBRANE CURING**

- A. Assure membrane curing compounds are delivered to the job in the manufacturer's original container, clearly labeled to show the name of the manufacturer and the contents. The clear curing compound must be sufficiently transparent and free from permanent color that would change the color of the natural concrete. Use clear compound containing a fugitive dye having color sufficient to render the film visible on the concrete for at least 4 hours after application. The concrete surface must maintain its natural color after curing.
- B. Use a compound ready for use as shipped by the manufacturer. Dilute following the manufacturer's recommendations. Use curing compound only with written approval. Sampling will not be required if manufacturer's certification is available. Apply the curing compound under pressure with a spray nozzle to cover the entire exposed surface thoroughly and completely with a uniform film not exceeding manufacturer's Specifications. Maintain the required pressure in the spray machine to force the material to leave the nozzle in a fine mist. Keep all concrete surfaces moist with a fine water spray or with wetted burlap until the sealing compound is applied. Keep the curing compound

application close to the finishers of the top surface of concrete at all times. Seal the concrete immediately after the finishing operations have been completed, to the satisfaction of the Engineer.

- C. If it is necessary to allow workers or equipment on the surface before the 7 day curing period is completed, cover the top surface of sealed concrete with a protective cushion for runways. Use a cushion consisting of a moist, 1 – inch minimum thick layer of fine sand, or layers of moist burlap that will prevent damage to the finished concrete. Cover the approved cushion with four by eight foot sheets of 3/4 - inch plywood laid over the cushion. Do not place the cushion material for at least 8 hours after the final application of the curing compound. Obtain the Engineer's written approval for any other proposed cushion material before use. Layers of plastic, visqueen or canvas are not an acceptable cushion material.
- D. Keep concrete, which has not completed its curing period, continuously moist during the stripping and surface repair operations. Remove all surface irregularities, repair all depressions, voids or holes, including those formed by trapped air, to the satisfaction of the Engineer. Immediately apply the curing compound before the surface has had an opportunity to dry out. Keep concrete, from which forms have been stripped, continuously moist until surface repair and finishing are completed and the impervious membrane curing has been applied.
- E. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

# MFWP – MAKOSHIKA WATERLINE EXTENSION

## GLENDIVE, MONTANA

### DIVISION 31 EARTHWORK

#### TABLE OF CONTENTS

#### DIVISION 31 – EARTHWORK

---

SECTION	DOCUMENT
31 05 00 .....	Common Work Results for Earthwork
31 05 19.13 .....	Geotextiles for Earthwork
31 23 00 .....	Excavation and Fill
31 23 23.23 .....	Compaction
31 23 23.33 .....	Flowable Fill
31 23 33 .....	Trenching and Backfill
31 50 00 .....	Excavation Support and Protection

**PART 1 GENERAL**

**31.1.01 DESCRIPTION**

- A. This Specification includes work common to earthwork, grading, trenching, excavation and fill and all appurtenances thereto as shown on the Drawings and specified herein.

**31.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |                        |  |
|------------------------|--|
| ASTM D698              | Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> or 600 kN-m/m <sup>3</sup> )  |
| ASTM D1557             | Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> or 2700 kN-m/m <sup>3</sup> ) |
| AASHTO T89             | Determining the Liquid Limit of Soils  |
| AASHTO T99             | Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb (2.5kg) Rammer and 12-inch (305mm) Drop               |
| AASHTO T90             | Determining the Plastic Limit and Plasticity Index of Soils  |
| AASHTO T191/ASTM D1556 | Density of Soil In-Place by the Sand-Cone Method   |
| AASHTO T310/ASTM D6938 | In-Place density and water content of the soil and soil aggregate by Nuclear Method (Shallow Depth)                              |
| AASHTO T11/ASTM C117   | Materials Finer Than 0.075mm (No. 200) Sieve in Mineral Aggregates by Washing  |
| AASHTO T27/ASTM C136   | Sieve Analysis of Fine and Coarse Aggregate  |

**31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 55 26</b>	<b>TRAFFIC CONTROL</b>
<b>SECTION 01 74 23</b>	<b>FINAL CLEANING</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 05 19.13</b>	<b>GEOTEXTILES FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 23 23.23</b>	<b>COMPACTION</b>
<b>SECTION 31 23 23.33</b>	<b>FLOWABLE FILL</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 31 50 00</b>	<b>EXCAVATION SUPPORT AND PROTECTION</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 23</b>	<b>AGGREGATE BASE COURSE</b>
<b>SECTION 32 92 19</b>	<b>SEEDING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**31.1.04 SUBMITTALS**

- A. Refer to Related Work sections for applicable submittals required in these Specifications if not included herein.
- B. Technical Provisions
- Reserved

**31.1.05**    **TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2**    **PRODUCTS**

**31.2.01**    **GENERAL**

- A. Refer to Related Work Sections for applicable product details if not included herein.
- B. **Technical Provisions**
  - 1. Areas specified to be furnished with “non-shrink backfill” may be either flowable fill furnished in accordance with the provisions of **SECTION 31 23 23.33 FLOWABLE FILL** or Type I pipe bedding in accordance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILL** of these Specifications, unless otherwise specified. Material shall be approved by Engineer prior to placement. **(SID\_OFF)**

**PART 3**    **EXECUTION**

**31.3.01**    **GENERAL**

- A. These general construction requirements apply to all site grading, structure excavation, utility excavation and earthwork unless noted otherwise.
  - B. Until expiration of the guarantee period, the Contractor shall assume full responsibility and expense for all backfill and embankment settlement and shall refill and restore the work as directed to maintain an acceptable surface condition, regardless of location.
  - C. All additional materials required and repairs to surface improvements shall be furnished without additional cost to the Owner.
  - D. Cleanup
    - 1. As work progresses, remove debris and complete to finish grade each portion of the work. Once the work is complete, clear debris and finish the entire site to smooth, uniform slopes presenting a neat and workmanlike appearance. Remove and dispose of all rocks brought to the surface during excavation or backfilling.
    - 2. Final Cleanup of the site shall be completed in accordance with the provisions of **SECTION 01 74 23 FINAL CLEANING** of these Specifications.
    - 3. Cleanup shall include the removal and disposal of all unsuitable/excess materials.
    - 4. All equipment shall be removed from the site.
    - 5. The site shall be left in a manner so as to present a clean and neat appearance, in an equal or better state prior to construction.
    - 6. All surface objects, trees, stumps, roots and other obstructions that are not designated to remain shall be cleared and disposed of as specified.
  - E. The removal of surface improvements (pavement, curb and gutter, walks) shall be held to a minimum. All materials to be removed and means of replacement shall be subject to the approval of the Owner’s Representative where said removals are not detailed on the Drawings.
    - 1. All materials that are removed shall be disposed of off-site at a location provided by the Contractor.
-

2. All pavements, walks or curb and gutter that are to be removed shall be sawn to provide a neat and true edge.
  3. Refer to **SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** for related information on job-site removals.
- F. ~~The Owner's Representative shall be notified of any need for blasting to remove materials which cannot be broken up mechanically, and there shall be no blasting operations conducted until the Owner's Representative has been properly notified. (TP-1)~~
1. ~~Blasting will be allowed only when proper precautions are taken to protect life and property, and then shall be restricted as the Owner's Representative directs.~~
  2. ~~The Contractor shall assume full responsibility for any damages caused by blasting, regardless of the requirements for notification and approval.~~
  3. ~~The Contractor shall secure any required permits for blasting and shall conduct blasting operations in conformance with all applicable federal, state and local laws, regulations and ordinances.~~
  4. ~~See section 31 23 33 TRENCHING AND BACKFILL for further detail on blasting.~~
- G. **Technical Provisions**
1. **Strikeout Section 31 05 00, Subsection 31.3.01, Part F in its entirety. (MSP)**
  2. **Where the Contractor has installed backfill in trenches and/or other excavations made by himself or Subcontractors, and settlement has occurred prior to the Contractor's bond expiration date, the Contractor shall return the surface to the required grade. In paved areas, the Engineer shall determine if the failure is due to improper pavement consolidation or subgrade failure. Slight depressions caused by improper pavement consolidation may be remedied by adding paving materials in a method satisfactory to the Engineer and Owner. If no satisfactory method of adding pavement exists, the Contractor shall remove the pavement, re-grade and re-compact the subgrade and repave the area. In turfed areas, the area of settlement shall be filled with clean topsoil material and the area re-seeded. All costs associated with the correcting settlement shall be at the expense of the Contractor. (SID\_OFF)**

**31.3.02 CONSTRUCTION LIMITS**

- A. The Contractor shall limit the operation of their equipment to those areas shown on the Drawings or as directed by the Owner's Representative to be construction areas.
- B. The indiscriminate operation of equipment outside of designated construction areas will not be permitted.
- C. **Technical Provisions**
  1. Reserved

**31.3.03 DUST CONTROL**

- A. Contractor shall be responsible for dust control, providing all equipment and personnel for the work. Furnish Engineer name(s) and telephone number(s) of the person(s) responsible for dust control during evenings and weekends. If this person cannot be contacted, Owner may at Contractor expense, perform the work or contract the work out. **(TP-1) (TP-2)**
- B. The Contractor shall maintain temporary site roadways, the Owner's existing roads, parking lots and public roads used during construction operations free from dust, mud, gravel, cobbles, or other contaminants. **(TP-1) (TP-2)**
- C. The Contractor shall comply with local environmental regulations for dust control and directions of the Owner. If the Contractor's dust control measures are considered inadequate by the Owner, the Owner will require the Contractor to take additional dust control measures.
- D. Providing Dust Control shall be included in the price bid for the work that requires dust control and no additional compensation will be made therefor.

**E. Technical Provisions**

1. In the event that the Contractor's contact, or a responsible person thus associated, cannot be contacted and/or respond to the request for dust control within 4 hours, the Owner may take action as specified in part A of this subsection. **(SID\_OFF)**
2. Cost incurred by Owner for maintenance specified in this subsection shall be the responsibility of the Contractor. Payment shall be withheld as a Set-off on the Contractor's next application for payment. **(SID\_OFF)**

**31.3.04 SURPLUS MATERIAL**

- A. Material in excess of that required for permanent work and/or materials deemed by the Owner's Representative to be unsuitable for use, with the exception of topsoil, shall be disposed of off-site at a location provided by the Contractor unless a disposal site is noted on the Drawings.
- B. Dispose of debris and unused excavated materials off the project site in accordance with all applicable state and local regulations.
- C. All surplus waste materials remaining after completion of the backfilling and embankment operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular component of construction.
  1. Disposal shall be accomplished outside the project limits at a location provided by the Contractor.
  2. The backfilling and surplus or waste disposal operations shall be a part of the work required under the specific work items, not as work that may be delayed until final cleanup.
- D. Excess soil deposit sites shall be obtained by the Contractor unless shown on the Drawings.
- E. Excess soil disposal sites, where shown on the Drawings, shall be graded to drain, shall not impede an existing drainage and shall be re-seeded.
- F. Private or off site excess soil disposal sites shall be restored to the satisfaction of the landowner.
- G. **Technical Provisions**
  1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**31.1.01 DESCRIPTION**

- A. This Specification includes work for of furnishing, and placing a geotextile as a subsurface drainage fabric permeable separator between dissimilar materials (such as between subgrade and sub base/base), stabilization fabric, temporary and/or permanent erosion control measures or as waterproofing/stress releasing membrane within pavement structures.

**31.1.02 REFERENCES**

- A. The current publications listed below form part of this specification.
- B. Standards
- |                   |  |
|-------------------|--|
| ASTM D123         | Standard Terminology Relating to Textiles  |
| ASTM D276         | Test Methods for Identification of Fibers in Textiles  |
| ASTM D4354        | Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs)  |
| ASTM D4318        | Determining the Liquid Limit, Plastic Limit and Plasticity Index of Soils  |
| ASTM D698         | Laboratory Compaction Characteristics of Soil Using Standard Effort ( 12,400 ft-lbf/ft <sup>3</sup> or 600 kN-m/m <sup>3</sup> ) |
| ASTM D4751        | Determining, Apparent Opening, Size of a Geotextile  |
| ASTM D4759        | Determining, the Specification Conformance of Geosynthetics  |
| ASTM D276         | Identification of Fibers in Textiles   |
| ASTM D4873        | Guide for Identification, Storage and Handling of Geotextiles  |
| ASTM D5141        | Test Method for Determining Filter Efficiency and Flow rate for Silt Fence Application of a Geotextile Using Site Specific Soils |
| ASTM D5261        | Test Methods for Measuring Mass per Unit Area of Geotextiles   |
| ASTM D4632/4632M  | Breaking; Load and Elongation Of Geotextiles (Grab Method)   |
| ASTM D4533/4533M  | Trapezoid Tearing, Strength of Geotextiles   |
| ASTM D3786/3786M  | Bursting Strength of Textile Fabrics -Diagram Bursting Strength Tester Methods   |
| ASTM D4833/4833M  | Index Puncture Resistance of Geomembranes, and Related Products  |
| ASTM D4491/4491M  | Water Permeability of Geotextiles by Permittivity  |
| ASTM D4355/4355W  | Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus                               |
| ASTM D422 & D1140 | Particle Size Analysis of Soils  |
- C. ASSHTO Specifications – M288 Geotextile Specifications for Highway Applications
1. Augmenting and prevailing over this specification section.

**31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.
- |                         |  |
|-------------------------|--|
| <b>SECTION 01 22 19</b> | <b>MEASUREMENT AND PAYMENT</b>                       |
| <b>SECTION 01 33 00</b> | <b>SUBMITTAL PROCEDURES</b>                          |
| <b>SECTION 01 45 00</b> | <b>QUALITY CONTROL</b>                               |
| <b>SECTION 03 05 00</b> | <b>COMMON WORK RESULTS FOR CONCRETE</b>              |
| <b>SECTION 31 05 00</b> | <b>COMMON WORK RESULTS FOR EARTHWORK</b>             |
| <b>SECTION 32 05 00</b> | <b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b> |

**31.1.04 SUBMITTALS**

- A. Assure the manufacturer furnishes the purchaser a certificate stating: the name of the manufacturer, the chemical composition of the filaments or yarns, and other information fully describing the geotextile. The manufacturer must include in the certificate, a guarantee stating that the geotextile furnished meets Specifications. The certificate must be attested to by a person having a legal authority to bind the company. Mismatching, or misrepresentation by the manufacturer is reason to reject the geotextile under these Specifications. Notice sent to the

manufacturer by the purchaser regarding rejection of, will be considered to be notice to all wholesalers, jobbers, distributors, agents and other intermediaries handling the manufacturer's product.

- B. Shop drawings and product data shall be submitted for geotextiles, geosynthetics, and other appurtenant material in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.

- C. **Technical Provisions**

- 1. Reserved

**31.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**31.2.01 GENERAL**

- A. Assure that fibers used in the manufacture of geotextiles, and the threads used in joining geotextiles by sewing, consist of long-chain synthetic polymers, composed of at least 95% by weight polyolefins or polyesters. They must be formed into a network so the filaments on yarns retain dimensional stability relative to each other, including selvages. Furnish materials meeting the physical requirements for the indicated application as described by the corresponding table(s) of properties in ASSHTO M288, Geotextile Specifications for Highway Applications.

- B. Label the fabric and its container with the manufacturer's name and fabric type or trade name, lot number and quantity.

- C. During shipment and storage, protect the fabric from direct sunlight, ultra-violet rays, temperatures exceeding 160°F, mud, dust and debris. Keep the fabrics in the manufacturer's wrapping until just before use. Include with each shipping, a document, a certification showing that the geotextile meets the manufacturer's certificate and a guarantee that has been previously filed with the purchaser.

- D. **Technical Provisions**

- 1. Reserved

**31.2.02 GEOTEXTILE STABILIZATION**

- A. Geotextile Stabilization Fabric shall conform to the requirements of Section 716 of the MDT Standard Specifications for High Survivability, Non-woven Stabilization Geotextile.

- B. **Technical Provisions**

- 1. **Geotextiles shall be as manufactured by:**
    - a. **Propex 801, or approved equal. (SID\_OFF)**

**31.2.03 GEOGRID REINFORCEMENT**

- A. Geogrid reinforcement shall conform to the following minimum requirements.

- Ultimate Tensile Strength      4,800 lbs/ft

- Tensile Strength at 5% Strain    2,130 lbs/ft

- B. **Technical Provisions**

- 1. Reserved

## **PART 3 EXECUTION**

### **31.3.01 GENERAL**

- A. Where placing geotextiles on native ground, cut the trees and shrubs flush with the ground surface. Do not remove the topsoil and vegetation mat. Remove all sharp objects and large rocks. Fill depressions or holes with a suitable material to provide a firm foundation.
- B. Replace or repair all geotextile that is torn, punctured, or muddy. Remove the damaged area and place a patch of the same type of geotextile overlapping 3 - feet, in all directions, beyond the damaged area.
- C. **Technical Provisions**
  - 1. Geotextile fabrics and geogrids shall be constructed in accordance with the provisions of Section 622 of the MDT Standard Specifications except as noted here. (PRSP-MDT)

### **31.3.02 DRAINAGE, SEPARATION AND STABILIZATION APPLICATIONS**

- A. Shape the subgrade to a smooth surface and to the cross section required. Shape slopes to gradually transition into slope adjustments without noticeable breaks. At the ends of cuts, the intersection of cuts, and embankments, adjust slopes in the horizontal and vertical planes to blend into each other or into the natural ground.
- B. Remove all material larger than 6 - inches within the top 6 - inches of the roadbed. Remove unsuitable material from the roadbed and replace with suitable material. Finish the roadbed and ditches to the required elevation and cross-section.
- C. Place the geotextile smooth and free of tension, stress, or wrinkles. Fold and cut the geotextile to conform to curves. Overlap in the direction of construction. Overlap the geotextile a minimum of 2 - feet at the ends and sides of adjoining sheets or sew the geotextile joints according to the manufacturer's recommendations. Do not place longitudinal overlaps below anticipated wheel loads. Hold the geotextile in place with pins, staples, or piles of cover material.
- D. End dump the cover material onto the geotextile from the edge of the geotextile or from previously placed cover material. Do not operate equipment directly on the geotextile. Spread the end-dumped pile of cover material maintaining a minimum lift thickness of 10 - inches. Compact the cover material with rubber tired or nonvibratory smooth drum rollers. Avoid sudden stops, starts, or turns of the construction equipment. Fill all ruts from construction equipment with additional cover material. Do not regrade ruts with placement equipment.
- E. Place subsequent lifts of cover material in the same manner as the initial lift. Vibratory compactors may be used for compacting subsequent lifts. If foundation failures occur, repair the damaged areas and revert to the use of nonvibratory compaction equipment.
- F. **Technical Provisions**
  - 1. Reserved

### **31.3.03 TEMPORARY AND PERMANENT EROSION CONTROL APPLICATIONS**

- A. Place and anchor the geotextile on the approved smooth-graded surface. For slope protection, place the long dimension of the geotextile down the slope. For stream bank protection, place the long dimension of the geotextile parallel to the centerline of the channel.
- B. Overlap the geotextile a minimum of 12 - inches at the ends and sides of adjoining sheets or sew the geotextile joints according to the manufacturer's recommendations. Overlap the uphill or upstream sheet over the downhill or downstream sheet. Offset end joints of adjacent sheets a minimum of 5 - feet. Pins may be used to hold the geotextile sheets in place. Space pins along the overlaps at approximately 3 - foot centers. (TP-1)
- C. Place aggregate, slope protection, or riprap on the geotextile starting at the toe of the slope and proceed upward. Place riprap onto the geotextile from a height of less than 12 – inches. Place slope protection rock or aggregate backfill onto the geotextile from a height less than 3 – feet. In underwater applications, place the geotextile and cover material in the same day.

D. **Technical Provisions**

1. Replace Section 31 05 19.13, Subsection 31.3.03, Part B with the following:

Overlap the geotextile a minimum of 24 - inches at the ends and sides of adjoining sheets or sew the geotextile joints according to the manufacturer's recommendations. Overlap the uphill or upstream sheet over the downhill or downstream sheet. Offset end joints of adjacent sheets a minimum of 5 - feet. Pins may be used to hold the geotextile sheets in place. Space pins along the overlaps at approximately 3 - foot centers. **(MSP)**

**END OF SECTION**

**PART 1 GENERAL**

**31.1.01 DESCRIPTION**

- A. This Specification includes work for clearing and grubbing, excavation, filling or backfilling, to the specified lines, grades and cross sections as preparation for overlying base course or other courses as shown in the Contract Documents.
- B. Also included are the removal and disposal of debris and excess soil, the furnishing and placement of fill materials.
- C. The term “fill” shall also be considered synonymous with “embankment” as included herein.

**31.1.02 REFERENCES**

- A. This section reserved.

**31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 23.23</b>	<b>COMPACTION</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 13</b>	<b>SUBGRADE MODIFICATIONS</b>

**31.1.04 SUBMITTALS**

- A. Submit to the Engineer samples of embankment and imported borrow material for laboratory moisture-density relationship testing by the Engineer.
- B. Shop drawings and product data shall be submitted for in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**31.1.05 TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**31.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.

B. **Technical Provisions**

1. Reserved

**31.2.02 ON-SITE EMBANKMENT**

- A. Fill and backfill materials are to consist of natural soils free from organic matter, frozen material, refuse, construction debris or other man-made items.
- B. Obtain approval of the Engineer for all fill before placing and use only the fill from designated borrow areas.

C. **Technical Provisions**

1. Reserved

**31.2.03 IMPORTED BORROW MATERIALS (FOR EMBANKMENTS IN-PLACE)**

- A. If required, obtain borrow soil for embankments from areas off the project site.
- B. Obtain Engineer approval of borrow areas. Imported borrow is to meet the requirements of On-Site Embankment as included herein.
- C. Imported borrow material, if required, shall be provided by the Contractor at no additional expense to the Owner.
  1. The Contractor shall notify the Owner's Representative sufficiently in advance of opening any borrow areas so that the borrow material can be tested before being used.
  2. Sufficient time for testing the borrow shall be allowed.

D. **Technical Provisions**

1. Reserved

**PART 3 EXECUTION**

**31.3.01 GENERAL**

- A. The following construction requirements are in reference to procedures for preparation of embankments and subgrades that take place prior to placement of subbase and base course material as shown on the Drawings.
- B. Meet OSHA requirements for excavations and excavated material stockpiles which may require design of temporary slopes and/or shoring by a licensed design professional.
- C. The Contractor shall inform and satisfy themselves as to the character quantity and distribution of material to be excavated.
- D. Take precautions to protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, fences, and vegetation.
- E. Any disturbed or damaged facilities will be suitably restored or replaced consistent with condition(s) which existed prior to construction.

F. **Technical Provisions**

1. Reserved

**31.3.02 CLEARING AND GRUBBING**

- A. Perform clearing and grubbing including the excavation, removal and disposal of roots, stumps, sod, or any organic material and buried debris from within construction limits.
  - B. Stockpile for project use any topsoil removed by clearing and grubbing.
  - C. Dispose of all clearing and grubbing material as specified.
-

D. **Technical Provisions**

1. Reserved

**31.3.03 BORROW SITES**

- A. Borrow sites shall be obtained by the Contractor unless shown on the Drawings.
- B. Borrow sites, where shown on the Drawings, shall be graded to drain, shall not impede an existing drainage and shall be re-seeded.
- C. Private or off site borrow sites shall be restored to the satisfaction of the landowner.

D. **Technical Provisions**

1. Reserved

**31.3.04 ROADWAY / SURFACE IMPROVEMENT EXCAVATION**

- A. Excavate to the specified lines and grades. Excavate without causing rutting, pumping or other disturbance to underlying materials.
- B. Correct subgrade disturbance by removing the disturbed soil and replacing and compacting to the requirements specified in **01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. Correct subgrade disturbance before placing overlying fill, backfill, base course or other courses.
- D. Unsuitable material encountered during excavation and fill of roadways and other surface improvements shall be replaced in accordance with the provisions of **SECTION 32 11 13 SUBGRADE MODIFICATIONS** of these Specifications, or as directed by the Engineer.
- E. Maintain the subgrade to drain at all times. Construct side ditches or gutters from cuts to embankments to prevent erosion damage to embankments.
- F. Construct and maintain temporary drainage where existing surface drainage, sewers, or under-drainage are disturbed during the work until permanent drainage facilities are completed. Protect and preserve all existing drains, sewers, subsurface drains, conduits, gas lines, and other underground structures which may be affected by the work. Repair all damage to these facilities or structures resulting from the work, to the satisfaction of the Engineer.
- G. Excavate to minimize foundation soil and/or subgrade soil exposure to erosion, drying or infiltrating moisture. Perform excavation to provide drainage away from foundation/subgrade soils and minimize the potential for surface runoff to enter the foundation/subgrade soils.
- H. Grade all intersecting streets and approaches within the project limits as specified or as directed using suitable materials on the surfaces to produce smooth riding and satisfactory approaches to the intersections.

I. **Technical Provisions**

1. Reserved

**31.3.05 ROADWAY / SURFACE IMPROVEMENT EMBANKMENT PLACEMENT**

- A. Place fill materials (embankment) to the specified lines and grades.
- B. Repair damaged embankments to the specified elevations and grades.
- C. Do not operate heavy equipment for spreading or compacting fill within 4 - feet of structures.
- D. If the surface of a previous roadbed or pavement surface matches the surface of the finished subgrade, scarify the top 6 - inches of the previous surface, full width of the subgrade, to permit uniform reshaping and compaction.

- E. Place fill in uniform layers not exceeding 8 - inches in loose thickness. Once placed, moisten or aerate, mix, and compact each layer as specified. Work clay soils to maximum 2 - inch nominal size before compacting.
  - 1. Do not begin fill placement until the underlying subgrade construction has been approved by the Engineer.
  - 2. Do not place fill on wet or frozen subgrade.
- F. Compaction
  - 1. Embankments shall be compacted to the requirements included in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
    - a. Refer to **SECTION 31 23 23.23 COMPACTION** for additional information on embankment compaction requirements.
- G. If grading operations are suspended due to weather, blade the entire area until it is smooth, free of depressions and ruts, and crowned to drain water.
- H. **Technical Provisions**
  - 1. Reserved

**31.3.06 SURFACE TOLERANCES**

- A. Assure the finished surface does not deviate more than 0.1 - foot at any point from the staked elevation; and the sum of the deviations from true grade of any two points not more than 30 - feet apart does not exceed 0.1 – foot.
- B. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

**PART 1 GENERAL**

**31.1.01 DESCRIPTION**

A. This Specification includes work for general compaction requirements of backfill and embankment.

**31.1.02 REFERENCES**

A. This section reserved.

**31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

A. The following items of Related Work are specified and included in other Sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**31.1.04 SUBMITTALS**

A. This section reserved.

**31.1.05 TESTING**

A. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.

B. **Technical Provisions**

1. Reserved

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**31.3.01 GENERAL**

A. Compaction of backfill and embankments shall be obtained by means of tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers.

B. All such equipment shall be of a size and type approved by the Owner's Representative.

1. Flooding shall not be considered an acceptable means of obtaining compaction nor shall the use of a backhoe bucket.
2. Permission on the part of the Owner or Owner's Representative to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract.
3. The Contractor shall be responsible for making the determination and for any damage caused by compaction equipment.

- C. Material for mechanically compacted backfill and embankments shall be placed in lifts which, prior to compaction, shall not exceed the thickness specified below for the various types of equipment: **(TP-1)**
1. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired roller:
    - a. Maximum lift thickness 6 - inches.
  2. Rolling equipment including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels:
    - a. Maximum lift thickness of 6 - inches.
  3. Hand-directed mechanical tampers:
    - a. Maximum lift thickness of 4 - inches.
  4. Refer to related work sections for maximum lift heights allowed for placement and compaction of applicable material.
- D. Mechanically compacted backfill and embankment shall be placed in horizontal layers of thickness not exceeding those specified above compatible to the material being placed and the type of equipment being used.
- E. Compaction adjacent to all foundations, footings, manholes, catch basins, valve boxes, curb boxes, end of sewer services and similar structures shall be performed by the use of hand-directed mechanical tampers with lifts not exceeding that specified above.
- F. Each layer shall be evenly spread, moistened or dried, if necessary, and then tamped or rolled until the specified compaction has been attained.
1. Apply uncontaminated water, when required, at the locations and in the amounts required to compact the backfill material to the specified requirements.
  2. Water required for compacting trench backfill may be obtained from the municipal system if approved by the municipal Owner, or from other sources.
  3. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.
  4. Do not place backfill or embankment when moisture content prevents effective compaction or causes rutting. Dry all embankments and fill having excessive moisture by scarifying and blading and/or mixing the affected areas before compacting or placing succeeding layers.
  5. Refer to **SECTION 01 45 16 FIELD QUALITY CONTROL REQUIREMENTS** for additional information on density and moisture requirements.
- G. Proof roll and/or perform field density testing of subgrade material prior to placement of backfill or embankment as applicable. Compact all soft, yielding or otherwise unstable areas. Or, remove and replace any unstable or otherwise unsuitable subgrade approved by the Engineer.
1. Refer to **SECTION 01 45 16 FIELD QUALITY CONTROL REQUIREMENTS** for additional information on density and moisture requirements of subgrade.
- H. **Technical Provisions**
1. **When heavy, self-propelled vibratory and/or rolling compaction equipment is utilized. Backfill and embankment material as specified in part C of this subsection, shall be placed and compacted in loose lift thicknesses of 8 - inches or less. When hand-directed equipment such as a jumping jack or plate compactor are used, loose lift thickness shall not exceed 6 - inches and 4 - inches, respectively. (BIL\_OFF)**

**END OF SECTION**

**PART 1 GENERAL**

**31.1.01 DESCRIPTION**

- A. This Specification consists of furnishing and placing Flowable Fill to the lines and grades shown on the plans as backfill in trenches and/or at other locations. Flowable Fill is a self-compacting cementitious material using mineral aggregates (sand and/or gravel), native or processed materials, fly ash/cement, water, air entraining solution and (optionally) other admixtures. Flowable Fill is also known as Controlled Low-Strength Material (CLSM) and Controlled Density Fill (CDF). Flowable Fill is only permitted when specifically called out in the Contract Documents or approved by Engineer.

**31.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |            |   |
|------------|---|
| ASTM D4832 | Preparation/Testing of Soil-Cement Slurry Test Cylinders                                      |
| ASTM C39   | Test Method for Compressive Strength of Cylindrical Concrete Specimens                        |
| ASTM D6023 | Standard Test Method for Unit Weight  |
| ASTM C150  | Specification for Portland Cement   |
| ASTM C618  | Specification for Fly Ash   |
| ASTM C494  | Specification for Chemical Admixture for Concrete   |
| ASTM E329  | Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction |
| ASTM C1064 | Temperature of Freshly Mixed Portland Cement Concrete   |
| ASTM C117  | Materials Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing                |
| ASTM C136  | Sieve Analysis of Fine & Coarse Aggregate   |
| ASTM C117  | Materials Finer Than No. 200 (0.075 mm) Sieve in Mineral Aggregates by Washing                |
| ASTM D4318 | Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils                     |
| ASTM C94   | Ready Mix Concrete  |
| ACI 301    | Standard Specifications for Structural Concrete for Buildings                                 |
| ACI 304    | Guide for Measuring, Mixing, Transporting and Placing Concrete                                |

**31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**31.1.04    SUBMITTALS**

- A. The Contractor is to provide the Engineer with a mix design by either trial batch or field experience methods to verify the required compressive strength of the flowable fill at the 28 day age. Mix design requirements are included herein, Proportions, and Compressive Strength. Proportions shall be selected on the basis of unconfined, air cured compressive strength test specimens.
- B. Shop drawings and product data shall be submitted for in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**31.1.05    TESTING**

- A. Testing shall include; but not limited to, air content, slump, temperature, and cylinders for strength tests.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2    PRODUCTS**

**31.2.01    GENERAL**

- A. Provide a mixture of the materials described below to produce a self-compacting cementitious material batched on a per cubic yard basis.
- B. **Technical Provisions**
  - 1. Reserved

**31.2.02    MATERIALS**

- A. Portland Cement. Portland cement shall conform to the requirements of ASTM C150, Type I or II.
- B. Fly Ash. Fly Ash shall conform to ASTM C618, Class C or F.
- C. Coarse Aggregate, Fine Aggregate and Native Materials. Any aggregate gradation which produces performance characteristics of the flowable fill specified herein will be accepted, except as follows: The amount of material passing the #200 sieve shall not exceed 20 percent. In addition, liquid limit and plasticity index shall not exceed 25 and 5, respectively.
- D. Water. Water used in mixing shall be free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- E. Chemical Admixtures. Chemical Admixtures shall conform to the requirements of ASTM C494.
- F. **Technical Provisions**
  - 1. Reserved

**31.2.03    PROPORTIONS**

- A. A variety of sand/gravel aggregates, and/or native (or processed) materials meeting the above requirements in conjunction with appropriate amounts of Portland cement and flyash, air entraining solution, and (optionally) other admixtures may be used to produce the required mix properties described herein.

- B. The Contractor shall submit, to the Engineer, a mix design based upon a trial batch or field experience, including the proportions and sources of all constituent materials, air entraining and (optionally) other admixtures, expressed as cubic yard batch weights. The mix shall contain a minimum of 50 pounds of cement and up to 250 pounds fly ash per cubic yard, with the remainder of the volumes composed of aggregates, water, and any approved admixtures. Measured compressive strength, air content and yield for the mix design trial batch (or for the field experience based mix design) shall be submitted.
- C. **Technical Provisions**
  - 1. Reserved

**31.2.04 COMPRESSIVE STRENGTH**

- A. Flowable Fill shall be designed to achieve a 28 day compressive strength of 30 to 500 psi when tested in accordance with ASTM C39. Excavatable mixes shall be designed to attain 28 day strengths in the range of 30 - 150 psi. Test specimens shall be made in accordance with ASTM D4832. Compressive strength tests shall be performed at frequencies of at least one test set per 150 yd<sup>3</sup> and at least one test set per day of placement unless otherwise specified. **(TP-1)**
- B. **Technical Provisions**
  - 1. **The 28 day compressive strength as specified in part A of this subsection, shall show a strength of 30 to 150 psi, and be designed to attain initial set within 4 hours of batching. Contractor shall submit test results based upon a trial batch to the Engineer verifying this property before use. (PRSP-SID\_MOD)**

**31.2.05 CONSISTENCY**

- A. Consistency of the fresh mixture shall be such that the mixture may be readily placed without segregation. High flowability material generally has a slump greater than 8 – inches. As an alternative to slump testing, desired consistency may be approximated by filling an open-ended 3 - inch diameter cylinder, 6 - inches high, with the mixture and cylinder immediately pulled straight up. The correct consistency of the mixture will produce an approximate 8 - inch diameter circular type spread without segregation. Adjustments of the proportions of constituents may be made to achieve proper solid suspension and optimum flowability. However, strength requirements and proper yield shall be maintained for the actual batch weights.
- B. **Technical Provisions**
  - 1. Reserved

**PART 3 EXECUTION**

**31.3.01 GENERAL**

- A. Comply with ACI 304 and ASTM C94 for Measuring, Mixing, Transporting, and Placing the Flowable Fill, and as herein specified.
- B. **Technical Provisions**
  - 1. Reserved

**31.3.02 LIMITATIONS OF PLACEMENT**

- A. Do not place CLSM on frozen ground. Mix and place only when the air temperature is at least 35 degrees F and rising. At the time of placement, Flowable Fill shall be at least 40 degrees F. Stop mixing and placement when the air temperature is 40 degrees F and falling.
- B. Flowable backfill shall be placed by methods that preserve the quality of the material in terms of compressive strength, flow, homogeneity, plasticity and workability. The material shall be transported, placed, and/or consolidated so that it flows easily around, adjacent to and under

structures. It shall have the flow, consistency, and workability such that the material is self-compacting.

- C. Protect freshly placed Flowable Fill from premature drying, excessive cold, or hot temperatures. The air in contact with the backfill surface shall be maintained at temperatures above freezing. Begin curing, immediately following placement before the backfill has dried. Continue with curing until the backfill has attained the 28 day strength requirement. This strength is to be determined prior to any load applications or construction activity, unless otherwise directed by an Engineer.
- D. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

## **PART 1 GENERAL**

### **31.1.01 DESCRIPTION**

- A. This Specification includes work for the excavation, trenching and backfilling for pipelines and appurtenances. It includes all clearing, grubbing, site preparation, removal and disposal of debris from the excavation, handling and storing materials for fill and backfill, all bracing, shoring and trench protection, construction dewatering, all backfill, subgrade preparation, final grading, site dressing and cleanup.

### **31.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |                           |  |
|---------------------------|--|
| AASHTO T89                | Determining the Liquid Limit of Soils  |
| AASHTO T90                | Determining the Plastic Limit and Plasticity Index of Soils  |
| ASTM D4318                | Determining Liquid Limit, Plastic Limit and Plasticity Index of Soils  |
| ASTM D4253                | Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table             |
| ASTM D4254                | Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density |
| AASHTO T11/ASTM C117      | Materials Finer Than 0.075µm (No. 200) Sieve in Mineral Aggregates by Washing                                |
| AASHTO T27/ASTM C136/136M | Sieve Analysis of Fine and Coarse Aggregate  |

### **31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 05 19.13</b>	<b>GEOTEXTILES FOR EARTHWORK</b>
<b>SECTION 31 23 23.23</b>	<b>COMPACTION</b>
<b>SECTION 31 23 23.33</b>	<b>FLOWABLE FILL</b>
<b>SECTION 31 50 00</b>	<b>EXCAVATION SUPPORT AND PROTECTION</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

### **31.1.04 SUBMITTALS**

- A. Submit to the Engineer material quality test results including Type 1 Bedding gradation and plasticity index; and Type 2 Bedding gradation.
- B. Submit to the Engineer samples of on-site and off-site borrow soils used for imported backfill for laboratory moisture-density relationship testing by the Engineer.
- C. ~~If applicable, submit a blasting plan to the Engineer.~~ **(TP-1)**
- D. Shop drawings and product data shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- E. Technical Provisions
- Strikeout Section 31 23 33, Subsection 31.1.04, Part C in its entirety. (MSP)**

**31.1.05 TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**31.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
  - 1. Reserved

**31.2.02 TYPE I PIPE BEDDING**

- A. Type 1 Pipe Bedding includes the material placed from 4-inches below the bottom of the pipe, around the pipe, and up to the springline of the pipe.
- B. Provide Type 1 Bedding consisting of sand, sandy gravel, or gravel having a maximum 3/4 - inch size and a maximum plasticity index of 6, determined by AASHTO T89 and T90 or by ASTM D4318.
- C. Where trench excavation encounters wet or unstable material, Type 1 Pipe Bedding must be free draining and non-plastic.
- D. Refer to Plan Detail sheets for requirements.
- E. **Technical Provisions**
  - 1. Type 1 Pipe Bedding material as specified in this subsection, shall be replaced and meet the following requirements. **(PRSP-SID\_MOD)**
    - a. Provide Type 1 Bedding material consisting of crushed stone or gravel having a maximum plasticity index of 6, as determined by AASHTO T89 and T90 or by ASTM D4318, and the following gradation.

<u>Sieve Opening</u>	<u>% Passing</u>
1 – inch	100
3/4 – inch	90-100
3/8 – inch	20-55
No. 4	5-10
No. 8	0-5

**31.2.03 SELECT TYPE I PIPE BEDDING**

- A. Select Type 1 Bedding includes the material placed from the springline of the pipe to 6 inches over the pipe.
- B. Select Type 1 Bedding shall consist of soil, sand or fine gravel, free from clods, lumps of frozen material, or rock exceeding 1-1/2 - inches in its greatest dimension.
- C. Excavated trench material may be screened or sorted for use as backfill subject to approval of the Engineer.
- D. Where trench excavation encounters wet or unstable material, Select Type 1 Bedding must be free draining and non-plastic.

E. **Technical Provisions**

1. Reserved

**31.2.04 TYPE II PIPE BEDDING**

1. Type 2 Pipe Bedding is used as directed by the Engineer to replace unsuitable material encountered in the trench bottom.
2. Place Type 2 Pipe Bedding from the bottom of the Type 2 Bedding material to the depth required to adequately support the pipe.
3. Type 2 Bedding shall consist of granular material meeting the following gradation.

<u>Sieve Opening</u>	<u>% Passing</u>
3 inch	100
No. 4	0 - 25
No. 8	0 - 10
No. 200	0 - 5

B. **Technical Provisions**

1. Type 2 Pipe Bedding material as specified in this subsection, shall be replaced and meet the following requirements. **(SID\_OFF)**
  - a. Provide Type 2 Bedding material consisting of granular material meeting the following gradation and a maximum plasticity index of 6 and a maximum liquid limit of 25%. Material may also be considered for Trench Stabilization Gravel.

<u>Sieve Opening</u>	<u>% Passing</u>
3 – inch	100
1/2 – inch	60
No. 4	0 – 25
No. 8	0 - 10
No. 200	0 - 5

- b. The crushing shall result in a product where at least 50% of the material retained on the No. 4 sieve will have at least 1 fractured face, and be approved by the Engineer.

**31.2.05 TRENCH BACKFILL MATERIAL**

- A. Backfill material obtained from trench excavations must be free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials.
- B. Backfill materials are subject to the performance type and provisions lined out in the Execution of this Specification.

C. **Technical Provisions**

1. Reserved

**31.2.06 IMPORTED TRENCH BACKFILL MATERIAL**

- A. Imported backfill material is from borrow source(s) outside the project limits and is used when, in the opinion of the Engineer, an adequate volume of suitable backfill material is not available within the project limits.
- B. Imported backfill material shall be free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials and subject to Engineer's approval prior to arrival onsite, and subject to the performance type and provisions lined out in Execution this Specification.

C. **Technical Provisions**

1. Reserved

**31.2.07**    **SEPARATION GEOTEXTILE**

- A. The plans may require, or the Engineer may direct, the use of non-woven geo-textile fabric intended to provide materials separation.
- B. The fabric will wrap all or part of the Type 1 Pipe Bedding and Select Type 1 Pipe Bedding to prevent materials migrating into the trench bottom and trench walls as shown on the plans or as directed by the Engineer. The fabric shall be AASHTO M288 Class 1, 2, or 3 as specified or determined by the Engineer.
- C. Separation Geotextiles, when specified, shall be in accordance with the provisions of **SECTION 31 05 19.13 GEOTEXTILES FOR EARTHWORK** of these Specifications.
- D. **Technical Provisions**
  - 1. Separation geotextile for pipe bedding will not be required for this project, unless requested in the field by the Owner/Engineer. (PRSP)

**PART 3**    **EXECUTION**

**31.3.01**    **GENERAL**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. Reserved

**31.3.02**    **PROTECTION OF EXISTING PROPERTIES**

- A. General
  - 1. Take precautions to protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, and fences. Restore or replace all disturbed or damaged facilities to its original condition at Contractor's expense.
  - 2. Contact utility Owners using the Montana One Call System for utility locates before starting work. Protect the utilities exposed during the work and prevent damaging underground utilities adjacent to excavations. Immediately notify the utility Owner of any construction damage. Repairs of damage to marked utilities are at the expense of the Contractor.
  - 3. Re-locate existing water mains, sanitary sewers and storm drains shown on the plans that conflict with new pipelines or structures as indicated in the Contract Documents. No separate payment will be made for this work unless shown as a payment item. If the Owner authorizes the relocation of mains or sewers which are not indicated in the bid documents, and the Engineer determines the work was not included in the original contract, payment will be made under the applicable sections of the General Conditions.
  - 4. Cut and replace existing service lines interfering with trenching operations only with the Engineer's permission and at the Contractor's expense. Show all repaired and/or adjusted water and sewer lines on the As-Built Plans.
  - 5. Protect existing water and sewer mains and water and sewer services from freezing at all times during construction.
- B. Privately Owned Utilities
  - 1. If any existing private utility interferes with the work in either alignment or grade, and has to be moved, the work will be performed by the appropriate Utility Owner, unless otherwise specified in the Contract Documents. Such private utilities may include gas mains, underground electrical and telephone cables, telephone poles, light poles, etc.

- C. Existing Structures
  - 1. Prevent damage to existing buildings or structures in the work area. Repair all construction related damage to the satisfaction of the Owner.
- D. Existing Overhead Utilities
  - 1. Use extreme caution to avoid conflict, contact or damage to overhead utilities during the work.
  - 2. In the event utilities need to be moved, the work shall be performed in accordance with the provisions of **SECTION 31 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** of these Specifications.
- E. Exploratory Excavation
  - 1. The location of existing buried public utilities may need to be verified by exploratory excavation before construction.
  - 2. Exercise care to prevent damaging all utilities and repair any utility damage caused by exploratory excavation.
- F. Pavement Removal and Stripping
  - 1. Where trench excavation or appurtenant structure excavation requires removing curb and gutter, concrete sidewalks, asphalt concrete pavement, or Portland cement concrete pavement, cut the concrete or pavement in a straight line parallel to the excavations edge using a spade-bitted air hammer, concrete saw or other suitable equipment to produce a straight, square and clean break. Re-cut edges broken during construction, before concrete or paving operations.
  - 2. For trenches passing through existing pavement, cut the pavement along a neat vertical line at least 12 inches from the trench edge. Where the neat line cut is less than 3-feet from the edge of the existing pavement, remove and replace the entire pavement section between trench and edge of pavement.
  - 3. Dispose of the asphalt concrete and/or Portland cement concrete debris off-site according to applicable state and local regulations.
    - a. Pavement Removal shall also be performed in accordance with the provisions of **SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS** of these Specifications.
  - 4. When excavating across existing gravel streets or other developed surfaces, remove the surfacing material full depth and stockpile for inclusion as trench backfill or legally dispose of the surfacing material.
  - 5. When excavating across cultivated or sodded areas, remove topsoil full depth to a maximum 12 – inch depth, whichever is less, and stockpile for possible project use.
- G. **Technical Provisions**
  - 1. Reserved

**31.3.03 MAINTENANCE OF FLOWS**

- A. Maintain the flow of sewers, drains and water courses encountered during construction. Restore culverts, ditches, fences, crosswalks and structures disturbed by construction to their original condition upon completion of the work.
- B. **Technical Provisions**
  - 1. Reserved

**31.3.04 TIME AND DISTANCE OF OPEN TRENCHES**

- A. Perform the work so that trenches will remain open the minimum time required to accomplish the work.

- B. Do not begin trench excavating until appropriate compaction equipment is at the excavation site.
- C. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connections to in-place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.
- D. The maximum permissible distance between backfilling/compaction operations and the end of newly installed pipe is 200 - feet in existing streets (and/or alleys) and 500 - feet in all other areas unless otherwise approved by Engineer.
- E. The maximum distance between the newly installed pipe and the excavator is to be 100 - feet in existing streets (and/or alleys) and 200 - feet in all other areas unless otherwise approved by Engineer.
- F. For each work group consisting of a trench excavator, a pipe laying crew, and a backfilling/compacting crew, the maximum allowable open trench at any time is 300 - feet in existing streets (and/or alleys) and 700 - feet in all other areas, unless otherwise approved by Engineer. **(TP-1)**
- G. The maximum distance behind the end of the new pipe is 1,500 - feet for final gravel surfacing, base, or pavement replacement, unless otherwise approved by Engineer.
- H. **Technical Provisions**
  - 1. **Open trenches as specified in part F of this subsection shall be defined as areas absent backfill, subbase, and base course material as shown on the Drawings and meeting the minimum compaction requirements established within the Contract Documents. In-place density and moisture testing for stated material shall be performed prior to proceeding with further Work. (PRSP-SID<sub>20</sub>)**

**31.3.05 TRENCH EXCAVATION**

- A. General
  - 1. Meet current OSHA Safety and Health Standards for all excavation, trenching, shoring, and Related Work.
    - a. Excavation protection shall be in accordance with **SECTION 31 50 00 EXCAVATION SUPPORT AND PROTECTION** of these Specifications.
  - 2. Excavate at the specified locations for pipeline installations and appurtenant structures.
  - 3. Crossings under sidewalks or curbs may be made by tunneling, if approved by the Engineer. If a portion of a sidewalk or curb is removed, use a concrete saw to make joints, compact the backfill as specified, and replace the removed section with new concrete sidewalk or curb.
  - 4. During excavation, stockpile backfill materials away from the trench banks to assure trench wall stability. Stockpile excavated materials on only one side of the trench without obstructing existing fire hydrants, valves, manholes and other appurtenances. Assure surface drainage of adjoining areas is unobstructed.
  - 5. Remove and dispose of all excess or unsuitable excavated materials.
  - 6. Prevent surface water from flowing into excavations. Promptly remove all water accumulating in trench excavations. Do not permit water to accumulate in any open trench. Remove and re-lay all pipe out of alignment or grade caused by trench flooding.
  - 7. Grade the trench bottoms to the specified lines and grades. Assure bedding material provides uniform bearing and support for each pipe section along its entire length. Excavate for bell and joints after the trench bedding is graded, limiting the excavation to the required length, depth and width for making the particular type of joint used. Backfill over excavations with Type 2 Bedding Material.

8. No differentiation between common and rock trench excavation is made, except when listed as separate bid items on the bid proposal or bid form. Excavation includes removing and subsequent handling of all earth, gravel, bedrock or other material encountered regardless of the type, character, composition or condition of the material.
  9. The use of trench digging machinery is permitted, except in places where its operation is likely to cause damage to existing structures or features, in which case hand methods are to be employed.
- B. Trench Dimensions
1. Excavate to the trench dimensions specified below.
  2. Width
    - a. Excavate to provide room to install and join the pipe as specified. The minimum trench width is 3.5 - feet, for outside pipe diameters of 18 - inches or less. The minimum trench width is 2 - feet plus the outside pipe diameter, for pipe sizes exceeding 18 - inches. Maximum trench width may be specified in the Contract Documents.
  3. Depth
    - a. Excavate the trench as required for the invert grade or pipe bury as specified in the Contract Documents, plus 4 - inches for the Type 1 Pipe Bedding. If bedrock, boulders or large stones are encountered at the bottom of the trench, excavate at least 6 - inches below the bottom of the pipe for backfilling with Type 1 Pipe Bedding. **(TP-1)**
- C. Soft or Unsuitable Trench Subgrade
1. When soft or unstable material is encountered at the trench subgrade which will not uniformly support the pipe, excavate the material to the depth directed by the Engineer and backfill to trench subgrade elevation with Type 2 Pipe Bedding.
    - a. Trench subgrade shall be considered the springline of the pipe.
- D. **Blasting (TP-2)**
1. ~~Obtain Engineer approval to blast for excavation. If approved, the Engineer will establish the time limits blasting will be permitted.~~
  2. ~~Use utmost care to protect life and property during blasting. Use only a licensed blaster with experience in the type of blasting required for the work.~~
  3. ~~Safely and securely store all blasting materials meeting local laws and ordinances and clearly mark all storage places "Dangerous Explosives". Do not leave any explosives where they could endanger persons or property.~~
  4. ~~Blasting Rock in Trenches~~
    - a. ~~When blasting rock in trenches, cover the blasting area with earth backfill or approved blasting mats. Before blasting, station workers and provide danger signals to warn people and stop vehicles.~~
    - b. ~~Assume responsibility for all damage to property and injury to persons resulting from blasting or accidental explosions during the work.~~
    - c. ~~Furnish the following information to the Owner and Engineer at least 48 hours before the commencement of blasting operations: Name of the Contractor's powder man, powder man's experience, type of shot, type of explosives and detonator being used, proof of insurance covering liability for such operation, traffic control plans and planned procedures for protecting the public.~~
  5. ~~Assure blasting plan meets federal, state and local ordinances. Obtain all required permits before blasting starts.~~

- E. Pavement damaged caused by equipment
  - 1. Equip all track mounted equipment operated on pavement surfacing with pads to prevent pavement damage.
  - 2. Restore all pavement damaged by construction to its original condition. **(TP-3) (TP-4)**
- F. Shoring, Bracing, and Sheeting
  - 1. Protection of excavations for utilities and appurtenances shall be performed in accordance with the provisions of **SECTION 31 50 00 EXCAVATION SUPPORT AND PROTECTION** of these Specifications.
- G. Excavation for Appurtenances
  - 1. Make excavations for manholes, hydrants, structures and other appurtenances of the size and depth to permit compacting of backfill on all sides to the specified density. The requirements for removing water and other applicable portions of these Specifications apply to excavation for appurtenances.
- H. **Technical Provisions**
  - 1. **Replace Section 31 23 33, Subsection 31.3.05, Part B.3.a. with the following:**

**Excavate the trench as required for the invert grade or pipe bury as specified in the Contract Documents, plus 6 - inches for the Type 1 Pipe Bedding. If bedrock, boulders or large stones are encountered at the bottom of the trench, excavate at least 6 - inches below the bottom of the pipe for backfilling with Type 1 Pipe Bedding. (MSP)**
  - 2. **Strikeout Section 31 23 33, Subsection 03.3.05, Part D in its entirety. (MSP)**
  - 3. **Pavement damaged caused by equipment as specified in part E.2, included herein, shall be replaced in accordance with the provisions of SECTION 32 12 16 ASPHALT PAVING of these Specifications. (SID\_OFF)**
  - 4. **The Contractor and Engineer shall get together before construction related actives start to evaluate the preexisting condition of the road to be used as the base for evaluation after construction. (REV\_PRSP)**

**31.3.06 TRENCH DEWATERING**

- A. Remove all ground water encountered in trench excavations. Do not place pipe, bedding or backfill materials below the groundwater elevation established by dewatering operations. The cost of dewatering operations is considered a part of the excavation cost.
- B. Contractor shall adhere to all local, state, and federal, regulations and laws for dewatering and discharge. Any applicable permit for dewatering shall be the responsibility of the Contractor.
- C. **Technical Provisions**
  - 1. **Soil moisture and ground water levels will fluctuate due to seasonal changes, weather, irrigation and other variations in conditions. Methods and procedures related to differing soils could include adjusting the means and methods of excavation, installation or removal of soils encountered. The Contractor is responsible to determine construction methods, approved by Engineer, and include these costs in the bid unit prices. (MSP)**
  - 2. **If dewatering is deemed necessary at the time of construction, the Contractor shall consult a licensed professional engineer or geologist familiar with the local geologic, hydrogeologic, and geotechnical conditions as well as the construction practices pertaining to the Contractor's means and methods of dewatering. (PRSP-SID\_MOD)**

**31.3.07 TRENCH BACKFILLING**

- A. General
  - 1. Backfill all trenches as specified immediately after grade, alignment and pipe jointing has been inspected and approved by the Engineer. Conduct any pipe testing as specified in the

respective water distribution, sewerage/drainage sections. Correct all defects discovered by tests prior to backfilling.

**B. Pipe Bedding Placement**

**1. Type 1 Bedding:**

- a. Place Type 1 Pipe Bedding material 4 - inches under the pipe, around the pipe, and up to the springline of the pipe. Place in maximum lifts of 6 - inches, using hand operated or other compaction methods without damaging or disturbing the pipe. Thoroughly compact each layer. Use special care to assure compaction under the pipe haunches.
- b. Place backfill material in equal lifts on both sides of the pipe for the full trench width. Take care to prevent migration of Type 1 Bedding into surrounding soils during placement and compaction

**2. Select Type 1 Bedding:**

- a. Place Select Type 1 Bedding material from the springline to 6 - inches over the pipe. Where wet or unstable material exists, assure the material is free draining and non-plastic.
- b. Place in maximum lifts of 6 - inches using hand or other compaction methods without damaging or disturbing the pipe. Thoroughly compact each layer.
- c. Place backfill in equal lifts on both sides of the pipe for the full trench width. Take care to prevent migration of Select Type 1 Bedding into surrounding soils during placement and compaction.

**3. Type 2 Pipe Bedding:**

- a. Use Type 2 Pipe Bedding described in Products Section as specified or as directed by the Engineer to replace unsuitable material encountered in the trench bottom, placing it from the bottom of the Type 1 Bedding material to the depth required to adequately support the pipe.

**4. Separation Geotextile**

- a. Place Separation Geotextile where shown on the plans or where directed by the Engineer and in accordance with the provisions of **SECTION 31 05 19.13 GEOTEXTILES FOR EARTHWORK** of these Specifications.

**C. Trench Backfill**

1. After the pipe bedding materials are placed and compacted as specified, backfill the trench. Use backfill material free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials from the top of the Select Type 1 Pipe Bedding to 6 - inches below the ground surface, or to the subgrade elevation, material containing rock up to 8 - inches in the greatest dimension may be used.
2. Unless otherwise indicated or directed, rock shall be removed to an elevation at least 6 - inches below the bottom surface of the pipe barrel and below the lowest projection of joint hubs.
3. Rock shall be removed to such additional horizontal dimensions as will provide a minimum clearance of six inches on all sides of pipe and appurtenant structures such as valves, housings, access structures, etc.

**D. Compaction**

1. A minimum of 1 - foot of backfill material shall be placed over the top of a pipe before operating vibratory or sheep's foot type compaction equipment.
  - a. This material shall be compacted using hand-directed mechanical tampers.

2. Trench backfill from the top of the pipe bedding to ground surface or to the street subgrade shall be compacted to the requirements included in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
    - a. Refer to **SECTION 31 23 23.23 COMPACTION** for additional information on backfill compaction requirements.
  3. Remove, replace, and re-compact backfill in trenches where settlement has occurred as directed by the Engineer at the Contractor's expense.
- E. **Replacement of Unsuitable Backfill Material**
1. Remove and dispose of excavated soils that are saturated, contain deleterious materials or have characteristics that, in the opinion of the Engineer, render the soils unsuitable as backfill.
  2. Replace unsuitable soils with material obtained from trench excavations within the project limits at the expense of the Contractor. If suitable replacement material is not available within project limits, obtain material from an approved borrow source, to be paid for as Imported Backfill Material.
  3. Place and compact all imported material according to the applicable backfill Specification requirements.
- F. **Backfill Appurtenances**
1. Place and compact backfill for appurtenances to finished grade around manholes, inlets, valve boxes and other underground items without disturbing appurtenance alignments.
  2. Use backfill methods that shall eliminate the possibilities for appurtenance damage.
  3. Meet the backfill material, placement, and compaction requirements specified for the adjoining trench.
- G. **Technical Provisions**
1. Reserved

**END OF SECTION**

---

## **PART 1 GENERAL**

### **31.1.01 DESCRIPTION**

- A. This Specification includes shoring and protection of excavations and all work included thereto as shown on the drawings and as specified herein.
- B. The stability of construction excavations and associated worker safety, including slope geometry and shoring/bracing considerations, are the responsibility of the Contractor. Meet current OSHA regulations. This may require design of temporary slopes and/or shoring by a licensed professional Engineer.

### **31.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - OSHA Occupational Safety and Health Act Requirements
  - MUTCD Federal Highway Administration Manual on Uniform Traffic Control Devices

### **31.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 51 00</b>	<b>TEMPORARY UTILITIES</b>
<b>SECTION 01 55 26</b>	<b>TRAFFIC CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **31.3.01 GENERAL**

- A. This section reserved.
- B. Technical Provisions
  - 1. Reserved

### **31.3.02 PROTECTION**

- A. The Contractor shall take all necessary precautions for the protection of the work and the safety of the public.
  - 1. All barricades and obstructions shall be illuminated at night by flashing signal lights which shall be kept burning from sunset to sunrise, or reflective signs.
  - 2. Barricades shall be painted to increase their visibility.
  - 3. Suitable signs shall be so placed as to show in advance where construction, barricades or detours exist.

4. All barricades and traffic control shall conform to the Federal Highway Administration Manual on Uniform Traffic Control Devices latest edition (MUTCD).
- B. The Contractor shall at all times conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and to insure the protection of persons and property.
- C. No road or street shall be closed to the public except with the permission of the proper authority.
  1. Any police or other traffic control shall be arranged for by the Contractor and be at their expense.
  2. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times.
  3. No valves on existing utilities shall be operated without permission from the proper authority.
  4. Temporary provisions shall be made by the Contractor to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed.
- D. All costs of furnishing, placing maintaining and removing barricades, fences and appurtenances shall be included in the prices bid for which the protection is being provided and no separate compensation will be made therefor.
- E. Furnish personnel support facilities including: sanitary facilities; drinking water; first aid supplies and facilities; and, trash removal.
- F. Do not park vehicles or equipment or store materials on private property without written permission from the property Owner.
- G. No open excavation shall be left open over night without supervision and the implementation of a barrier and signage to prevent access to any person and or objects, cost of such barriers shall be incidental to the cost of excavation.
- H. **Technical Provisions**
  1. Reserved

**31.3.03 SHORING AND EXCAVATION SUPPORT**

- A. Provide all shoring, bracing, trench boxing, and tight sheeting required to prevent caving and protect workers, meeting current Occupational Safety and Health Act Requirements, and to protect adjacent property and structures. The cost of this work is included in the cost for trench excavation.
- B. All excavations shall be sheeted, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities and other properties.
- C. Any damage to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner shall be repaired at the Contractor's expense and without delay.
- D. It shall be the Contractor's responsibility to provide for safe working conditions for all excavations in strict conformance with safety regulations.
  1. Damages or injury resulting from settlement, slides, cave-ins, water pressure, pedestrian or vehicular involvement shall be the responsibility of the Contractor and all damages shall be repaired at the Contractor's expense.
  2. Where the depth of an excavation requires the slopes or shoring system to be designed by an Engineer retained by the Contractor, the Contractor shall furnish a copy of the Engineer's design to the Project Engineer.
  3. The Contractor shall bear all costs for shoring and slope design.

- E. The Contractor shall assume full responsibility for proper and adequate placement of sheeting, shoring, trench boxing, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement.
- F. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in place structures to any extent that may cause damage.
- G. Sheeting, shoring, trench boxing, and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in place structures and prevent displacement of supported grounds.
  - 1. Sheeting and bracing shall be left in place only as required by the Drawings, this Project Manual or ordered by the Owner's Representative.
  - 2. Otherwise, sheeting and bracing shall be removed as the backfilling reaches the level of respective support.
  - 3. Wherever sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Owner's Representative may direct.
- H. All costs of furnishing, placing and removing sheeting, shoring and bracing materials, trench boxes, including the value of materials left in place as required by the Contract, shall be included in the prices bid for which the protection is being provided and no separate compensation will be made therefor.
- I. When any sheeting, shoring, or bracing materials are left in place by written order of the Owner's Representative, in the absence of specific requirements of the Contract to do so, a prior agreed upon payment will be made for those materials as an extra work item, including waste material resulting from upper cut-off requirements.
- J. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

# MFWP – MAKOSHIKA WATERLINE EXTENSION

## GLENDIVE, MONTANA

### DIVISION 32 EXTERIOR IMPROVEMENTS

#### TABLE OF CONTENTS

#### DIVISION 32 – EXTERIOR IMPROVEMENTS

---

SECTION	DOCUMENT
32 05 00 .....	Common Work Results for Exterior Improvements
32 11 13 .....	Subgrade Modifications
32 11 23 .....	Aggregate Base Courses
32 12 13 .....	Preparatory Coats
32 12 16 .....	Asphalt Paving
32 16 43 .....	Sidewalks, Driveways, and Valley Gutters
32 91 13 .....	Soil Preparation
32 92 19 .....	Seeding
32 92 19.16 .....	Hydraulic Seeding

**DIVISION - 32**

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes work common to exterior improvements including but not limited to; retaining walls, concrete, pavement, and all work included thereto as shown on the Drawings and specified herein.

**32.1.02 REFERENCES**

- A. This section reserved.

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 01 74 23</b>	<b>FINAL CLEANING</b>
<b>SECTION 03 00 00</b>	<b>CONCRETE</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 03 20 00</b>	<b>CONCRETE REINFORCING</b>
<b>SECTION 03 39 00</b>	<b>CONCRETE CURING</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 13</b>	<b>SUBGRADE MODIFICATIONS</b>
<b>SECTION 32 11 23</b>	<b>AGGREGATE BASE COURSE</b>
<b>SECTION 32 12 13</b>	<b>PREPARATORY COATS</b>
<b>SECTION 32 12 16</b>	<b>ASPHALT PAVING</b>
<b>SECTION 32 16 43</b>	<b>SIDEWALKS, DRIVEWAYS, AND VALLEY GUTTERS</b>
<b>SECTION 32 92 19</b>	<b>SEEDING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**32.1.04 SUBMITTALS**

- A. Refer to Related Work sections for applicable submittals required in these Contract Documents if not included herein.
- B. Shop drawings and product data shall be submitted for in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
1. Reserved

**32.1.05 TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Moisture density curves will be provided by the Contractor for each material supplied including but not limited to; aggregates, embankment, backfill, excavated material, engineered fill, and borrow material.
- C. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- D. **Technical Provisions**
1. Reserved

## **PART 2 PRODUCTS**

### **32.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
  - 1. Reserved

## **PART 3 EXECUTION**

### **32.3.01 GENERAL**

- A. These general construction requirements apply to all work common to exterior improvements including but not limited to, retaining walls, concrete, pavement, and all work included thereto as shown on the Drawings and specified herein.
- B. Cleanup
  - 1. Cleanup of the site shall be completed before final acceptance of the work in accordance with the provisions of **SECTION 01 74 23 FINAL CLEANING** of these Specifications.
  - 2. Cleanup shall include the removal and disposal of all unsuitable materials.
  - 3. All equipment shall be removed from the site. The site shall be left in a manner so as to present a clean and neat appearance.
  - 4. All surplus and waste materials remaining after completion of the exterior improvements shall be disposed of in an acceptable manner within 24 hours after completing the work on each area of the site.
    - a. Disposal at any location within the project limits shall be as specified, or as approved by the Owner's Representative; otherwise, disposal shall be accomplished outside the project limits at a location provided by the Contractor.
    - b. The waste disposal operations shall be a part of the work required under the exterior site improvement work, not as work that may be delayed until final cleanup.
- C. **Technical Provisions**
  - 1. The Contractor will protect all pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, planters, lawn ornaments, and other surface structures affected by construction activities in connection with performance of the contract together with grass, shrubs, yards or pastures crossed or adjacent to the work from damage or disturbance. If removed or otherwise damaged, the Contractor shall restore to the original condition or better as determined by the Engineer. All replacement of such structures shall be made with new materials conforming to these Specifications or as approved by the Engineer. Unless listed as a pay item, all cost and work required for replacement will be the Contractor's sole expense. **(PRSP-SID\_MOD)**
  - 2. The Contractor shall protect existing paved surfaces from damage during construction. Keep equipment off paved surfaces unless absolutely necessary. Tracked equipment shall be provided with suitable pads or sufficient surface protection to avoid damage. **(PRSP-SID\_MOD)**
  - 3. The Contractor shall be responsible for all damage to roads, sidewalk, ditches, shoulders, embankments, culverts or other public or private property or facility that may be damaged by moving, hauling or otherwise transporting equipment, materials or men to or from the work. The Contractor shall make, without delay, satisfactory and acceptable arrangements with the Owner of, or the land owner of the damaged property concerning its repair or replacement or payment of costs incurred in connection with said damage. **(PRSP-SID\_MOD)**

**32.3.02 CONSTRUCTION LIMITS FOR EXTERIOR IMPROVEMENTS**

- A. These general construction requirements apply to all exterior site improvement work.
- B. The limits of construction are shown on the Drawings or shall be established by the Owner's Representative.
  - 1. The Contractor shall confine construction operations within these limits.
  - 2. All surface objects, trees, stumps, roots and other obstructions that are not designated to remain shall be cleared and disposed of as specified.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.03 REMOVAL OF EXISTING PAVEMENT, CONCRETE CURB, SIDEWALK, DRIVEWAY AND/OR STRUCTURES**

- A. The work consists of removing and disposing of existing pavement, concrete curb, combined curb and gutter, sidewalk, private driveways, and crosswalks, along with any structures designated for removal in the Contract Documents. Details of removals are specified in the Contract Documents.
- B. Dispose of all existing pavement, concrete curb, crosswalk and/or combined curb and gutter specified for removal in the Contract Documents or directed by the Engineer. Exercise care in such removal to assure that remaining nearby facilities and/or structures are not disturbed. Restore to original condition any such existing facilities or structures damaged by construction activities.
- C. All materials to be removed and means of replacement shall be subject to the approval of the Owner's Representative where said removals are not detailed on the Drawings.
- D. All materials that are removed shall be disposed of off-site at a location provided by the Contractor.
- E. Cut, remove and dispose of designated existing pavement to the lines indicated on the Contract Documents, or directed by the Engineer. Make straight and approximately vertical cuts of edges along which new pavement is to be placed.
- F. Remove and dispose of existing private concrete driveways and/or sidewalks which interfere with construction of street improvements or which do not match new grade as shown on the Contract Documents or as directed by the Engineer.
- G. All pavements, walks or curb and gutter that are to be removed shall be sawn full depth to provide a neat and true edge.
- H. **Technical Provisions**
  - 1. Reserved

**32.3.04 RELOCATING OR REMOVING UTILITY POLES, STREET SIGNS AND MAILBOXES**

- A. This item consists of relocating or removing existing street lights, signs, power poles, telephone poles and mailboxes as shown in the Contract Documents.
- B. Power, Street Light and Telephone Poles
  - 1. Affected utility companies are to move power, street light, and telephone poles, unless they are designated in the Contract Documents to be removed or relocated by the Contractor.
  - 2. When relocating or removing power poles, street light poles and telephone poles, comply with any applicable requirements of the Contract Documents.
- C. Street and Traffic Control Signs
  - 1. Remove and reinstall all street, stop and other traffic control/direction signs designated to be relocated by the Contractor as shown in the Contract Documents, or as designated by the Engineer. Include removing, temporarily installing, storing, and permanently installing the signs.

2. The locations shown in the Contract Documents for street lights, street signs, power poles, telephone poles and private mailboxes to be relocated are approximate only. The specific locations are to be designated by the Engineer.
  3. Relocate all signs within the staked grading limits whose existing locations do not conform to final plan locations. Also relocate signs outside the staked grading limits to conform to final plan locations.
  4. Preserve all street, stop and other traffic control and direction signs that are to remain in place. Should any such signs be moved for the Contractor's convenience, permanently reinstall the signs after construction of curb and gutter is complete. Assume responsibility for any damage to such signs. No extra compensation will be allowed for preserving, removing or replacing stop and traffic control and direction signs designated to remain in place, since this work is considered incidental to the contract unit prices for the various items of the contract.
  5. Where stop signs and traffic direction or control signs are temporarily removed, but are needed for traffic reasons during construction, temporarily install a similar stop sign or traffic direction sign in locations acceptable to the Engineer. Assure that the temporary signs remain in place until the permanent stop or traffic control signs are in place.
  6. Store signs which are not used for temporary installation.
  7. Set all permanent signs in fresh concrete, the pole supporting the sign being vertical, and the bottom of the sign being 7 - feet above the top of the curb or sidewalk. Replace all signs which are damaged during removal with new signs.
  8. Assure that all sign locations conform to the latest issue of the Manual on Uniform Traffic Control Devices.
  9. Remove all signs designated for removal without damaging the signs. Salvage and deliver all such damaged signs to the Owner.
- D. **Mailboxes**
1. Mailboxes within the staked grading limits generally are not shown in the Contract Documents. Remove mailboxes within the staked grading limits designated for relocation by the Engineer and place the mailboxes on temporary posts outside, but immediately adjacent to, the construction limits. Ensure that the location designated for temporary use shall provide uninterrupted service.
  2. Upon completion of construction, reinstall mailboxes and posts in permanent location in accordance with current U.S. Post Office regulations and applicable City standards. Contractor shall contact property owner if existing mailbox support is of a condition rendering it unsuitable for reuse.
- E. **Technical Provisions**
1. Contractor will coordinate all utility relocation activity with construction activity. If a utility company is non-responsive, Contractor shall notify Engineer. (PRSP-SID\_MOD)

**END OF SECTION**

## **PART 1 GENERAL**

### **32.1.01 DESCRIPTION**

- A. This Specification includes work for Sub-excavation consisting of removing and disposing of unstable material from below planned subgrade and subbase elevation in cut sections or from below the natural ground line in embankment sections.

### **32.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards  
This section reserved.

### **32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 05 19.13</b>	<b>GEOTEXTILES FOR EARTHWORK</b>
<b>SECTION 31 23 23.23</b>	<b>COMPACTION</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

### **32.1.04 SUBMITTALS**

- A. Submit to the Engineer gradations, moisture density curves and other preliminary test results for sources to be used for imported or recycled material used in subgrade modifications.
- B. Shop drawings and product data shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**  
1. Reserved

### **32.1.05 TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Moisture density curves shall be provided by the Contractor for each material supplied.
- C. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- D. **Technical Provisions**  
1. Reserved

## **PART 2 PRODUCTS**

### **32.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.

B. **Technical Provisions**

1. Reserved

**32.2.02 SUBEXCAVATION / REPLACEMENT BELOW SUBGRADE / SUBBASE**

A. Sub-excavation consists of removing and disposing of unstable material from below planned subgrade elevation in cut sections or from below the natural ground line in embankment sections.

B. Replacement material for sub-excavations consists of either:

1. Suitable materials from within the project limits if suitable material is present within the project limits, or
2. Imported materials if suitable material is not present within the project limits. Where imported pitrun gravel is used, furnish replacement material meeting the following gradation requirement:

<u>Sieve Opening</u>	<u>% Passing</u>
3 – inch	100
No. 4	25 - 60
No. 200	12 Max

C. **Technical Provisions**

1. Reserved

**PART 3 EXECUTION**

**32.3.01 GENERAL**

A. Before placing the embankment or base courses, blade smooth and shape the modified subgrade, to the plan cross section before the base course is placed on the street.

B. Geotextiles and/or geogrids included during subgrade modifications shall be furnished and installed in accordance with the provisions of **SECTION 31 05 19.13 GEOTEXTILES FOR EARTHWORK** of these Specifications.

C. **Technical Provisions**

1. Reserved

**32.3.02 SUBEXCAVATION/REPLACEMENT BELOW SUBGRADE**

A. Sub-excavation consists of removing and disposing of unsuitable material from below planned subgrade elevation in cut sections or from below the natural ground line in embankment sections.

B. Soil is unsuitable if, in the opinion of the Engineer, it contains excessive organics, refuse, construction debris, or other objectionable material; or if it unstable, rutting or yielding; or if it contains excessive moisture.

C. Generally, soils will be sub-excavated and replaced only if they are unable to adequately support equipment typically used for excavation and soil transport.

D. Assure the Engineer has measured the area where unstable materials have been removed before backfilling. Do not backfill any area where unstable foundation soils have been excavated until authorized by the Engineer. Backfill placed without approval may be ordered removed and replaced at Contractor expense.

E. Backfill with either suitable soils from within the project limits or imported pitrun gravel complying with the requirements included herein.

F. Compaction

1. Compact the material using appropriate tamping equipment or power rollers. Correct all irregularities or depressions that develop under rolling by scarifying the material and adding or removing material, as required, until the surface meets the compaction requirements

included under **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.

- a. Refer to **SECTION 31 23 23.23 COMPACTION** for additional information on backfill compaction requirements.

G. **Technical Provisions**

1. Reserved

**END OF SECTION**

---

## **PART 1 GENERAL**

### **32.1.01 DESCRIPTION**

- A. This Specification includes work for the placing of one or more base courses composed of crushed gravel, stone or other similar materials meeting the gradation and other quality criteria specified herein.

### **32.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |                          |  |
|--------------------------|--|
| AASHTO T11               | Amount of Material Finer Than No. 200 (0.075 mm) Sieve in Aggregate  |
| AASHTO T27               | Sieve Analysis of Fine and Coarse Aggregates   |
| AASHTO T89               | Determining Liquid Limit of Soils  |
| AASHTO T90               | Determining the Plastic Limit and Plasticity Index of Soils  |
| AASHTO T176              | Sand Equivalent Value of Soils and Fine Aggregate  |
| AASHTO T96               | Resistance to Degradation By Abrasion and Impact in the Los Angeles Machine  |
| ASTM D5821               | Determining the Percentage of Fractured Particles in Coarse Aggregate  |
| AASHTO T99/(ASTM D698)   | Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb (2.5 kg) Rammer and 12-Inch (305 mm) Drop |
| AASHTO T191/(ASTM D1556) | Density of Soil in-Place By Sand Cone Method   |
| AASHTO T310/(ASTM D6938) | In-Place density and water content of the soil and soil aggregate by Nuclear Method (Shallow Depth)                  |

### **32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 03 30 00</b>	<b>CAST-IN-PLACE CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 05 19.13</b>	<b>GEOTEXTILES FOR EARTHWORK</b>
<b>SECTION 31 23 00</b>	<b>EXCAVATION AND FILL</b>
<b>SECTION 31 50 00</b>	<b>EXCAVATION SUPPORT AND PROTECTION</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 12 16</b>	<b>ASPHALT PAVING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

### **32.1.04 SUBMITTALS**

- A. Submit to the Engineer gradations, moisture density curves and other preliminary test results for sources to be used for base materials prior to delivery to the site for approval by the Engineer. If recycled materials are proposed, CBR test data must be submitted to the Engineer to assure consistency with design requirements.
- B. Shop drawings and product data shall be in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. Technical Provisions
1. Reserved

**32.1.05 TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density and optimum moisture.
- B. Moisture density curves shall be provided by the Contractor for each base material supplied.
- C. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- D. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**32.2.01 GENERAL**

- A. This section reserved.

**32.2.02 CRUSHED BASE**

- A. Consists of both fine and coarse fragments of crushed stone or crushed gravel, and/or natural gravel, and when approved, blended with sand, finely crushed stone, crusher screenings, recycled concrete and/or asphalt or other similar materials.
- B. Use crushed stone or gravel consisting of hard, durable particles of fragments of stone, free of excess of flat, elongated, soft or disintegrated pieces, dirt, or other deleterious matter, and having a percent of wear not exceeding 50 at 500 revolutions when tested under AASHTO T96.
- C. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 35 percent of the material retained on the No. 4 sieve has at least one fractured face. **(TP-1)**
- D. Incorporate all material produced in the crushing operation and passing the No. 4 mesh sieve into the base material necessary to meet the gradation requirements.
- E. **Technical Provisions**
  - 1. **Crushed material as specified in part C of this subsection, shall be crushed so that it produces material where at least 50 percent of the material retained on the No. 4 sieve has at least one fractured face. (PRSP-SID\_MOD)**

**32.2.03 GRADATION**

- A. As determined by AASHTO Methods T11 and T27, furnish material for the grading specified in the Contract Documents including binder or filler, which may have been added at the plant or at the site, meeting the requirements of that grading in the Table of Gradations below:

**TABLE OF GRADATIONS**  
**PERCENTAGES BY WEIGHT PASSING SQUARE MESH SIEVE**

<u>Passing</u>	<u>1 1/2" Minus</u>	<u>1" Minus</u>	<u>3/4" Minus</u>
1 1/2 Inch	100		
1 Inch	—	100	
3/4 Inch	—	—	100
1/2 Inch	—	—	—
No. 4 Sieve	25 - 60	40 - 70	40 - 70
No. 10 Sieve	—	25 - 55	25 - 55
No. 200 Sieve	0 - 8	2 - 10	2 - 10

- B. Up to 5% "oversized" material is permitted provided that the "oversized" material passes the screen size immediately larger than the top size specified. The produced material between the maximum screen opening and the No.4 sieve shall be reasonably well graded.

- C. Suitability of the aggregate is determined by the gradation testing of material placed in the project as required in the Contract Documents, within the allowable limits described by the Table of Gradations for the particular grading specified.
- D. That portion of the fine aggregate passing the No. 200 sieve must be less than 60 percent of that portion passing the No. 40 sieve.
- E. Assure the liquid limit for that portion of the fine aggregate passing a No. 40 sieve cannot exceed 25, nor the plasticity index exceed 6, as determined by AASHTO T89 and T90.
- F. **Technical Provisions**
  - 1. Reserved

## **PART 3 EXECUTION**

### **32.3.01 GENERAL**

- A. Before placing the base course, smooth and shape the surface of the underlying subgrade, sub-base, and/or embankments to the cross section shown on the Drawings before placing the base course.
- B. Furnish and install base courses to the thicknesses shown on the Drawings.
- C. Do not place base course on wet, muddy, or frozen subgrade or sub-base course.
- D. Assure the underlying subgrade is natural soil free of topsoil, organic material or refuse.
- E. Complete at least one area of finished and accepted subgrade, sub-base or underlying base before the placing of any base course.
- F. Place base courses for pavements, curb and gutters, sidewalk, etc. over the prepared subgrade as soon as practical.
- G. **Technical Provisions**
  - 1. The final compacted crushed base course thickness as specified in part B of this subsection, shall be 10 – inches of 1-1/2 –inch minus crushed aggregate base course. (PRSP)

### **32.3.02 PLACEMENT AND SPREADING**

- A. Mix and place the material in maximum 8 - inch horizontal layers loose thickness. Deposit and spread each load of material on the prepared subgrade, or on a completed sub-base course layer continuously without breaks. Assure hauling over the subgrade or over any completed subbase course does not damage the subgrade, subbase or base course.
- B. Deposit and spread the material in a uniform layer, without segregation, to a loose depth so that when compacted, and making allowance for any filler to be blended on the underlying surface, the layer has the specified thickness.
- C. Spread using dump boards, spreader boxes, or moving vehicles equipped to distribute the material in a uniform layer or a windrow. Place and spread the material in a uniform layer to the specified depth without causing segregation.
- D. Construct each layer meeting these requirements. Blade smooth and thoroughly compact each layer as specified before placing the succeeding layer.
- E. If segregation or moisture problems exist, or if the material was placed on the road in windrows, thoroughly blade-mix it the full depth by alternately blading the entire layer to the centerline and back to the roadway edge.
- F. Uniformly add water, when required, on site and place in amounts required to compact the material as necessary to aid in densification and to limit segregation. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.
- G. Apply water during the work to control dust and to maintain the base course in a damp condition.

- H. Water required for compacting base gravel may be obtained from the municipal system if approved by the Owner, or from other sources.
- I. Compact the material using appropriate tamping equipment or power rollers. Correct all irregularities or depressions that develop under rolling by scarifying the material and adding or removing material, as required, until the surface meets specifications.
  - 1. Subbases shall meet compaction requirements established in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- J. Perform blading and compacting alternately, as required to produce the specified surface until final inspection. Tamp the material along curbs, headers, manholes, and similar structures and all places inaccessible to rollers using approved mechanical tampers or hand tampers meet field density requirements.
- K. **Technical Provisions**
  - 1. Placement and spreading of aggregate base course as specified in this subsection shall not be performed until subgrade and/or subbase has met the requirements for compaction, moisture, grade and other applicable parameters as contained within these Contract Documents. **(WIL\_OFF)**

**32.3.03 SURFACE TOLERANCES**

- A. The base course surface when finished and tested with a 10 - foot straight edge placed on the surface with its center line parallel to the center line of the street, will not have a surface deviation from the straight edge exceeding 0.03 – feet (3/8 – inch).
- B. Additionally, the finished grade cannot deviate more than 0.05 – feet at any point from the staked elevation, and further, the sum of the deviations from two points not more than 30 - feet apart cannot exceed 0.05 - feet.
- C. For base course receiving asphalt concrete surfacing, the finished grade cannot deviate more than 0.02 - feet at any point from the staked elevations, and the sum of the deviations from two points not more than 30 - feet apart cannot exceed 0.02 - feet.
- D. If patching of the base course is necessary to meet the tolerances, perform patching using methods and aggregates approved by the Engineer.
- E. **Technical Provisions**
  - 1. Reserved

---

**END OF SECTION**

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes work for the single application of asphalt material as specified in the Contract Documents on a prepared sub-grade, sub-base, base or asphalt surface meeting the plans and Specifications.

**32.1.02 REFERENCES**

- A. This section reserved.

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 12 16</b>	<b>ASPHALT PAVING</b>

**32.1.04 SUBMITTALS**

- A. Shop drawings and product data shall be in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. **Technical Provisions**
1. Reserved

**32.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**32.2.01 GENERAL**

- A. Furnish asphalt material grade and type as specified below meeting the requirements of Table 1 and Table 2 in this Section.

<u>Type and Grade</u>	<u>Use</u>
Liquid Asphalt, MC-70	Asphalt Prime Coat
Emulsified Asphalt, SS-1 or SS-1h	Asphalt Tack Coat
Emulsified Asphalt, CRS-1 or CRS-2	Asphalt Tack Coats

- B. Furnish Blotter Sand as specified below meeting the requirements of MDT 407.02.2.
1. Blotter material shall be 100% passing the 1/2 - inch screen having a PI of 6 or less.
- C. **Technical Provisions**
1. Reserved

**TABLE 1  
SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALTS**

TYPE	RAPID SETTING				MEDIUM SETTING				SLOW SETTING					
	RS-1		RS-2		MS-1		MS-2		MS-2h		SS-1		SS-1h	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Test of Emulsions:	20	100	...	...	20	100	100	100	100	...	20	100	20	100
Viscosity, Saybolt-Furol at 77°F (25°C)	...	...	75	400	...	...	...	...	...	...	...	...	...	...
Viscosity, Saybolt-Furol at 122°F (50°C)	60	...	60	...	...	...	...	...	...	...	...	...	...	...
Demulsibility*, 35ml, 0.02N CaCl <sub>2</sub> , percent	55	...	63	...	55	...	65	...	65	...	57	...	57	...
Residue by Distillation, percent														
Test on Residue from distillation tests														
Penetration, 77°F (25°C), 100g, 5s	100	200	100	200	100	200	100	20	40	90	100	200	40	90
Ductility, 77°F (25°C), 5cm/min, cm.	40	...	40	...	40	...	40	...	40	...	40	...	40	...
Solubility in Trichloroethylene	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...
Suggested Uses:	Surface treatment penetration macadam and tack coat		Surface treatment and penetration macadam		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.		Plant or road mixture with graded and fine aggregates, substantially quantity of which passes a No. 8 (2.36 mm) sieve and a portion of which may pass a No. 200 (0.075 mm) sieve.		Plant or road mixture with graded and fine aggregates, substantially quantity of which passes a No. 8 (2.36 mm) sieve and a portion of which may pass a No. 200 (0.075 mm) sieve.	

\* The demulsibility test shall be made within 30 days from the date of shipment.

**TABLE 2  
SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALTS  
ASSHTO M208**

TYPE	RAPID SETTING				MEDIUM SETTING				SLOW SETTING			
	CRS-1		CRS-2		CMS-1		CMS-2h		CSS-1		CSS-1h	
GRADE	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Test of Emulsions:	...	...	...	...	...	...	...	...	...	...	...	...
Viscosity, Saybolt-Furol at 77°F (25°C)	...	20	100	100	400	50	450	50	450	...	100	20
Viscosity, Saybolt-Furol at 122°F (50°C)	...	...	...	...	...	...	...	...	...	...	...	...
Demulsibility <sup>A</sup> 35ml, 0.08% sodium dioctylsulfosuccinate, %	40	...	40	...	...	...	...	...	...	...	...	...
Particle Charge Test	Pos	...	Pos	...	Pos	...	Pos	...	Pos <sup>B</sup>	...	...	Pos <sup>B</sup>
Distillation:	...	...	3	...	3	...	12	...	12	...	...	...
Oil distillation by volume of emulsion, percent	...	...	...	...	...	...	...	...	...	...	...	...
Residue, percent	60	...	...	65	...	...	65	...	...	...	57	...
Test on Residue from distillation tests	...	...	...	...	...	...	...	...	...	...	...	...
Penetration, 77°F (25°C), 100g, 5s	100	250	100	250	100	250	40	90	100	250	40	90
Ductility, 77°F (25°C), 5cm/min, cm.	40	...	...	40	...	...	...	...	40	...	40	...
Solubility in Trichloroethylene	97.5	...	...	97.5	...	...	97.5	...	...	...	97.5	...
Suggested Uses:	Surface treatment, penetration macadam and tack coat	Surface treatment and penetration macadam	Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.	Plant or road mixture graded and fine aggregates, a substantial quantity of which passes a No. 8 (2.36 mm) sieve and a portion of which may pass a No. 200 (0.075 mm) sieve. Slurry seal treatment.								

<sup>A</sup> The demulsibility test shall be made within 30 days from the date of shipment.  
<sup>B</sup> If the particle charge test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

## **PART 3 EXECUTION**

### **32.3.01 GENERAL**

- A. Paving adjacent to new and/or existing concrete such as curbs, valley gutters, manholes, etc. shall be furnished with prime/tack coat at all concrete/asphalt joints.
  - 1. Paint the edge of the gutter adjacent to the asphalt surfacing with an asphalt prime coat before placing the pavement surface course. **(TP-1)**
  - 2. When an asphalt seal coat is specified, apply the oil and cover aggregate 3 - inches on to the gutter to provide a good seal on the joint between the concrete and pavement.
- B. **Technical Provisions**
  - 1. **Contractor shall clean excess asphalt off concrete, as approved by the Engineer. (MSP)**

### **32.3.02 DISTRIBUTORS**

- A. Use a pressure distributor for prime and tack coats that distributes the required amount of asphaltic material at the specified temperature in a uniform spray, without atomization. Assure the distributor is pneumatic tired and does not rut or otherwise damage the surface being sprayed. Equip it with a bitumeter having a dial visible to the truck driver for maintaining the constant speed required for application at the specified rate.
- B. Assure the pump is operated by a separate power unit or by the truck power unit. Equip the pump with a tachometer having a dial readily visible to the operator, registering gallons per minute passing through the nozzles.
- C. The distributor shall be designed so that the normal width of application shall be not less than 12 - feet, with provision for the application of lesser or greater width when necessary. The distributor shall be designed or equipped so that the height of the spray bar above the surface to be sprayed, may be set and maintained within a tolerance of 1/2 - inch (plus or minus) of the height required to provide a uniform application.
- D. Assure the distributor is equipped and operated so that the asphaltic material is circulated or agitated throughout the entire heating system. Provide a means for constant, accurate temperature indication of the asphaltic material is provided. Assure the thermometer well is placed without contacting the heating tube.
- E. **Technical Provisions**
  - 1. Reserved

### **32.3.03 ASPHALT PRIME COAT**

- A. Asphalt prime coat will be applied only if specified in the plans or special provisions.
- B. Spray the asphalt prime coat, under average conditions, from 0.20 to 0.50 gallons per square yard (0.9 to 8.2 liters per square meter) of low viscosity MC-70 asphalt on the prepared surface of a non-asphaltic base course.
- C. Immediately before applying the prime coat, clean the surface to be primed of all dirt and loose materials using blowers or a power broom, supplemented by hand brooming if necessary. Finish the surface to receive the asphalt material to the specified requirements for smoothness, compaction, and grade. Apply prime coat when the surface is dry or slightly damp and when the air temperature in the shade is not less than 50° F.
- D. Apply asphalt material using a pressure distributor at the rate or rates directed by the Engineer.
- E. Before spraying, spread building paper over the surface from the joint back, for the distance required for the spray bar to begin spraying and operating at full force when the surface to be treated is reached. Once the asphalt is applied, remove and dispose of the building paper. Assure the spray bar is shut off instantaneously at each construction joint to assure a straight line and full application of asphalt prime up to the joint. If required to prevent dripping, insert a drip pan under

the nozzle where the application ends. Use a hand sprayer to apply primer material to touch up all spots missed by the distributor.

- F. Protect the surfaces of structures and trees adjacent to the area being treated from being spattered or marred. Do not discharge asphalt material into borrow pits or gutters.
- G. After the prime coat has been applied, assure it is left undisturbed for at least 24 hours or until it is cured or blotted. Blot all excess asphalt material remaining on the surface after 24 hours with sand before opening the surface to traffic. Maintain the primed or tacked surface until the surfacing has been placed. Maintenance includes spreading any additional sand required to prevent asphalt material adhering to the tires of vehicles using the surface and patching all breaks in the surface with additional bituminous material. Any area of surface disturbed by traffic or otherwise, is to be cleaned before the next course is placed. Before placing the surface course, sweep all excess and/or loose sand used for blotter from the surface.
- H. **Technical Provisions**
  - 1. Reserved

**32.3.04 ASPHALT TACK COAT**

- A. The asphalt tack coat is the application of a diluted, slow-breaking, SS-1 or SS-1h asphalt emulsion to insure bond between the surface being paved and the overlying course. Immediately before applying the tack coat, clean the surface to be tacked of all dirt and loose materials using blowers or power brooms, supplemented by hand brooming if necessary.
- B. Apply tack coat when the surface is dry or slightly damp, and when the air temperature in the shade is at least 50° F.
- C. Dilute the asphalt emulsion, SS-1 or S-1h, with water at one part emulsion to one part water. Apply the diluted emulsion using a pressure distributor at the rate of 0.1 gallon per square yard (4.5 liters per square meter).
- D. Before application, spread building paper over the surface, from the joint back, for the required distance for the spray bar to begin spraying and operating at full force when the surface to be treated is reached. Once the asphalt is applied, remove and dispose of the building paper. Shut off the spray bar shall instantaneously at each construction joint to assure a straight line and full application of asphalt prime up to the joint. If required to prevent dripping, insert a drip pan under the nozzle where the application is stopped. Use a hand sprayer to apply primer material for touching up all spots missed by the distributor.
- E. After the tack coat has been applied, assure it is undisturbed until the asphalt emulsion has “broken”, generally within 30 minutes of application. Place the next paving course after the emulsion has broken.
- F. Schedule operations so that all tack coats are placed with the asphalt-paving course in the same day.
- G. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes the work for the production and placement of plant mix asphalt concrete pavement including new asphalt paving, asphalt overlays, and asphalt patching.
- B. Hot plant mix asphalt concrete is a mineral aggregate and asphalt material mixed at a central hot plant meeting these Specifications and placed in one or more courses on a newly prepared or existing street roadway in accordance with the Contract Documents.

**32.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - ASTM D5361 Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing
  - ASTM D2041 Theoretical Maximum Specific Gravity and Density of Bituminous Mixtures
  - ASTM C1097 Hydrated Lime for Use in Asphaltic Concrete Mixtures
  - ASTM D3666 Evaluating and Qualifying Agencies Testing and Inspecting
  - ASTM D5821 Determining the Percentage of Fractured Particles in Coarse Aggregate
  - ASTM C123 Lightweight Particles in Aggregate
  - ASTM D6307 Asphalt Content of Hot Mix Asphalt by Ignition Method
  - STM C142 Clay Lumps and Friable Particles in Aggregates
  - MS-2 Asphalt Institute – Mix Design Methods
  - AASHTO T11/(ASTM D1140) Amount of Material Finer than No. 200 (0.075 mm) Sieve in Aggregate
  - AASHTO T27/(ASTM C136) Sieve Analysis of Fine and Coarse Aggregate
  - AASHTO T89/(ASTM D4318) Determining Liquid Limit of Soils
  - AASHTO T90/(ASTM D4318) Determining the Plastic Limit and Plasticity Index of Soils
  - AASHTO T283/(ASTM D4867) Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
  - AASHTO T176/(ASTM D2419) Sand Equivalent Value of Soils and Fine Aggregate
  - AASHTO T96/(ASTM C131) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - AASHTO T245/(ASTM D6926, D6927) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified, and included in other sections of these Specifications.
  - SECTION 01 22 19 MEASUREMENT AND PAYMENT**
  - SECTION 01 33 00 SUBMITTAL PROCEDURES**
  - SECTION 01 45 00 QUALITY CONTROL**
  - SECTION 01 46 16 FIELD QUALITY CONTROL PROCEDURES**
  - SECTION 03 05 00 COMMON WORK RESULTS FOR CONCRETE**
  - SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK**
  - SECTION 31 23 00 EXCAVATION AND FILL**
  - SECTION 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS**
  - SECTION 32 05 19.13 GEOTEXTILES FOR EXTERIOR IMPROVEMENTS**
  - SECTION 32 11 13 SUBGRADE MODIFICATIONS**
  - SECTION 32 11 23 AGGREGATE BASE COURSE**

**32.1.04 SUBMITTALS**

- A. Submit to the Engineer for approval a mix design for each mix required on the project. Assure the job-mix formula is within the gradation limits Products section of this Specification.
- B. Have the job-mix formula prepared by an independent testing laboratory approved by the Engineer. The requirements of ASTM D-3666 are the guidelines for testing laboratory approval. The cost of the job-mix formula(s) is at Contractor expense.
- C. Keep the job mix formula current and contain the following minimum information:
  - 1. Gradation of all constituent aggregates.
  - 2. Specific gravity of constituent aggregates and asphalt cement.
  - 3. Source of supply of all materials and grade of Asphalt Cement.
  - 4. Marshall design curves for stability, unit weight, flow and volumetric requirements (VMA and total voids) at asphalt contents below and above optimum (four points minimum).
  - 5. Measured voidless (Rice's) specific gravity used in voids computations.
  - 6. Composite aggregate grading.
  - 7. Recommended asphalt cement content.
  - 8. Marshall compactive effort (50 blows).
  - 9. Date of mix design (job mix formula).
  - 10. Index of retained strength.
- D. In addition to the job mix formula, all asphalt concrete surfacing mix submittals will have laboratory tests indicating that the Tensile Strength Ratio (TSR) as determined by AASHTO T-283, is at least 70%. Test shall be performed at 7.0 +/- 1% air voids and shall include the freeze cycle.
- E. Obtain Engineer approval of the asphalt material source before shipments are made to any project. The source of supply cannot change after work is started unless approved in writing by the Engineer. The Engineer is not liable for the quantity shipped.
- F. Samples of asphalt binder material may be taken, as directed by the Engineer, and placed in uncontaminated one-quart containers. When sampled, these shall be taken from the tanker car or truck at the point of delivery on the project and submitted to the Engineer.
- G. The material supplier shall issue, in duplicate, a certificate showing full compliance with the Specifications for the designated grade of material, together with the following information. Project number, date of shipment, source of the material, car or truck initial and number, destination, gross quantity loaded, loading temperature, and net quantity in gallons at 60° F or tons, whichever unit of measurement is stipulated. Assure the certificate of compliance accompanies the shipment and is furnished to the Engineer. The certificate, signed by the supplier representative, must also certify that the conveyance vessel was inspected and found to be free of contaminating material.
- H. The certificate of compliance is the basis for tentative acceptance and use of the material. Samples taken according to applicable sampling methods and retained by the Engineer may be tested at the Engineer's discretion. Failure of the asphalt material to meet these Specifications may result in rejection of the entire, associated work. If rejected, remove and replace rejected work at no additional cost to the Owner.
- I. Upon request by the Engineer, furnish the Engineer and/or laboratory (responsible for completing the mix design) with data or a report showing the temperature viscosity relationship of each asphalt binder used on the project. Assure this data covers the range of temperatures used for mixing and compaction. In addition, the Engineer may request a complete set of test results from Table 3, included herein, for each grade used on the project.
- J. Shop drawings and product data shall be in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- K. **Technical Provisions**
  - 1. Reserved

**32.1.05    TESTING**

- A. Testing shall include; but not limited to, field density testing and laboratory maximum density, thickness, asphalt content, aggregates and constituent material verifications.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**PART 2    PRODUCTS**

**32.2.01    GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. The Asphalt Concrete Surface Course must have at least a 3-bin separation, when continuous flow mixing types of plants are used. When a drum dryer is used with a weight batching system from dry bins, separate and stockpile the crushed aggregate into two sizes.
- C. The specific type and grading of aggregate shall be as indicated on the plans or in the Contract Documents. The types and grades are described in this Specification.
- D. The furnishing of asphalt materials for use in asphaltic concrete mixes shall meet the requirements for the particular grade specified in the Contract Documents. The types and grades are described in this Specification.
- E. Prepare pavement course to conform to the lines, grades, thickness and typical cross sections shown on the Drawings, and shall be rolled, finished, and approved by the Engineer before the placement of the next course.
- F. **Technical Provisions**
  - 1. All asphalt installed shall be (Type B), unless otherwise specified. (MSP)

**32.2.02    PLANT MIX AGGREGATES**

- A. Furnish aggregates from acceptable sources approved by the Engineer. (TP-1)
- B. Furnish test data as outlined in this section on each source to be used for acceptance by the Engineer.
- C. Designation of the source of supply and the acceptability of the material there from, does not extend to the grading of the material as it may naturally come from the pit or crusher. Adjust the crusher and screens to remove certain portions of the material as may be necessary to furnish gravel that will comply with the Specifications in the contract. No additional compensation will be allowed for such adjustment of the equipment or the rejection of waste. It is understood that the Engineer may order procurement of material from any portion of any area designated as a pit site and may reject portions of the deposit as unacceptable.
- D. Aggregate materials shall not contain more than 1.5% by weight of clay lumps, shale, or coal, nor shall light weight particles exceed 3.5% by weight. No combination of clay, shale, coal, or lightweight particles shall exceed 3.5% by weight. Do not use Scoria (fired clay). Aggregate materials shall conform to the grading stipulated in the Contract Documents. Use reasonable care in the selection of material in a pit so that uniform product will be produced at all times. No compensation will be allowed for such stripping of the pit as may be required in order that satisfactory material may be secured.
- E. Aggregate used shall consist of gravel, crushed to the specified size, crushed stone, composed of hard durable pebbles or stone fragments, reclaimed asphalt pavement, and finely crushed stone filler, sand or natural clean material, or other fine mineral material. The portion of the material retained on the No. 4 sieve (4.74 mm) will be called coarse aggregate and that passing the No. 4 sieve (4.74 mm) and retained on the #200 sieve (0.075 mm) will be call fine aggregate. The

material Passing the #200 (0.075 mm) will be called mineral filler. The reclaimed asphalt pavement shall be removed from its original location and reduced by suitable means to such particle size as may be required for use in hot plant mix asphalt concrete.

- F. For all gradings of fine aggregate, including any blended fine aggregate and mineral filler, passing a No 40 sieve (0.425 mm), shall have a liquid limit not exceeding 25 and a plasticity index of not more than 6.
- G. Produce coarse aggregate retained on the No. 4 sieve (4.75 mm) having a minimum of 50% by weight of particles with at least one mechanically fractured face. The coarse aggregate shall not exceed 40% wear at 500 revolutions.
- H. Preliminary acceptance of aggregates proposed for use may be made at the point of production. Final acceptance will be made only after tests of the aggregates are complete and in place.
- I. Surface Course Asphalt Plant Mix Aggregate:

**TABLE 1**  
**REQUIREMENTS FOR GRADING OF SURFACE COURSE AGGREGATE**

Percentage by Weight Passing Job Mix Target Bands						
Sieve Size	Type A	Type B		Type C		Job Mix Tolerances
1" (25.0 mm)	100	---		---		---
¾" (19.0 mm)	91-93	100		---		+/- 7
½" (12.5 mm)	76-89	83-93		100		+/- 7
3/8" (9.5 mm)	61-79	73-87		91-93		+/- 7
No 4 (4.75 mm)	41-54	47-63		51-71		+/- 6
No 10 (2.00 mm)	31-39	32-43		34-46		+/- 6
No 40 (0.425 mm)	16-27	15-25		16-26		+/- 5
No 200 (0.075 mm)	4-7	5-7		5-9		+/- 2

- 1. The above gradation bands represent the job mix target limits, which determine the suitability of aggregate for use. The final job mix target gradation must be within the specified bands and uniformly graded from coarse to fine and not vary from the low limits on one screen to the high limits on the adjacent screen, or vice versa. The final job mix gradation limits are established by applying the job mix tolerances to the job mix targets.
- 2. The job mix formula establishes target values. During production of the mix, the gradations shall lie within the job mix gradation limits specified in Table 1. For example, "Type A, No. 200" band is "4-7". QA job mix target of 5 has been selected for the final mix. The job mix gradation limits is 5, plus and minus 2. Therefore, the job mix gradation limits for production is "3-7".

**J. Technical Provisions**

- 1. Aggregate material data to be sent in for acceptance as specified in part A of this subsection, shall be accompanied with sample and test for specification compliance before aggregate is crushed for stockpiling. Sampling and testing must be completed within the last one-year period and/or upon change of source before aggregate is crushed for stockpiling. **(PRSP-SID\_MOD)**

**32.2.03 TYPE B – MODIFIED ASPHALT**

- A. Where designated, place a high-density hot mix asphalt surface course in accordance with the requirements of this Section.
- B. Grading requirements for surface course aggregate shall be as follows:

<u>Sieve Opening</u>	<u>% Passing</u>	<u>Job Mix Tolerance</u>
3/4 – inch	100	-
1/2 – inch	82-95	±7
3/8 – inch	70-90	±7
No. 4	45-65	±6
No. 10	32-45	±6
No. 40	15-25	±5
No. 80	8-16	±2
No. 100	4-8	±2
Asphalt Cement		4 - 6.5%

- C. Provide crushed aggregate with at least 75% of the aggregate retained on the No. 4 sieve having at least two mechanically fractured faces. When two fractures are contiguous, the angle between the fracture planes shall be at least 30 degrees to count as two fractured faces.
- D. All Type B-Modified asphaltic concrete surfacing shall meet the following Marshall Design criteria as determined by ASTM D1559:
  - 1. Number of Blows per Face 75
  - 2. Stability, minimum 1500 lbf
  - 3. Flow 8 – 16
  - 4. Percent Air Void 3 - 5
  - 5. Percent Air Void Filled with Bitumen 65 -75
- E. **Technical Provisions**
  - 1. Reserved

**32.2.04 ASPHALT BINDER MATERIAL**

- A. Furnish Asphalt binder material to be used as specified in the Contract Documents that meet the type and grade specified requirements in this section in Table 3.
  - 1. Grades
    - a. (PGAB) PG 58-22
    - b. (PGAB) PG 58-28
    - c. (PGAB) PG 64-22
    - d. (PGAB) PG 64-28 (Polymer Modified)
- B. The percentage of asphalt by weight, to be added to the aggregate will be, generally, between 4 and 8 percent of the weight of the total mix. The mix design will establish the exact percentage of asphalt in the mix, based upon preliminary laboratory tests, sieve analysis and grading and character of the aggregate furnished within the Specification limits. No claim is allowed for the payer for rejecting any batch or load of mixture containing an excess or deficient amount of asphalt binder varying more than 0.4 of a percent from the fixed mix design percentage.
- C. All transport vehicles must be equipped with a spigot or gate valve installed in either: (1) the unloading line, (2) in the tanker at the centerline on the tank, (3) in the pressure line from the unloading pump, or other locations approved by the Engineer. Assure the spigot or gate valve has a diameter of between 3/8 - inch and 3/4 - inch. The spigot valve must be located to prevent contamination from plant dust or other contaminants.

- D. The supplier furnishing the asphalt binder material shall inspect each tanker car or truck before it is loaded and ship only in clean, uncontaminated, fully insulated cars or trucks, sealed after loading by the supplier.
- E. Apply asphalt material at temperatures that assure uniform mixing or spreading. Application temperature ranges for each grade of material should be accompanied with the mix design. Application temperature for mixing applications will be in accordance with the mix design.

**TABLE 3**  
**PERFORMANCE GRADED ASPHALT BINDER (PGAB)**

Performance Grade	PG 58		PG 64		Test Methods
	-22	-28	-22	-28	
Average 7-day Maximum Pavement Design Temperature, °C	<58		<64		
Minimum Pavement Design Temperature, °C	>-22	>-28	>-22	>-28	
<b>Original Binder</b>					
Flash Point Temp.: Minimum °C	230				AASHTO T48
Viscosity: Maximum, 3 Pa · s (3000 CP), Test Temp, °C	135				ASTM D4402
Dynamic Shear: G* / sin delta, Minimum, 1.00 kPa Test Temp @ 10 rad / s, °C	58		64		AASHTO TP5
<b>Rolling Thin Film Oven (AASHTO T240) or Thin Film Oven (T179) Residue</b>					
Mass Loss, Maximum, %	1.0				AASHTO T240
Dynamic Shear: G* / sin delta, Minimum, 2.20 kPa Test Temp @ 10 rad / s, °C	58		64		AASHTO TP5
<b>Pressure Aging Vessel Residue (AASHTO PP1)</b>					
PAV Aging Temp, °C	100		100		AASHTO PP1
Dynamic Shear: G* / sin delta, Maximum, 5000 kPa Test Temp @ 10 rad / s, °C	22	19	25	22	AASHTO TP5
Creep Stiffness <sup>a</sup> : S, Minimum, 300 MPa m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C	-12	-18	-12	-18	AASHTO TP1
Direct Tension <sup>a</sup> : Failure Strain, Minimum, 1.0%, Test Temp @ 1.0 mm/min. °C	-12	-18	-12	-18	AASHTO TP3

- a. If creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

**F. Technical Provisions**

- 1. **Asphalt binder material shall be PG 58-28. (MSP)**

**32.2.05 HYDRATED LIME FOR ASPHALT**

- A. Mineral filler may be incorporated in the asphalt concrete mixture. Furnish hydrated lime as filler when specified. Assure it is free of lumps and extraneous material and meets the following gradation requirements as per ASTM D242:

<u>Sieve</u>	<u>Percent Passing</u>
No. 30 (0.60 mm) Sieve	100
No. 80 (0.180 mm) Sieve	95-100
No. 200 (0.075 mm) Sieve	70-100

- B. Assure the hydrated lime meets paragraph 2 (chemical composition) and paragraph 7 (a) requirements (chemical analysis) of ASTM C1097.
- C. Where required, the mineral filler will be effectively mixed with the hot plant mix asphaltic concrete.
- D. **Technical Provisions**
  - 1. Reserved

**32.2.06**     **COMPOSITIONS OF MIXES**

- A. The maximum permissible variation from the job-mix formula within the Specification limits is as follows:
  - 1. Aggregate Gradation . . . . . Within Job Mix Tolerances
  - 2. Asphalt . . . . . ± 0.4 percent\*
  - 3. Temperature of Mix . . . . . ± 20°F.
    - a. (\*) This tolerance will be permitted only if the job mix parameter curves indicate that the corresponding Marshall design limits are not exceeded.
- B. Produce Hot Plant Mix Asphalt Concrete Surface courses having the following characteristics as measured by AASHTO T245, ASTM D6726 & D6927 “Resistance to Plastic Flow of Bituminous Mixtures by Means of the Marshall Apparatus”:
  - 1. Number of compaction blows, each end of specimen . . . . . 50.
  - 2. Stability, minimum . . . . . 1200.
  - 3. Flow . . . . . 8 – 18.
  - 4. Air voids, percent . . . . . 3-5.
  - 5. Percent voids in mineral aggregate (minimum). . . . . See Table 4.

<b>TABLE 4</b>	
<b>REQUIRED VOIDS IN MINERAL AGGREGATE (VMA)</b>	
Nominal particle size (table 2)	Voids in Mineral Aggregate, Min.
3/8 – inch (9.5 mm)	14
1/2 - inch (12.5 mm)	13
3/4 - inch (19.0 mm)	12
1 – inch (25.0 mm)	11
1 1/2 - inch (37.5 mm)	10
Nominal maximum particle size is one size larger than the first sieve to retain more than 10 percent.	

- C. **Technical Provisions**
  - 1. Reserved

**PART 3**     **EXECUTION**

**32.3.01**     **GENERAL**

- A. Before placing asphalt, smooth and shape the surface of the underlying subgrade, sub-base, base course and/or embankments to the cross section shown on the Drawings.
- B. Excess material shall be disposed of at a legal disposal area chosen by the Contractor, unless otherwise specified.
- C. Assure the area to be paved is true to line and grade and has a dry and properly prepared surface before starting paving operations. Assure the surface is free from all loose screenings and other loose or foreign material.
- D. Furnish and install asphalt to the thicknesses shown on the Drawings.

**E. Technical Provisions**

1. For all asphalt paving/patching, machine spreading and finishing will be required to provide a smooth uniform surface. Hand spreading and finishing methods shall not be considered an acceptable form of asphalt repair and replacement. (PRSP-SID<sub>19</sub>)
  - a. Refer to subsection Mechanical Pavers included herein, for acceptable asphalt paving equipment.

**32.3.02 CRUSHING**

**A. Crushing Equipment**

1. Fit crushing plant-screening equipment, when required, with blowers or other devices capable of removing excess and undesirable fines.

**B. Screening Plants**

1. Screening plants consist of a revolving trommel screen, shaker screen, vibrating screen, or other devices capable of removing oversize material, excess and undesirable fines.

**C. Scales**

1. Furnish scales, when required, satisfactory to the Engineer. Test and certify scales prior to their use on the project and as often thereafter as the Engineer may consider necessary to insure their accuracy. Have on hand not less than ten, 50-pound weights for testing scales.
2. House the recording devices of the scales in a suitable manner. Place the scales in a location suitable to facilitate accurate weighing of loads. The scales shall be accurate to one-half of one percent at any weight. Alternate methods or devices for weighing may be acceptable, provided that these methods or devices produce the same degree of accuracy as required of platform scales.

**D. Technical Provisions**

1. Reserved

**32.3.03 MATERIAL HANDLING**

A. All work involved in clearing and stripping pits and quarries, including handling unsuitable material encountered, are performed with no additional compensation being allowed for this work. The pits as utilized shall immediately be opened so as to expose the vertical faces of the various strata of acceptable material and, unless otherwise directed, the material shall be secured in successive vertical cuts extending through all the exposed strata.

B. Provide, unless otherwise specified, material containing as large a proportion as possible of crushed aggregate. Combine the crushed material with the screened material to obtain a uniform product.

C. No material will be accepted which is loaded into hauling units in a segregated condition or which does not meet the required grading. In case the material deposit contains sand or other material in excess of the Specification gradation requirements, or of an unacceptable quality, such excess or undesirable material shall be removed and disposed of prior to crushing, or during screening operations, if crushing is not required.

D. Provide a storage bin of ample capacity to insure uniform quality and delivery of material. Loading of trucks directly from the conveyor belt, from the crusher or screening plant will not be permitted.

**E. Technical Provisions**

1. Reserved

**32.3.04 STOCKPILES**

A. Grub and clean sites for aggregate stockpiles prior to storing aggregates. Assure the site is firm, smooth and well drained. Maintain a bed of aggregate suitable to avoid the inclusion of soil or foreign material.

- B. Build up coarse aggregate stockpiles in tiers of not more than 4 - feet in thickness. Assure each tier is completely in place before the next tier is placed. Do not allow material to “cone” down over the next lower tier.
- C. Dumping, casting or pushing over the sides of stockpiles will be prohibited, except in the case of fine aggregate stockpiles.
- D. Space stockpiles of different gradations of aggregate far enough apart, or separated by suitable walls or partitions, to prevent the mixing of the aggregates.
- E. Any method of stockpiling aggregate, which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate, will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated and failure of such samples to meet all grading requirements for the aggregate discontinuance of such stockpiling procedures.
- F. Transfer the aggregate from the stockpiles in such a manner that uniform grading of the material is preserved.
- G. **Technical Provisions**
  - 1. Reserved

**32.3.05**     **CONVEYOR STOCKPILING**

- A. Materials stockpiled by conveyors shall be deposited in a succession of merging cone piles. Do not drop material over 12 - feet nor allow cones to exceed 12 - feet in height. Cones should be leveled to a thickness of approximately 4 - feet prior to starting another tier.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.06**     **TRUCK STOCKPILING**

- A. Materials stockpiled by trucks shall construct the stockpile in tiers approximately 4 - feet in thickness. Complete each tier before the next tier is started.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.07**     **ASPHALT MIXING PLANTS**

- A. Use mixing plants of either the weight batching type, the continuous flow mixing type, or drum dryer type. Use drum dryer mixers specifically designed and constructed for producing hot mix.
- B. Equip all plants with approved conveyors, power units, aggregate handling equipment, aggregate screens and bins that are coordinated and operated to produce a uniform mixture within the specified job mix tolerances.
- C. Use batch-type plants having a minimum batch production capacity of 2,000 pounds. Use continuous flow or drum dryer plants having a minimum production capacity of 60 tons per hour. These capacity requirements may be modified if specified in the Contract Documents.
- D. Stop production and remove from the project mixing plants that fail to continuously produce a mixture meeting requirements as specified.
- E. For verification of weights and measures, character of materials and determination of temperatures used in the preparation of the paving mixes, the Engineer or his authorized representative will, at all times, have access to all portions of the mixing plant, aggregate plant, storage yards and other facilities for producing and processing the materials for the work. All sampling and testing of processed and unprocessed material is performed in accordance with the provisions of the Contract Documents.
- F. **Technical Provisions**
  - 1. Reserved

**32.3.08 WEATHER LIMITATIONS**

- A. Weather Limitations shall apply to all asphalt operations included herein, unless otherwise specified.
- B. Ambient air temperature in the shade shall be 35°F and rising.
- C. Do not place asphalt when any and/or all of the following conditions are observed:
  - 1. The moisture in the stockpiled aggregate or the dryer adversely effects the quality of mix production, normal plant operations.
  - 2. Snow, rain, and/or standing water is present.
  - 3. Weather conditions would cause rapid unpredictable cooling of asphalt mat. Including high winds and low ambient air temperatures.
  - 4. Surface temperature of underlying material is frozen and/or does not meet the minimum surface temperatures specified in the table below for the respective compacted lift thickness to be placed.

Surface Temperature Placement Limits			
Lift Thickness	T < 2"	2" ≤ T ≤ 3"	3" < T
Min. Surface Temp.	50°F	40°F	35°F

D. **Technical Provisions**

- 1. Reserved

**32.3.09 NEW ASPHALT PAVING**

- A. For new work, meet the surface preparation requirements for the underlying material as specified in the Specifications. Prime prepared soil or aggregate bases as applicable.
- B. Before paving, proof-roll the base with equipment having at least one 18 kip single axle load or equivalent. Excavate and replace areas that yield or crack under these wheel loads as directed by Engineer at no additional cost to the Owner. This does not replace or relax the base or subgrade compaction requirements.
  - 1. The underlying surface(s) and materials shall be compacted to minimum requirements established in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. Paint the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in contact with asphalt mixes with a thin coating of asphaltic material to provide a water-tight joint.
- D. **Technical Provisions**
  - 1. **Clean excess asphalt off curbs and gutters as determined by the Engineer.**

**32.3.10 ASPHALT OVERLAYS**

- A. Where a base is rough or uneven, place a leveling course using a paver or motor grader and compact before the placing of subsequent courses.
  - 1. The underlying surface(s) and materials shall be compacted to minimum requirements established in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- B. When specified, furnish and install construction fabric to control reflective cracking, in accordance with the provisions of **SECTION 32 05.13 GEOTEXTILES FOR EXTERIOR IMPROVEMENTS** of these Specifications.
- C. When a leveling course is not specified, patch or correct all depressions and other irregularities, subject to the Engineer's approval, before starting other paving operations. Remove all rich and unsuitable patches, excess crack or joint filler, and all surplus bitumen from the area to be paved. Do not blot excessive deposits of asphalt with sand or stone.

- D. Apply a tack coat when the surface to be paved is an existing portland cement concrete, brick or asphalt pavement.
- E. Coat the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in actual contact with asphalt mixes with a thin, complete coating of asphalt material to provide a water-tight joint.
- F. **Technical Provisions**
  - 1. Reserved

**32.3.11 ASPHALT PATCHING**

- A. Assure the area to be paved is true to line and grade, is dry and properly prepared surface before starting paving operations. Clean the surface of all loose screenings and other loose or foreign material.
- B. Before paving, proof roll the base. Areas that yield excessively or crack under such wheel loads will be excavated and replaced, to correct yielding and cracking problems at no additional cost to the Owner. This does not replace the base or subgrade compaction requirements.
  - 1. The underlying surface(s) and materials shall be compacted to minimum requirements established in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. Cut the edge of existing pavements against which additional pavement is to be placed straight and vertical.
- D. Neatly cut all asphalt edges using an asphalt saw.
- E. Cut asphalt edges to form as regular a patch shape as practical and should, in general, approximate a rectangle.
- F. Cut asphalt edges at least 12 - inches wider than the trench width, or as directed by the Engineer, on each side of trench excavations; and, in general, be cut parallel to the street centerline for mainline construction and perpendicular to the street centerline for service lateral construction.
- G. Remove and replace asphalt surface widths of less than 3 - feet.
- H. **Technical Provisions**
  - 1. **Skin patching shall not generally be considered a satisfactory method of repair. (PRSP-SID\_MOD)**
  - 2. **All pavement damaged during construction by the Contractor's equipment or the use thereof shall be removed to the full depth of the asphalt and replaced. Removal and replacement shall be over an area that is continuous with the asphalt restoration and as otherwise required by the Engineer to provide a smooth and durable patch. No compensation will be allowed for removal and replacement of damaged pavement outside of the pay limits for pavement restoration. Patches less than full depth will not be allowed. (PRSP-SID\_MOD)**

**32.3.12 TRANSPORTATION OF MIX**

- A. Transport the mix in vehicles cleaned of all foreign material which may affect the mix. The truck beds must be painted, or sprayed with a lime-water, soap or detergent solution at least once a day or as often as required. After this operation elevate the truck bed and thoroughly drain it, with no excess solution being permitted. Dispatch the vehicles so that all material delivered is placed in daylight, unless the Engineer approves artificial light. Deliver material to the paver at a uniform rate and in an amount well within the capacity of the paving and compacting equipment.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.13**     **SPREADING AND FINISHING**

- A. Maximum lift thickness is 2 1/2 – inches for surface courses and 5 – inches for base courses.
- B. Rollers and equipment used for spreading and finishing shall meet the requirements as included herein.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.14**     **MECHANICAL PAVERS**

- A. Spread and strike off the base and surface courses with a mechanical paving machine. Operate the paving machine so that material does not accumulate and remain along the sides of the receiving hopper.
- B. Do not use equipment, which leaves tracks or indented areas, which cannot be corrected in normal operation, produces flushing or other permanent blemishes, or fails to produce a satisfactory surface.
- C. Construct longitudinal joints and edges to true line markings. Establish lines for the paver to follow in placing individual lanes parallel to the centerline of the proposed roadway. Position and operate the paver to follow closely the established lines.
- D. When using pavers in echelon, assure the first paver follows the marks or lines with the second paver following the edge of the material placed by the first paver. To assure a hot joint and obtain proper compaction, assure the pavers work as close together as possible not exceeding 100 - feet apart. In backing trucks against the paver, take care not to jar the paver out of its proper alignment.
- E. As soon as the first load of material has been spread, check the texture of the unrolled surface to determine its uniformity. Segregation of materials is not permitted. If segregation occurs, suspend spreading operation until the cause is determined and corrected.
- F. Offset transverse joints in succeeding courses at least 2 - feet. Offset longitudinal joints at least 6 - inches.
- G. Correct all irregularities in alignment left by the paver by trimming directly behind the machine. Immediately after trimming, thoroughly compact the edges of the course by tamping. Avoid distorting the pavement during this operation.
- H. Assure edges against which additional pavement is to be placed is straight and approximately vertical. Use a lute or covered rake immediately behind the paver, when required, to obtain a true line and vertical edge. Correct all irregularities in the surface of the pavement course directly behind the paver. Remove excess material forming high spots by a shovel or lute. Fill low areas with hot mix and smooth it with the back of a shovel being pulled over the surface. Fanning of material over such areas is not permitted.
- I. **Technical Provisions**
  - 1. **Mechanical pavers specified in this subsection shall also meet the following requirements. (SID\_OFF)**
    - a. **Mechanical pavers shall be furnished with a heated, free-floating screed.**
    - b. **Use self-propelled pavers that spread, shape, and finish the combined plant mix material to the specified profile and cross slope.**
    - c. **Immediately stop paving if the paver tears, shoves, segregates or otherwise damages the plant mix, and repair or replace the paver before resuming paving operations.**
    - d. **Equip the paver with a mobile grade reference system that provides a uniform pavement profile.**
    - e. **Equip the paver with the necessary components to create a rolled/compacted tapered sluff or safety edge if required.**

- f. Ensure the paver maintains the transverse slope at all times and is able to adjust the slope throughout super- elevated curves.
- g. Ensure auger extensions are used to match the screed width.

**32.3.15**     **MOTOR GRADERS**

- A. When motor graders, with Engineers approval, are used for the spreading of leveling courses, place the material on the roadbed so that the proper amount of material is available.
- B. Spread the mix to the required thickness, line and grade, with a uniform surface texture, while at a workable temperature.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.16**     **HAND SPREADING**

- A. In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Engineer. Wood or steel forms, approved by the Engineer, rigidly supported to assure correct grade and cross section, may be used. In such instances, measuring blocks and intermediate strips must be used to obtain the required cross-section. Perform hand placing carefully. Uniformly distribute the material to avoid segregation of the coarse and fine aggregate. Broadcasting of material is not permitted. During the spreading operation, loosen and uniformly distribute all material using lutes or covered rakes. Reject material that has formed into lumps and does not break down readily. Following placing and before rolling, check the surface with templates and straightedges and correct all irregularities.
- B. Maintain on the project heating equipment for keeping hand tools free from asphalt. Exercise caution to prevent heating that may burn the material. Assure the temperature of the tools when used is not greater than the temperature of the mix being placed. Use heat only to clean hand tools; petroleum oils or solvents are not permitted.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.17**     **ASPHALT COMPACTION**

- A. Furnish the number of rollers necessary to provide the specified pavement density. During rolling, keep the roller wheels moist to avoid picking up the material.
- B. After the longitudinal joints and edges have been compacted, start rolling longitudinally at the sides and progress toward the center of the pavement. For transverse graded streets, begin rolling on the low side and progress to the high side, overlapping passes by at least one-half the width of rollers and uniformly lapping each preceding pass. Operate the rollers at a slow, uniform speed with the drive roll or wheel nearest the paver. Do not exceed 3 miles per hours.
- C. Do not quickly change the line of rolling reversing direction suddenly. If rolling displaces the material, re-work the area using lutes or shovels and restore it the original grade of the loose material before re-rolling. Do not permit heavy equipment or rollers to stand on the finished surface before it has been compacted and has thoroughly cooled.
- D. When paving in single width, roll the first lane placed as follows:
  - 1. Transverse joints
  - 2. Outside edge
  - 3. Initial or breakdown rolling, beginning on the low side and progressing toward the high side
  - 4. Second rolling, same procedure as 3
  - 5. Finish rolling
- E. When paving in echelon, or abutting a previously placed lane, perform the longitudinal joint rolling the same as transverse joint rolling.

- F. When paving in echelon, leave 2 or 3 - inches of the edge unrolled, which the second paver can match unrolled. Then the joint between the lanes can be rolled together. Do not leave edges exposed more than 15 minutes without being rolled.
- G. In laying a surface mix adjacent to any finished area, place it high enough so that, when compacted, the finished surface is true and uniform. **(TP-1)**
- H. On slight grades, check gutters with a straightedge and test with running water to assure drainage to the planned outlet.
- I. The average mat density shall meet the minimum compaction requirements established in **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- J. **Technical Provisions**
  - 1. For laying of mix next to adjacent finished areas as specified in part G of this subsection, assure that finished compacted plant mix asphalt material is 1/4 – inch above the lip-of-gutter, and/or valley gutters, and shall be flush with the surface of the existing asphalt surface. **(PRSP-SID\_MOD)**

**32.3.18**     **BREAKDOWN ROLLING**

- A. Immediately begin breakdown rolling following the rolling of the longitudinal joint and edges. Operate rollers as close to the paver as required to obtain density without causing undue displacement.
- B. Operate the breakdown roller with the drive roll or wheel nearest the finishing machine. The Engineer may make exceptions when working on steep slopes or super-elevated curves.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.19**     **SECOND ROLLING**

- A. Assure the second rolling follows the breakdown rolling as close as possible while the paving mix is still at a temperature that will provide the specified density.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.20**     **FINISH ROLLING**

- A. Perform the finish rolling while the material is still warm enough to remove roll marks. If necessary, the Engineer may require using pneumatic-tired rollers. Complete finish rolling the same day the mixture is placed.
- B. In places inaccessible to standard rollers, perform compaction using trench rollers or others to meet the specified compaction requirements. Operate the trench roller as directed until the course is compacted.
- C. Hand, manual or mechanical tamping, may be used in such areas if it is proved to the Engineer that the operation will provide the specified density.
- D. **Technical Provisions**
  - 1. Reserved

**32.3.21**     **TRANSVERSE JOINTS**

- A. Construct and compact transverse joints to provide a smooth riding surface. Joints will be straight edged and string lined to assure smoothness and true alignment.
- B. Joint formed with bulkheads to provide a straight line and vertical face will be checked with a straightedge before fresh material is placed against it to complete the joint. If bulkheads are not used to form the joint and the roller is permitted to roll over the edge of the new material, locate the joint line in back of the rounded edge the distance required to provide a true surface and cross-

section. If a joint has been distorted by traffic or by other causes, trim it to line. Paint the joint face with a thin coating of asphalt before the fresh material is placed against it.

- C. Place the material against the joints vertical face with the paving machine positioned so that the material overlaps the edge of the joint 1 to 2 - inches. Maintain a uniform depth of the overlapped material . Remove and dispose of the coarse aggregate in the overlapped material that dislodged during raking.
- D. Position rollers on the previously compacted material transversely so that no more than 6 - inches of the rolling wheel rides on the edge of the joint. Operate the roller to pinch and press the mix into place at the transverse joint. Continue rolling along this line, shifting position gradually across the joint, in 6 to 8-inch increments, until the joint has been rolled by entire width of the roller wheel.
- E. Keep the number of transverse joints to a minimum. When paving single width and maintaining traffic, pave one lane no farther than one block. Complete all lanes to the same station at the end of each paving day. When paving in echelon, bring the lanes up even as is practical.
- F. **Technical Provisions**
  - 1. Reserved

**32.3.22**     **LONGITUDINAL JOINTS**

- A. Roll longitudinal joints directly behind the paving operation. Assure the first lane placed is true to line and grade and has a vertical face. Place the material in the lane being paved up firmly against the face of the previously placed lane. Position the paver during spreading to assure the material overlaps the edge of the lane previously placed by 1 to 2 - inches. Uniformly maintain the width and depth of the overlapped material at all times. Keep the paver aligned with the line or markings placed along the joint for alignment purposes. Before rolling, remove and dispose of the coarse aggregate in the material overlapping the joint.
- B. Shift rollers onto the previously placed lane so that not more than 6 - inches of the roller wheel rides on the edge of the fine material left by brooming. Operate the rollers to compact the fines gradually across the joint. Continue rolling until a compacted, neat joint is obtained. When the abutting lane is not placed in the same day, paint the joint with a very thin coating of asphalt before placing the abutting lane. If the joint is distorted during the day's work by traffic or by other causes, carefully trim the edge of the lane to a neat line.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.23**     **EDGES**

- A. Roll the pavement edges concurrently with or immediately after rolling the longitudinal joint.
- B. Exercise care in consolidating the course along the entire length of the edges. In rolling pavement edges, extend the roller wheels 2 to 4 – inches beyond the pavement edge.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.24**     **SHOULDERS**

- A. Where paved shoulders or curbs are not specified, do not place the shoulder material against the pavement edges until the surface course rolling is completed. Take care to prevent distortion of the pavement edge from specified line and grade. When shoulders are paved (except in conjunction with the traveled way paving), cold joint construction procedure is required to assure a tight bond at the joint.
- B. When the rolling of the surface course has been completed and the edges have been thoroughly compacted, immediately place shoulder material against the edges and roll it.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.25**    **SURFACE TOLERANCES**

- A.    Produce a final surface that is uniform in texture and meets the line and grade specified. Before final acceptance of the Project or during the progress of the work, the Engineer will determine the thickness of all courses. Repair or replace all unsatisfactory work.
- B.    During compaction, preliminary tests to aid in controlling the thickness, may be performed by inserting a flat blade, correctly graduated, through the material to the top of the previously placed base, or by other approved methods.
- C.    For testing the surface on all courses, a 10 - foot straightedge will be used with the centerline of the straightedge placed parallel to the roadway centerline.
- D.    Any variations that exceed 5/16 - inch in 10 - feet for base course and 1/4 - inch in 10 - feet for surface course must be corrected.
- E.    Correct irregularities that may develop before the completion of rolling by loosening the surface mix and removing or adding materials as is required. If any irregularities or defects remain after the final compaction; such as alligator cracking, block cracking, edge cracking, rough or uneven joints, potholes, trench settlement, raveling, segregation, heaving, sinking, separation from curb and gutter, ponding, and settlement along curb and gutter, approaches, or valley gutters, remove the surface course and place and compact new material to a true and even surface. All minor surface projections, joints and minor honeycombed surfaces must be rolled smooth to grade, as directed.
- F.    Remove and replace areas of new pavement requiring patching as directed. Patching material will be tested for meeting Specifications. The cost of testing replacement asphalt is at Contractor expense.
- G.    **Technical Provisions**
  - 1.    Reserved

**END OF SECTION**

---

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes work for the construction of concrete sidewalk and driveway approaches, curb turn fillets, valley gutters, new street monuments, and all other miscellaneous new concrete construction complete in place.
- B. The construction of the items described above may be in reference to Flatwork Concrete included within this Specification.

**32.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - ACI American Concrete Institute

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 45 16</b>	<b>FIELD QUALITY CONTROL PROCEDURES</b>
<b>SECTION 03 00 00</b>	<b>CONCRETE</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 03 20 00</b>	<b>CONCRETE REINFORCING</b>
<b>SECTION 03 39 00</b>	<b>CONCRETE CURING</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 23</b>	<b>AGGREGATE BASE COURSE</b>

**32.1.04 SUBMITTALS**

- A. Shop drawings and product data shall be submitted for concrete, reinforcing bars, expansion material, and other pertinent items in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. Technical Provisions
  - 1. Reserved

**32.1.05 TESTING**

- A. Testing shall include; but not limited to, air content, slump, temperature, and cylinders for strength tests.
- B. Testing shall be performed in accordance with the provisions lined out in **SECTION 01 45 00 QUALITY CONTROL** and **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** of these Specifications.
- C. Technical Provisions
  - 1. Reserved

## **PART 2 PRODUCTS**

### **32.2.01 GENERAL**

- A. Concrete shall be furnished in accordance with the provisions of **SECTION 03 00 00 CONCRETE** of these Specifications.
- B. Gravel base material shall be furnished and installed in accordance with the provisions of **SECTION 32 11 23 AGGREGATE BASE COURSE** of these Specifications, and meeting the gradation requirements for 1 – inch minus material.
- C. Pre-formed Expansion material shall be furnished in accordance with the provisions of **SECTION 03 05 00 COMMON WORK RESULTS FOR CONCRETE** of these Specifications.
- D. Concrete reinforcement as specified in accordance with the provisions of **SECTION 03 20 00 CONCRETE REINFORCING** of these Specifications.
- E. Concrete cure shall be furnished and installed in accordance with the provisions of **SECTION 03 39 00 CONCRETE CURING** of these Specifications.
- F. Refer to Related Work sections for applicable product details if not included herein.
- G. **Technical Provisions**
  - 1. Reserved

## **PART 3 EXECUTION**

### **32.3.01 GENERAL**

- A. Construct sidewalks, driveway approaches, valley gutters, curb returns, either new or replacement, at the locations shown on the Drawings or as directed by the Engineer meeting the specifications included herein.
- B. The use of slip form machines is prohibited for items in this section unless otherwise specified.
- C. **Technical Provisions**
  - 1. Reserved

### **32.3.02 FLATWORK CONCRETE FOUNDATION PREPARATION**

- A. Complete excavation to the lines shown in the Contract Documents.
- B. Place at least 3 - inches of gravel base material and compact it to a firm, even surface under all curb and gutter. This requirement is waived if curb and gutter is installed on a portion of street base course material of 3 - inches or more in thickness. **(TP-1)**
- C. Assure the subgrade or base course for the concrete has a firm and even surface and is compacted accordance with the provisions of **SECTION 01 45 16 FIELD QUALITY CONTROL PROCEDURES** these Specifications.
- D. **Technical Provisions**
  - 1. Gravel base sections as specified in part B of this subsection, shall conform to the thicknesses included on the Drawings. **(PRSP-FV<sub>19</sub>)**

### **32.3.03 FLATWORK CONCRETE FORMS**

- A. Assure forms produce the shape, lines, and dimensions shown on the plans and/or drawings. Assure forms prevent leakage of mortar and maintain position and alignment. Thoroughly clean and oil before placing and do not remove forms until the concrete has hardened sufficiently to prevent damage.
- B. Form radii using flexible or curved metal forms set to fit the specified curvature. Obtain Engineer approval before using wood forms. Radii may be formed by using segments of straight forms if the length of the straight segment does not exceed one-tenth of the length of the radius.

- C. Use 6 - inch forms and 6 - inch pre-formed expansion joint material for concrete 6 - inches in depth.
- D. Place reinforcement as required. Place and hold in position before placing concrete.
  - 1. Refer to **SECTION 03 20 00 CONCRETE REINFORCING** for additional information.
- E. **Technical Provisions**
  - 1. Reserved

**32.3.04**     **FLATWORK CONCRETE PLACEMENT**

- A. Place and compact the subgrade to the specified grade before placing concrete. Dampen the subgrade just before placing the concrete. Spade and tamp the concrete thoroughly into the forms to provide a dense, compacted concrete free of rock pockets. Float, finish, and broom the exposed surfaces. Each placing/finishing crew shall have at least one ACI Flatwork Finishing Technician level or above, on site at all times.
- B. Do not place concrete at a rate that exceeds the finishing operation's ability to meet these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.05**     **STRIPPING FLATWORK CONCRETE FORMS**

- A. Remove forms when the concrete is sufficiently set to prevent chipping or spalling. When forms are removed before the curing period has expired, protect the concrete edges with moist earth or spray edges with curing compound. Clean, oil, and examine all forms for defects before they are used again.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.06**     **FINISHING FLATWORK CONCRETE**

- A. Finish the concrete surface true to the lines and grades shown on the plans. Float the concrete surface using a magnesium float to a smooth and uniform surface. Plastering of the surface is prohibited. Edge all outside edges of the slab and all joints using a 1/4 - inch radius-edging tool. After concrete has hardened sufficiently, give the surface a broom finish. Assure the broom strokes are square across the concrete from edge to edge, overlapping adjacent strokes. Broom without tearing the concrete. Assure the broomed finish produces regular corrugations not exceeding 1/8 - inch in depth.
- B. Do not apply additional surface water. The Engineer may permit adding water, but it must be applied by fog spray only. Use of an evaporation retardant, Confilm, or equal, following the manufacturer's directions is permitted.
  - 1. Refer to **SECTION 03 39 00 CONCRETE CURING** for additional information.
- C. **Technical Provisions**
  - 1. Reserved

**32.3.07**     **JOINTS FOR FLATWORK CONCRETE**

- A. Divide sidewalk into sections using contraction joints formed by a jointing tool or other approved methods. Extend the contraction joints into the concrete for at least one-fourth of its depth and be approximately 1/8 - inch wide.
  - B. Unless otherwise directed, space contraction joints at maximum 10 - foot intervals or at a distance equal to the sidewalk width, whichever is less.
  - C. In continuous sidewalk runs, install isolation joints at the location of a regular contraction joint if the distance between isolation joints does not exceed 300 - feet. **(TP-1)**
  - D. Place isolation joints at radius points, junctions with existing concrete, and opposite to or at expansion joints in adjacent concrete.
-

- E. Place isolation joints where new concrete abuts existing concrete. Form isolation joints around all appurtenances, such as manholes, utility poles, etc. extending into and through the concrete.
- F. Extend isolation joints the full depth of the concrete.
  - 1. Form expansion joints using 1/2 - inch (12 mm) thick, pre-formed joint filler as specified in **SECTION 03 05 00 COMMON WORK RESULTS FOR CONCRETE** of these Specifications.
- G. Install pre-formed joint filler between concrete and any fixed structure, such as a building or bridge. Assure all expansion joint materials extend the full depth of the concrete.
- H. Form cold joints at unions of consecutive pours as shown on the plans or directed by the Engineer. Assure the cold joint is vertical, the full depth of the concrete, and tooled to a 1/4 - inch radius.
- I. **Technical Provisions**
  - 1. Isolation joints as specified in part C of this subsection, shall be spaced no farther than 100 – feet apart. (PRSP-SID<sub>20</sub>)

**32.3.08**     **FLATWORK CONCRETE BACKFILL**

- A. In areas of existing lawns, use black loam or approved topsoil for the top 4 - inches of backfill. Place it out from the edge of concrete flatwork and in the amount required to replace the turf or lawn removed during installation. Place the backfill to a point level with the top of flatwork concrete, and grade and blend to match the existing undisturbed lawn area.
- B. Seeding shall then be furnished in accordance with the provisions of **SECTION 32 92 19 SEEDING** of these provisions.
- C. Where lawns do not exist, place the top 4 - inches of backfill using impervious dirt and conforming to the typical sections shown on the plans.
- D. Compact backfill to prevent settlement and level the surface to be free draining.
- E. **Technical Provisions**
  - 1. Reserved

**32.3.09**     **TOLERANCES**

- A. Assure all items of construction covered by this section present clean, uniform surfaces and lines free of irregularities and distortions. Plane surfaces and vertical tangent lines are tested with a 10-foot straightedge and cannot deviate more than 1/4 - inch.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.10**     **MISCELLANEOUS FLATWORK CONCRETE CONSTRUCTION**

- A. Construct new street monuments, new street light bases, and other miscellaneous concrete construction in accordance with detail drawings.
- B. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes ground surface preparation and topsoiling and furnishing and applying fertilizer and soil correcting agents in areas described in the Contract Documents or directed by the Engineer.

**32.1.02 REFERENCES**

- A. This section reserved.

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 92 19</b>	<b>SEEDING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**32.1.04 SUBMITTALS**

- A. Product data shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. **Technical Provisions**
1. Reserved

**32.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**32.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
1. Reserved

**32.2.02 TOPSOIL**

- A. Use topsoil that is loose, friable, loamy soil, free of excess acid and alkali. Assure topsoil does not contain objectionable amounts of sod, hard lumps, gravel, sub-soil or other undesirable material that would form a poor seedbed.
- B. Before stripping topsoil, assure it has supported the growth of healthy crops, grass or other vegetable growth.
- C. **Technical Provisions**
1. This subsection applies to imported "black dirt" as approved by Engineer, or other approved material, required for disturbed areas to be seeded as included herein. **(PRSP-FV<sub>19</sub>)**

**32.2.03 LIME**

- A. Lime shall be used for correcting low pH soils.

- B. Furnish ground limestone or other material deemed suitable by the Engineer containing a minimum 85% of total carbonate equivalent ground so that 90% will pass through a No. 100 mesh sieve.
- C. Coarser material may be acceptable, if the application rates are increased to provide at least the minimum quantities and depth specified using an approved Dolomitic lime or a high magnesium lime containing at least 10% magnesium oxide.
- D. **Technical Provisions**
  - 1. Reserved

**32.2.04 FERTILIZER**

- A. Furnish standard commercial fertilizers supplied separately or in mixtures containing the specified percentages of total nitrogen, available phosphoric acid, and water-soluble potash.
- B. Furnish fertilizer in standard containers clearly labeled with name, weight, and guaranteed analysis of contents.
- C. Apply fertilizer at the specified rate and depth meeting the applicable State and Federal laws.
- D. No cyanamide compounds of hydrated lime are permitted in mixed fertilizers.
- E. Fertilizers may be supplied in one of the following forms:
  - 1. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
  - 2. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
  - 3. A granular or pellet form suitable for application by blower equipment.
- F. **Technical Provisions**
  - 1. Reserved

**PART 3 EXECUTION**

**32.3.01 GENERAL**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. Reserved

**32.3.02 SUBSOIL PREPARATION**

- A. The area to which these Specifications apply and on which topsoil is to be placed shall be as indicated on the drawings or as otherwise specified.
- B. Grades on the areas to be topsoiled, which have been previously established in conformance with the drawings and/or other applicable specifications, shall be maintained in a true and even grade.
- C. If required, the subsoil shall be corrected for low and high pH as applicable;
  - 1. Low pH correction: Where the subsoil is highly acid, it shall be tested by a reputable laboratory and a pH correction material shall be spread at a rate sufficient to correct the pH to a range of 6.0 to 7.0. The material shall be distributed uniformly over the designated area(s) and worked into the soil in conjunction with an expanded tillage operation as described in Paragraph E below.
  - 2. High pH correction: Saline and alkali soils may be found in arid and semiarid regions and in areas near sea water. In many of these areas the salts can be leached, but other soils will require special amendments or management. In areas where these soil characteristics may occur, subsoil samples shall be tested by a reputable laboratory and subsequent recommendations, to include a possible delay in topsoil addition, shall be followed.
- D. After the area to be topsoiled have been brought to grade, compacted where necessary and immediately prior to the dumping and spreading of topsoil, the subgrade shall be loosened by

disking or by scarifying to a depth of at least 2 - inches to permit bonding of the topsoil to the subsoil.

E. **Technical Provisions**

1. Reserved

**32.3.03 PLACING TOPSOIL**

- A. Contractor may choose to reuse stockpiled topsoil or supply import topsoil, both approved by the Engineer prior to placement.
- B. Locations with irrigation systems shall be furnished with 3 – inches of topsoil, after firming, uniformly distributed on the designated areas. **(TP-2)**
- C. Locations absent an irrigation system shall be furnished with 6 – inches of topsoil, after firming, uniformly distributed on the designated areas. **(TP-2)**
- D. Import topsoil if sufficient topsoil is not available from excavated areas of the project. **(TP-1)**
- E. Spreading shall be performed in such a manner that seeding or sod installation can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent the formation of depressions or water pockets.
- F. Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or proposed for turfgrass sod installation.

G. **Technical Provisions**

1. **Place a minimum of 3 - inches of topsoil in all areas to be seeded, regardless of location. Contractor shall import the topsoil as necessary to maintain a minimum 3 – inches of topsoil replaced. (PRSP-MPW)**

**32.3.04 PLACING FERTILIZER**

- A. Fertilizer shall be uniformly incorporated into the top 4 – inches of the topsoil by disking, harrowing, or other approved methods.
  1. Assure fertilizer does not come into direct contact with sod roots if being installed.
- B. Apply fertilizer at the rate described in the Contract Documents.
- C. **Technical Provisions**
  1. Reserved

**32.3.05 PLACING PH CORRECTIONS**

- A. PH corrective agents shall be uniformly incorporated into the top 4 – inches of the topsoil by disking, harrowing, or other approved methods.
  1. Assure correcting agents does not come into direct contact with sod roots if being installed.
- B. Apply pH correcting agents at the rate described in the Contract Documents.
- C. **Technical Provisions**
  1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes and furnishing and planting seed in areas described in the Contract Documents or directed by the Engineer.

**32.1.02 REFERENCES**

- A. This section reserved.

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 92 19.16</b>	<b>HYDRAULIC SEEDING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**32.1.04 SUBMITTALS**

- A. Submit to the Engineer applicable seed mixture certifications. Furnish duplicate signed copies of the vendors statement certifying that each seed lot has been tested by a recognized seed testing laboratory within 6 months of date of delivery.
1. Assure the statement includes:
- a. Name and address of laboratory, date of test, lot number for each seed species and the test results including name, percentages of purity and of germination, percentage of weed content for each kind of seed furnished and, for seed mixes, the proportions of each kind of seed.
- B. Product data shall be submitted for applicable seed mixes in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
1. Reserved

**32.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**32.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
1. Reserved

**32.2.02 SEED**

- A. Furnish seed and seed mixture, as provided herein, free of all prohibited noxious weed seed or any other weed seed prohibited by state or local ordinance.

- B. Seal and label all seed containers to comply with Montana Seed Law and Regulations or meeting U.S. Department of Agriculture and Regulations under the Federal Seed Act, if shipped in interstate commerce.
- C. Do not use wet, moldy, or otherwise damaged seed in the work.
- D. Furnish seed mixture of the species described in the Contract Documents. Furnish seed in standard containers labeled with the seed name, lot number, net weight, percentages of purity, germination, hard seed, and percentage of maximum weed seed content for each seed species.

E. **Technical Provisions**

- 1. Seed mix for dry sites shall be a native seed blend as follows; **(MSP)**

a. Grass Species	%PLS Count	lbs./acre
Streambank Wheatgrass	40%	Drilled Rate
Western Wheatgrass	20%	(8 lbs./acre)
Sheep Fescue	15% - 20%	Broadcast Rate
Blue Grama	15% - 20%	(16 lbs./acre)
-others-	+/- 10%	Hydroseed Rate (16 lbs./acre)

- 2. Seed mix for irrigated sites shall be a seed blend as follows; **(MSP)**

a. Grass Species	%PLS Count	lbs./acre
Kentucky Bluegrass	40%	Drilled Rate
Perennial Ryegrass	40%	(10 lbs./acre)
Turfe Type Fescue	10% - 20%	Broadcast Rate
-others-	+/- 10%	(20 lbs./ acre) Hydroseed Rate (20 lbs./acre)

**PART 3 EXECUTION**

**32.3.01 GENERAL**

- A. Subgrade and topsoil shall be prepped and placed in accordance with **SECTION 32 92 13 SOIL PREPARATION** of these Specifications. **(TP-1)**
- B. **Technical Provisions**
  - 1. Contractor shall install erosion control blankets over all disturbed areas as a result of the project. **(MSP)**

**32.3.02 ALLOWABLE SEEDING MONTHS**

- A. Perform seeding when the temperature and moisture are favorable to germination and plant growth.
- B. Seed preferably before June 1st and after October 1st of each year. Seeding dates must be approved by the Engineer. **(TP-1)**
- C. **Technical Provisions**
  - 1. Dates for seeding as specified in part B of this subsection, shall occur before the end of May, or after the beginning of September. **(SID\_OFF)**

**32.3.03 SEED SOWING**

- A. Assure the prepared seedbed surface is firm enough to prevent seed loss from high winds or normal rainfall. If rolling is required, perform rolling before seeding using a suitable roller, of a weight appropriate to the soil conditions.
- B. Sow seed in the areas described in the Contract Documents at the specified application rates.
- C. Sow seed using a force feed drill having a grass seed attachment, except of slopes steeper than three to one or on areas too small to be seeded with a force feed drill. In these areas, seed may be sown by power sprayers, blowers or other effective methods. Use equipment in good working order.
- D. Seed at a depth of one-quarter inch or less and cultipack the seed.
- E. Do not sow seed in winds that prevent proper embedment into the surface.

**F. Technical Provisions**

- 1. Reserved

**32.3.04 CARE OF SEEDED AREAS**

- A. Protect all seeded areas from traffic or pedestrian use with warning barricades or other Engineer approved methods.
- B. Prevent weeds and other undesirable vegetation from establishing in the seeded area. Replace any seeded areas failing to germinate which have died or been damaged by construction activities. Replace such areas to meet the contract requirements. The contract warranty period applies to this item.

**C. Technical Provisions**

- 1. Contractor shall install erosion control mat, as approved by Engineer, after seed application. Straw type blankets are not approved. See the following for specifications; **(MSP)**
  - a. Mat characteristics shall be per the following:
    - i. 100% coconut fiber matrix in biodegradable double polypropylene netting (with up to 36-month net life), sewn together on 1½" centers.
    - ii. Minimum mat weight of 0.50 lb/sy.
    - iii. Maximum permissible shear stress of 2.25 lb/sf.
    - iv. Minimum mat thickness of 0.26".
    - v. Meeting requirements established in FHWA FP-03 as a Type 4 erosion control blanket for use on slopes not exceeding 1:1.
    - vi. Minimum mat overall dimensions of 8' wide by 100' long; larger mat rolls are allowed.
    - vii. Minimum mat water absorption of 230% by ASTM D1117.
    - viii. Minimum tensile strength of 19.9 lb/in in main direction and 14.3 lb/in in transverse direction, per ASTM D6818.
    - ix. Seed germination improvement of 415% minimum, per ASTM D7322.
  - b. Erosion mat installation shall be exactly per mat manufacturer's recommendations, including specialized methods for steeply sloped areas. Mat installation shall use a combination of (upslope) anchor trenches, mat overlaps, and stapling per manufacturer's requirements.
    - i. Erosion mat staples shall be 8" long, round-top, preformed steel of 13 ga. minimum.
  - c. Erosion Mat Manufacturer's Reference: Erosion mat shall be model C32BD blanket as manufactured by ECB/Verdyol (Riverton, Manitoba); or AEC Premier Coconut blanket as

manufactured by American Excelsior Company (Arlington, Texas); or equal, subject to requirements for Submittal review.

**END OF SECTION**

**PART 1 GENERAL**

**32.1.01 DESCRIPTION**

- A. This Specification includes the hydraulic seeding of the areas shown on the Contract Documents or as directed by the Engineer. Hydraulic seeding is typically employed for slopes steeper than 3:1 (horizontal to vertical) or when the seedbed surface is impractical to drill seed.

**32.1.02 REFERENCES**

- A. This section reserved.

**32.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications:

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 92 19</b>	<b>SEEDING</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

**32.1.04 SUBMITTALS**

- A. Required submittals shall be as proved in accordance with the provisions of **SECTION 32 92 19 SEEDING** of these Specifications.
- B. Product data shall be submitted for applicable seed mix, fertilizers and mulch, in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
1. Reserved

**32.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**32.2.01 GENERAL**

- A. Products shall be furnished in accordance with the provisions of **SECTION 32 92 19 SEEDING** of these Specifications.
- B. **Technical Provisions**
1. Reserved

**PART 3 EXECUTION**

**32.3.01 GENERAL**

- A. Topsoil shall be furnished and installed in accordance with the provisions of **SECTION 32 92 19 SEEDING** of these Specifications.
- B. **Technical Provisions**
1. Reserved

**32.3.02**    **APPLICATION RATES**

- A.    Apply seed mixture to the areas described in the Contract Documents at the specified application rates.
- B.    **Technical Provisions**
  - 1.    Reserved

**32.3.03**    **MAINTENANCE RESPONSIBILITIES**

- A.    Maintain and protect newly seeded areas until the grass is established and accepted by the Engineer. During this period, repair damaged areas and reseed areas where complete establishment has not occurred.
- B.    **Technical Provisions**
  - 1.    Reserved

**END OF SECTION**

# MFWP – MAKOSHIKA WATERLINE EXTENSION

## GLENDIVE, MONTANA

### DIVISION 33 UTILITIES

### TABLE OF CONTENTS

#### DIVISION 33 – UTILITIES

SECTION	DOCUMENT
33 01 12 .....	Inspecting and Testing of Water Utilities
33 05 00 .....	Common Work Results for Utilities
33 05 07.13 .....	Utility Directional Drilling
33 05 33 .....	Polyethylene Utility Piping
33 05 33.23 .....	Polyethylene Pressure Pipe and Tubing
33 05 97.26 .....	Utility Detectable Markings
33 14 13 .....	Public Water Utility Distribution Piping
33 14 17 .....	Site Water Utility Service Laterals
33 14 19 .....	Valves and Hydrants for Water Utility Service
33 14 43 .....	Packaged Pumping Systems for Water Utility Service

## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes the testing, cleaning, and disinfecting of water utility piping, valves, fittings, and all work included thereto as shown on the Drawings and specified herein.
- B. References made to ASTM, ANSI, NSF AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material included herein shall conform to these standards where such standards exist.

### **33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - AWWA B300 Hypochlorite for Disinfecting
  - AWWA B301 Liquid Chlorine for Disinfecting
  - AWWA C600 Installation of Ductile-Iron Mains and Their Appurtenances
  - AWWA C651 Disinfecting Water Mains

### **33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections these Specifications.

<b>SECTION 01 21 16</b>	<b>CONTINGENCY ALLOWANCES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 14 13</b>	<b>PUBLIC WATER UTILITY DISTRIBUTION PIPING</b>
<b>SECTION 33 14 17</b>	<b>SITE WATER UTILITY SERVICE LATERALS</b>
<b>SECTION 33 14 19</b>	<b>VALVES AND HYDRANTS FOR WATER SERVICE UTILITY</b>

### **33.1.04 SUBMITTALS**

- A. Submittals shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- B. Contractor shall submit a testing schedule and sequence plan with sufficient detail to verify conformance with the applicable testing standards.
- C. The submittal shall include as a minimum the following information as applicable:
  - 1. Chlorine product data
  - 2. Location of blow off, testing, and sampling ports
  - 3. Flushing, pressure testing, chlorinating, and sampling sequence and zones
  - 4. Additional information may be required by the Engineer.
- D. Technical Provisions
  - 1. Reserved

## **PART 2 PRODUCTS**

### **33.2.01 LIQUID CHLORINE**

- A. Liquid chlorine shall contain 100 percent available chlorine under pressure in steel containers.
- B. Liquid chlorine shall meet AWWA B301 and NSF 61 requirements and use only in combination with appropriate gas-flow chlorinators and ejectors.

C. **Technical Provisions**

1. Reserved

**33.2.02 SODIUM HYPOCHLORITE**

A. This section reserved.

B. **Technical Provisions**

1. Sodium hypochlorite as specified in this subsection shall not be accepted as an allowable form of chlorine. (PRSP-SID\_MOD)

**33.2.03 CALCIUM HYPOCHLORITE**

A. This section reserved.

B. **Technical Provisions**

1. Calcium hypochlorite as specified in this subsection shall not be accepted as an allowable form of chlorine. (PRSP-SID\_MOD)

**PART 3 EXECUTION**

**33.3.01 GENERAL**

A. Testing, Cleaning and Disinfecting shall be performed as specified herein for **SECTION 33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING, SECTION 33 14 17 SITE WATER UTILITY SERVICE LATERALS** and **SECTION 33 14 19 VALVES AND HYDRANTS FOR WATER UTILITY SERVICE**, and where specified within these Specifications.

B. Costs of said testing shall be borne by the Contractor as specified in **SECTION 01 45 00 QUALITY CONTROL**.

C. Contractor is reminded that State permits may be required for de-chlorination and discharge of chlorinated disinfection water.

D. **Technical Provisions**

1. Following completion of all tests, remove corporation stops used for testing purposes, install brass plugs, and assure plugs do not leak after main has been charged. The Engineer must witness this work. (PRSP-SID\_MOD)
2. City water will be provided by opening the valves for testing purposes. (MSP)

**33.3.02 WATER SERVICE TESTING**

A. Water service lines and appurtenances shall be tested in a manner acceptable to the Engineer.

B. When specified on the Drawings, new curb stops shall be installed prior to pressure testing of new water mains.

C. **Technical Provisions**

1. All service connections/couplings shall be visually checked for leaks at standard operating pressure for no less than 15 minutes, unless otherwise approved. (SID\_OFF)

**33.3.03 HYDROSTATIC AND LEAKAGE TESTING FOR PRESSURE PIPE**

A. Perform hydrostatic and leakage testing in accordance with AWWA C600. Once the pipe is laid and backfilled, test for at least 2 hours, all newly laid pipe, or any valved section, to a hydrostatic pressure of at least 1.5 times the normal operating pressure at the test point or 1.25 times the normal operating pressure at the highest point along the test section. (TP-1)

B. Conduct the pressure and leakage tests with the Engineer present.

C. Slowly fill the pipe with water, purging all air, and apply the test pressure using a pump hooked up so that the pressure and leakage can be measured. To purge the pipe of air during the test, it is necessary to tap the pipe at its highest points if permanent air vents, water services, hydrants, etc.

are not located at the high points. Use corporation stops for this purpose. Furnish the pump connections, gauges, stops, and all necessary apparatus for testing.

- D. Disassemble and reassemble all joints showing leakage after thorough cleaning. Remove and replace all cracked or defective pipes or fittings discovered in during the pressure test with sound material and repeat the test.
- E. Conduct the leakage test concurrently with the pressure test for 2 hours. Leakage is defined as the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 PSI of the pressure test after the pipe has been filled with water and purged of air. **(TP-2)**
- F. The pipe installation will be rejected if the leakage exceeds that determined by the following formula:

$$L = \frac{S \times D \times \sqrt{P}}{148,000}$$

- 1. In which L equals the allowable leakage in gallons per hour;
  - 2. S is the length of pipe tested, in feet;
  - 3. D is the nominal diameter of the pipe, in inches;
  - 4. P is the average test pressure during the leakage test, in pounds per square inch gauge.
- G. Should any test of pipe laid disclose leakage exceeding that specified above, locate and repair the defective joints until the leakage is within the specified allowance.
  - H. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size is allowed. Repair all visible leaks regardless of the amount of leakage.
  - I. Pressure test tapping sleeves after installation and before tapping.

J. **Technical Provisions**

- 1. Hydrostatic leak testing as specified in part A of this subsection, shall be hydrostatic tested to at least 2 times the normal operating pressure at the test point or 150 psig, whichever is less. **(PRSP-SID\_MOD)**
- 2. Leakage as defined in part E of this subsection, shall be restated to and defined as follows. Leakage is defined as (1) the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 PSI of the specified test pressure (after the pipe has been filled with water and purged of air) for the duration of the 2 hour test period, and (2) the quantity of water supplied into the pipe, or any valved section thereof, required to return the pressure to the specified test pressure at the end of the 2 hour test period. **(PRSP-SID\_MOD)**

**33.3.04 CLEANING WATER MAINS**

- A. Before chlorination, flush the mains thoroughly after the pressure and leakage test are completed.
- B. It is understood that such flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying. Use a minimum flushing velocity in the main of 2.5 feet per second. If no hydrant is installed at the end of the main, provide a tap of the size to produce a velocity in the main of at least 2.5 feet per second. Table 1 shows the rates of flow required to produce a velocity of 2.5 feet per second in various size pipes.

**TABLE 1**  
**REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES<sup>1/</sup>**  
(40 psi (276 kPa) Residual Pressure in Water Main)

Pipe Diam. Inches (cm)	Flow Required To Produce 2.5 fps (approx.) Velocity in Main, gpm (epm)	Size of Tap (inch)(mm)		Hydrant Outlet	
		1(25)1-1/2(38)2(51) number of taps on pipe <sup>2/</sup>		Number	Size in. (mm)
4 (10)	100 (380)	1		1	2-1/2 (63)
6 (15)	200 (760)	1		1	2-1/2 (63)
8 (20)	400 (1510)	2	1	1	2-1/2 (63)
10 (25)	600 (2270)	3	2	1	2-1/2 (63)
12 (30)	900 (3400)			2	2-1/2 (63)
16 (41)	1600 (6060)			2	2-1/2 (63)

1. With a 40 psi (267 kPa) pressure in the main with the hydrant flowing to atmosphere, a 2-1/2-inch (63mm) hydrant outlet will discharge approximately 1000 gpm(3786 epm) and a 4-1/2-inch (114mm) hydrant nozzle will discharge approximately 2500 gpm (9463 epm).
2. Number of taps on pipe based on discharge through 5 feet (1.5 meters)of galvanized iron (GI) pipe with one 90 • elbow.

- C. Exercise extreme care and conduct a thorough inspection during the water main laying to prevent and detect small stones, pieces of concrete, particles of material, or other foreign material that may have entered the mains. To remove this material, flush and inspect all hydrants on the lines to assure that the entire valve operating mechanism of each hydrant is in good condition.
- D. In 24-inch (61 cm) or larger diameter mains, in addition to flushing, broom-sweep the main, removing all sweepings before chlorinating the main.

**E. Technical Provisions**

1. Prior to any main flushing, the Engineer and the City of Glendive Public Works Office shall be notified and provided with a flushing schedule and plan a minimum of 24 hours in advance of any main flushing. **(PRSP-SID\_MOD)**
2. Any existing water main valves which are used to take water from the City of Glendive distribution system for the purpose of filling, testing, chlorination or flushing, shall be operated by the City of Glendive Water Department personnel, and only with the Contractor requesting such operation at least 24 hours in advance. All existing water main valves, connected to the system, are to be operated only by City of Glendive Water Department personnel. **(PRSP-SID\_MOD)**
3. Install an adequately-sized corporation stop on all main stubs longer than 10 feet to allow for the flushing of the stubs. **(PRSP-SID\_MOD)**
4. The City of Glendive will provide water for the cleaning of the new water mains. **(MSP)**

**33.3.05 DISINFECTING WATER MAINS**

- A. Disinfect the water mains subject to the Engineer’s approval in accordance with AWWA C651, “Disinfecting Water Mains”, and these Specifications, before placing the main in service.
- B. Keep the interior of all pipe, fittings and appurtenances free from dirt, heavy and foreign particles.

**C. Technical Provisions**

1. Reserved

**33.3.06 METHODS OF CHLORINATION**

- A. Three (3) methods of chlorination may be used. The tablet method gives an average chlorine dose of approximately 25 ppm; the continuous feed method gives a 24 hour chlorine residual of not less than 10 ppm; and the slug method provides a three hour exposure of not less than 50 ppm free chlorine.

1. Tablet Method **(TP-2)**

- a. This method may be used if the pipes and appurtenances are kept clean and dry during construction.
- b. During construction, place calcium hypochlorite granules at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-foot intervals. Use the quantity of granules shown in Table 2.
- c. Warning: Do not use this procedure on solvent welded plastic or on screwed joint steel pipe because of fire or explosion hazard from the reaction of the joint compounds with the calcium hypochlorite.

**TABLE 2**  
**OUNCES OF CALCIUM HYPOCHLORITE GRANULES TO BE PLACED AT**  
**BEGINNING OF MAIN AND AT EACH 500-FOOT (150 METER) INTERVAL**

Pipe Diameter		Calcium Hypochlorite Granules
Inches	(cm)	oz
4	(10)	0.5
6	(15)	1.0
8	(20)	2.0
12	(30)	4.0
16 and larger	(41)	8.0

- d. During construction, place 5g calcium hypochlorite tablets in each section of pipe and also place one tablet in each hydrant, hydrant branch and other appurtenance. Use the number of 5g tablets for each pipe section required to provide a minimum chlorine concentration of 25 ppm. The Calculating Quantities of Chlorine for Disinfecting Water Mains subsection of this Specification provides information on the number of 5g tablets for each pipe section required to provide a minimum chlorine concentration. Attach tablets to the inside of the pipe using an adhesive such as Permatex No.1 or equal. Assure no adhesive is on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets at the inside top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, mark their position on the section so it can be readily determined that the pipe is installed with the tablets at the top.
  - e. When installation has been completed, fill the main with water at a velocity not exceeding 1 fps (0.3 mps). Take precautions to assure that air pockets are eliminated. Leave this water in the pipe for at least 24 hours. If the water temperature is less than 41° F (5°C), leave the water in the pipe for at least 48 hours. Position valves so that the chlorine solution in the main being treated will not flow into water mains in active service.
2. Continuous Feed Method **(TP-1) (TP-4)**
- a. Before chlorinating, fill the main with water to eliminate air pockets and flush as specified above.
  - b. Use water from the existing distribution system or other approved source of supply to flow at a constant, measured rate into the newly laid water main. At a point not more than 10 feet (3 meters) downstream from the beginning of the new main, assure water entering the new main receives chlorine fed at a minimum 25 ppm free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals. **(TP-3)**
  - c. The Calculating Quantities of Chlorine for Disinfecting Water Mains subsection of this Specification provides information on the approximate amounts of chlorine compound required for various pipe sizes.
  - d. During chlorine application, position valves so that the chlorine solution in the main being treated does not flow into water mains in active service. Do not stop chlorine application until the entire main is filled with chlorinated water. Retain the chlorinated

water in the main for at least 24 hours, operating all valves and hydrants in the section treated to disinfect the appurtenances. At the end of the 24 hour period, the treated water in all portions of the main must have a minimum free chlorine residual of 10 ppm free chlorine.

- e. The preferred equipment for applying liquid chlorine is a solution feed vacuum operated chlorinator to mix the chlorine gas in solution water, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. It is recommended that direct feed chlorinators not be used. Hypochlorite solutions may be applied to the water main with a chemical feed pump designed for feeding chlorine solutions.
  - f. If approved, an optional continuous feed method utilizing calcium hypochlorite granules may be used. Place the granules in the pipe sections as specified under the Tablet Method.
3. Slug Method **(TP-2)**
- a. Before chlorinating, preliminary flush the main as specified herein.
  - b. Use water from the existing distribution system or other approved source of supply to flow at a constant measured rate into the newly laid water main.
  - c. Not more than 10 feet (3 meters) downstream from the beginning of the new main, add chlorine to the water entering the new main at a constant rate that the water will have a minimum 100 ppm free chlorine. Measure this concentration at regular intervals. Apply the chlorine continuously and for the time required to develop a solid column or “slug” of chlorinated water that will, as it moves through the main, expose all interior surfaces to a 100 ppm for at least 3 hours.
  - d. Measure the free chlorine residual in the slug as it moves through the main. If at any time it drops below 50 ppm stop the flow and relocate the chlorination equipment at the head of the slug, and as flow is resumed, add chlorine to restore the free chlorine in the slug to not less than 100 ppm.
  - e. As the chlorinated water flows past fittings and valves, operate related valves and hydrants to disinfect appurtenances and pipe branches.
4. Final Flushing
- a. After the retention period, flush the chlorinated water from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that in the system, or is acceptable for domestic use.

**B. Technical Provisions**

1. Continuous feed method as specified in part A.2 of this subsection, shall be the only method used. Other methods may be used for specific applications as approved by the Engineer. **(PRSP-SID\_MOD)**
2. Tablet and slug method as specified in parts A.1 and A.3 respectively, of this subsection, shall not be considered an acceptable form of chlorination unless otherwise specified and approved by the Engineer. **(PRSP-SID\_MOD)**
3. The chlorination feed as specified in part A.2.B of this subsection, shall show a dose of chlorine fed at a constant rate such that the water will have at least 50 ppm free chlorine, at a point measured 10 – feet downstream from the beginning of the new water main. **(PRSP-SID\_MOD)**
4. Water main tapping required for continuous feed method as specified in part A.2 of this subsection shall only be performed on PVC pipe material. In lieu of direct tapping HDPE, Contractor may choose to have a prefabricated piece of HDPE pipe furnished and installed

with a saddle fused service saddle having C.C. outlet threads. Direct tapping shall not be performed unless otherwise approved by the Owner/Engineer. (PRSP-SID<sub>19</sub>)

**33.3.07    BACTERIOLOGICAL TESTS**

- A. After final flushing and before the water main is placed in service, two (2) consecutive passing samples taken a minimum 16 – hours apart, shall be collected for every 1200 – feet of main(s) plus an additional sample from the end of the line and at least one set of samples from each branch greater than one pipe length, in accordance with AWWA C651.
- B. Re-disinfection
  - 1. If the initial disinfection fails to produce approved bacteriological, re-flush and resample the main.
  - 2. If check samples show bacterial contamination, re-chlorinate the main until approved results are obtained.
- C. Swabbing
  - 1. Where connections are made to existing piping and the connections are not disinfected along with the newly installed main, swab or spray the interior of all pipe and fittings used in making the connections with a 1 percent hypochlorite solution before installation.
- D. **Technical Provisions**
  - 1. None

**CONTINUED**

**33.3.08    CALCULATING QUANTITIES OF CHLORINE FOR DISINFECTING WATER MAINS**

A.    The amount or weight of chlorine required to disinfect a particular segment of water line is directly related to the volume of water contained in that particular segment of water main.

B.    Volume of Water in Pipe

$$\begin{aligned} \text{Volume of Water (Gallons)} &= \text{Area of Pipe (ft}^2\text{)} \times \text{Length (ft)} \times 7.48 \\ &= \pi \times R^2 \times L \times 7.48 \end{aligned}$$

$$\text{Where: } \pi = 3.1416$$

$$R = \text{Inside Radius of Pipe in Feet}$$

$$L = \text{Length of Pipe to be Disinfected, in Feet}$$

$$7.48 = \text{Gallons per Cubic Foot}$$

C.    Formula to Determine Lbs. of Chlorine Required

$$\text{Lbs. of Chlorine} = \text{ppm} \times \text{MG} \times 8.34$$

$$\text{Where: Lbs. of Chlorine} = 100\% \text{ Effective Chlorine}$$

$$\text{Ppm} = \text{Chlorine Dosage in Parts per Million}$$

$$\text{MG} = \text{Million Gallons of Water}$$

$$8.34 = 8.34 \text{ Lbs. of Water per Gallon}$$

D.    Sample Calculations

1.    Example: 4,500 lineal feet of 8" water main to be disinfected at a chlorine concentration of 25 ppm.

$$\text{Volume of Water} = \pi \times R^2 \times L \times 7.48$$

$$R = 4" = 4/12 \text{ Ft} = 0.333 \text{ Ft}$$

$$L = 4,500 \text{ Ft}$$

$$\text{Volume of Water} = 3.1416 \times (.333)^2 \times 4,500 \times 7.48$$

$$= 11,726 \text{ Gallons}$$

$$= 0.011726 \text{ MG}$$

$$\text{Lbs. of Chlorine} = \text{ppm} \times \text{MG} \times 8.34$$

$$\text{ppm} = 25$$

$$\text{Lbs. of Chlorine} = 25 \times 0.011726 \times 8.34$$

$$= 2.44 \text{ Lbs. of 100\% Effective Chlorine}$$

E.    Using Chlorine Compounds or Solutions Less Than 100% Effective Chlorine

1.    Most dry chlorine compounds or chlorine solutions on the market do not contain 100% effective chlorine. Normally the containers of the compound or solution will state the amount of effective chlorine as a percentage.

2.    Example: Determine how much Clorox (Sodium Hypochlorite) solution is required to provide 2.44 lbs. of 100% effective chlorine- Clorox container is labeled at 5.25% effective chlorine.

$$\text{Effective Chlorine Per Gallon Clorox} = 5.25\% \times 8.34 \text{ lbs./gal.} = 0.44 \text{ Lbs.}$$

$$\text{Gallons of Clorox Required} = 2.44 \text{ lbs} \div 0.44 \text{ lbs./gal.} = 5.55 \text{ gallons Clorox®}$$

**CONTINUED**

F. Chlorine Dosage Table

- Table 1 following presents the chlorine required to produce a 25 ppm concentration in 100 - feet of pipe. Also shown are the gallons required for a solution containing 1 percent effective chlorine.

**TABLE 1**  
**Chlorine Required to Produce 25 mg/L**  
**Concentration in 100 ft. of Pipe -- by Diameter**

Pipe Diameter Inches	100% Effective Chlorine Lbs.	1 Percent Chlorine Solutions Gallons
4	0.013	0.16
6	0.030	0.36
8	0.085	1.02
10	0.120	1.02
12	0.22	1.44
16	0.27	2.60
18	0.34	3.30
20	0.49	4.07
24	0.76	5.87
30	1.10	9.17
36	1.96	13.19
48		23.50

G. Dosage Table for Hypochlorite Tablets

- The number of 5-g tablets required for each pipe section to provide a chlorine dosage of 25 ppm is equal to  $0.0012 \times d^2 \times L$ , where d is the inside pipe diameter in inches and L is the length of the pipe section in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe.

**TABLE 2**  
**Number of 5-g Hypochlorite Tablets**  
**Required for Dose of 25 mg/L<sup>a</sup>**

Pipe Diameter	Length of Pipe Section, ft.				
	13 or Less	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13
18	5	7	8	12	16
20	7	9	10	15	20
24	9	13	14	21	28

<sup>a</sup> Based on 3.25 g available chlorine per tablet. Any portion of tablet rounded to next higher number.

H. **Technical Provisions**

- None

**END OF SECTION**

**PART 1 GENERAL**

**33.1.01 DESCRIPTION**

- A. This Specification includes work common to water, sanitary sewer and storm water utilities and all work included thereto as shown on the Drawings and specified herein.

**33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
- |             |   |
|-------------|---|
| AWWA C105   | Polyethylene Encasement for Ductile-Iron Pipe Systems   |
| AWWA C600   | Installation of Ductile-Iron Mains and Their Appurtenances  |
| AWWA C900   | Polyvinyl Chloride (PVC) Pressure Pipe and Fabrication Fittings, 4 In. Through 60 In.   |
| AASHTO T99  | Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb (2.5kg) Rammer and 12-inch (305mm) Drop              |
| ASTM A536   | Standard Specification for Ductile Iron Castings ASTM C547 Mineral Fiber Pipe Insulation  |
| ASTM C1338  | Test Method for Determining Fungi Resistance of Insulation Materials and Facing   |
| ASTM D698   | Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> or 600 kN-m/m <sup>3</sup> ) |
| ANSI/NSF 61 | Municipal Drinking Water System Components  |
| ASTM F1674  | Standard Test Method for Joint Restraint Products for Use with PVC Pipe   |

**33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 01 55 26</b>	<b>TRAFFIC CONTROL</b>
<b>SECTION 01 74 23</b>	<b>FINAL CLEANING</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 05 23.23</b>	<b>COMPACTION</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILL</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 32 11 23</b>	<b>AGGREGATE BASE COURSE</b>
<b>SECTION 32 92 19</b>	<b>SEEDING</b>
<b>SECTION 33 01 12</b>	<b>INSPECTION AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 07.13</b>	<b>UTILITY DIRECTIONAL DRILLING</b>
<b>SECTION 33 05 97.26</b>	<b>UTILITY DETECTABLE MARKINGS</b>
<b>SECTION 33 14 13</b>	<b>PUBLIC WATER UTILITY DISTRIBUTION PIPING</b>
<b>SECTION 33 14 17</b>	<b>SITE WATER UTILITY SERVICE LATERALS</b>
<b>SECTION 33 14 19</b>	<b>VALVES AND HYDRANTS FOR WATER UTILITY SERVICE</b>

**33.1.04 SUBMITTALS**

- A. Refer to Related Work sections for applicable submittals required in these Contract Documents if not included herein.
- B. Shop drawings and product data shall be submitted for in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. Technical Provisions
1. Reserved

**33.1.05 TESTING**

- A. Refer to Related Work sections for applicable tests required in these Contract Documents if not included herein.
- B. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. **Technical Provisions**
  - 1. Reserved

**33.2.02 POLYETHYLENE ENCASEMENT**

- A. Furnish polyethylene encasement in accordance with AWWA C105, "Polyethylene Encasement for Fray and Ductile Cast – Iron Pipe for Water and other Liquids".
- B. **Technical Provisions**
  - 1. Polyethylene encasement as specified in this subsection shall have the following minimum thickness based on material selected. Linear low-density polyethylene (LLDPE) shall have a minimum film thickness of 8 mils. High density cross-laminated polyethylene (HDCLPE) shall have a minimum film thickness of 4 mils. **(BIL\_OFF)**

**33.2.03 UTILITY INSULATION BOARD (IB)**

- A. Insulation board may be either expanded polystyrene (EPS) or extruded polystyrene (XPS).
- B. If called for on the construction plans or directed by the Engineer, the insulation board shall meet or exceed the following requirements:
  - 1. 25 psi minimum compressive strength, R-4.5/in. minimum insulating factor, and 2.0% maximum water absorption by volume
- C. **Technical Provisions**
  - 1. Reserved

**33.2.04 UTILITY INSULATED CASING (IC)**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. Insulated utility casing will not be required for this project. **(PRSP)**

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. These general construction requirements apply to all water, sanitary sewer and storm water utilities and all work included hereto.
- B. The Contractor shall install pipe and appurtenances following the manufacturer's recommendations and instructions. The Contractor shall provide all tools and equipment required to install each type of pipe used.
- C. The Contractor is responsible for all Contractor furnished material. Replace all defective material or material damaged by handling after delivery by the manufacturer. This includes the furnishing of all materials and labor required to replace installed material discovered damaged or defective before final acceptance of the work, or during the guarantee period.

- D. All materials shall be stored safely to prevent damage. Pipe interiors and other accessories shall be kept free from dirt and foreign matter at all times.
- E. The Contractor shall load and unload delivered pipe, fittings, valves, and accessories in a manner that will prevent damage.
- F. The Contractor shall distribute material to the work site, such that each piece is laid adjacent to its installation point for Contractor inspection prior to installation.
- G. All water must be removed from the trench during installation. A dry trench shall be maintained until the pipe ends are sealed and the trench is backfilled.
- H. Excavation and backfilling of utility trenches shall be in conformance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILLING** of these Specifications.
- I. Installation by horizontal directional drilling shall be in conformance with the provisions of **SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING** of these Specifications.
- J. Cleanup
  - 1. As work progresses, remove debris, excess pipe, and complete to finish grade each portion of the work. Once the work is complete, clear debris and finish the entire site to smooth, uniform slopes presenting a neat and workmanlike appearance. Remove and dispose of all rocks brought to the surface during excavation or backfilling.
  - 2. Before final acceptance cleanup of the site shall be completed in accordance with the provisions of **SECTION 01 74 23 FINAL CLEANING** of these Specifications.
  - 3. Cleanup shall include the removal and disposal of all unsuitable/excess materials.
  - 4. All equipment shall be removed from the site.
  - 5. The site shall be left in a manner so as to present a clean and neat appearance, in an equal or better state prior to construction.
- K. **Technical Provisions**
  - 1. All excess materials shall become the property of the Contractor and shall be removed from the site and disposed of properly, in accordance with any local, state, and federal regulations, and considered incidental to the contract with no additional compensation awarded as such. **(SID\_OFF)**

**33.3.02 CONSTRUCTION LIMITS FOR UTILITIES**

- A. The Contractor shall confine all construction activities to within the MDT, or County/City right-of-way or properties where Owner has acquired an easement. Any damage to adjacent property must be restored to equal or better condition. The Contractor shall not enter for delivery of materials or occupy for any purpose any private property outside the designated easements or MDT or County/City right-of-way without written permission from the Owner, Owner/Tenant of the property, or MDT.
- B. Construction on private property shall be limited to a 20 - foot corridor centered along the center of utility mains/services. All damage to private property must be restored to equal or better condition, as approved by the private property owner and Engineer.
- C. **Technical Provisions**
  - 1. Reserved

**33.3.03 SEPARATIONS**

- A. The following requirements are based on Montana Department of Environmental Quality (MDEQ) standards. In the event field conditions prove that the standard vertical and/or horizontal separations cannot be met, the Contractor shall notify the Engineer prior to proceeding with installation of utilities.

- B. Water mains must be laid at least 10 - feet horizontally and 18 – inches vertically, whether above or below, from any existing or proposed gravity sanitary or storm sewer, force main, septic tank, sewer manhole, or subsoil treatment system.
  - 1. The distance must be measured edge to edge.
- C. If the minimum horizontal separation as described above cannot be obtained, the sewer must be designed and constructed with the following minimum conditions:
  - 1. Sewers must be constructed of slip-on or mechanical joint pipe complying with public water supply design standards and be pressure tested to a minimum of 150 psi to assume water tightness.
  - 2. Sewer services utilizing in-line fittings and extending to the property lines, or beyond, must be installed and tested in the area of the encroachment. Saddles are not acceptable.
- D. Vertical crossings meeting the minimum separation described above must be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.
  - 1. Where a water main crosses under a sewer, adequate structural support must be provided for the sewer to maintain line and grade and to prevent damage to the water and/or sewer main.
- E. If the proper vertical separation as described above cannot be obtained, the water main shall be installed to comply with the following: **(TP-1)**
  - 1. At crossings, one standard length of new pipe must be centered at approximately a 90-degree angle in respect to the existing pipe.
  - 2. Vertical separation at crossings between water and sewer mains must be at least 6 – inches and meet one of the following criteria:
    - a. Option 1: Either the water or sewer main must be encased in a watertight carrier pipe which extends 10 feet on both sides of the crossing.
    - b. Option 2: Sewers must be constructed of slip-on or mechanical joint pipe complying with public water supply design standards and be pressure tested to a minimum of 150 psi to assume water tightness.
      - i. Sewer services utilizing in-line fittings and extending to property lines, or beyond, must be installed and tested within 10 feet of the crossing. Saddles are not acceptable.
    - c. Option 3: Water and sewer main must be encased in a minimum of six inches of flowable fill for a minimum of 10 feet each side of the crossing pipes.
  - 3. If the minimum 6 - inch separation is not viable, the water line must be relocated and vertical separation at crossings between water and sewer mains must be at least 18 inches.
    - a. If the vertical separation is less than 12 – inches the water main shall be lowered via 45° bends at a point 25 – feet from the crossing to achieve the minimum 18” separation, then transition back up to the required depth without the use of bends, unless otherwise approved by Engineer.
    - b. If the vertical separation is greater than 12 – inches the water main shall be lowered via 45° bends at a point 15 – feet from the crossing to achieve the minimum 18 – inch separation then transition back up to the required depth with the use of 45° bends, unless otherwise by Engineer.
    - c. All fittings used shall be mechanical joint and restrained along the entirety of the crossing.
    - d. The water main shall be fully restrained through the extent of the crossing and 42 – feet beyond the location of the outside bend either side of said crossing.

F. **Technical Provisions**

1. Vertical crossings as specified in Part E of this subsection, shall be furnished with non-shrink backfill 3' either side of crossing to minimum 6" above upper utility. **(SID\_OFF)**
  - a. Non-shrink backfill shall be furnished in accordance with the provision of **SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK** of these Specifications. **(SID\_OFF)**

**33.3.04 UTILITY LINE DEPTH OF COVER**

- A. The depth of cover over all utility lines shall at all times be a minimum of 6 1/2 – feet measured from top of pipe to finish grade elevation, unless called out elsewhere in the Drawings or established in the Technical Provision included herein. **(TP-1) (TP-2)**
- B. In the event that minimum cover is not met, insulation board and/or other insulation methods specified shall be installed in accordance with the applicable sections included herein.
- C. **Technical Provisions**
  1. Cover over top of water mains, services, and hydrant leads as specified in part A of this subsection, shall maintain a minimum depth of 7 – feet of cover as measured from the top of pipe to finish grade elevation unless otherwise approved by Engineer. **(SID\_OFF)**
  2. Utility line depth of cover as specified in part A of this subsection shall be called out in the project plans. **(BIL\_OFF)**
  3. Water mains shall have a 5 – foot minimum clearance between the top of the main and the bottom of the culverts at all crossings, unless otherwise approved by Engineer. **(PRSP-MSP)**

**33.3.05 POLYETHYLENE ENCASEMENT**

- A. All ductile iron and gray iron pipe, valves, valve boxes, curb boxes, hydrants, fittings and appurtenances, shall be fully encased in polyethylene film.
  1. The film shall be furnished in tube form for installation on pipe and all pipe-shaped appurtenances such as bends, reducers, off-sets, etc.
  2. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as valves, tees, crosses, etc.
- B. The polyethylene tubing shall be installed on the pipe prior to being lowered into the trench.
  1. Tubing length shall be sufficient to provide a minimum overlap at all joints of one foot or more. After completing the pipe jointing and positioning the overlap material, the overlap shall be secured in place with adhesive tape wrapped circumferentially around the pipe not less than three turns.
- C. After encasement, the circumferential slack in the tubing film shall be folded over at the top of the pipe to provide a snug fit along the barrel of the pipe.
  1. The fold shall be held in place with adhesive tape applied at intervals of approximately three feet along the pipe length.
  2. Any rips, punctures, or other damage to the tubing shall be repaired as they are detected. These repairs shall be made with adhesive tape and overlapping patches cut from sheet or tubing material.
- D. At odd-shaped appurtenances such as gate valves, the tubing shall overlap the joint and be secured with tape, after which the appurtenant piece shall be wrapped with a flat film sheet or split length of tubing by passing the sheet under the appurtenance and bringing it up around the body.
  1. Seams shall be made by bringing the edges together, folding over twice, and taping down. Wherever encasement is terminated, it shall extend for at least two feet beyond the joint area.

- E. Openings in the tubing for branches, service taps, air valves and similar appurtenances shall be made by cutting an X-shaped slit and temporarily folding back the film.
  - 1. After installing the appurtenance, the cut tabs shall be secured with tape and the encasement shall be completed as necessary for an odd-shaped appurtenance.
- F. Polyethylene encasement shall not be installed below a point 6 inches above the drain outlet of hydrants.
  - 1. The foundation material at the base of the hydrant shall be placed against the polyethylene to secure it in place.
- G. **Technical Provisions**
  - 1. Wrapping shall be 1 – layer of polyethylene encasement for all direct bury cast iron or ductile iron pipe and appurtenances having an epoxy coating. **(SID\_OFF)**

**33.3.06**     **UTILITY INSULATION BOARD (IB)**

- A. Insulation board shall be installed as shown on the Drawings. The insulation shall be a minimum of 4 - inches thick and placed around the top and sides of the pipe, unless noted differently on the Drawings. **(TP-2)**
- B. Insulation board shall be installed with a minimum 2 – inches of protective sand bedding placed on all sides of the insulation board, and placed a minimum 6 – inches above the top of pipe unless otherwise shown on the Drawings and approved by the Owner/Engineer.
- C. The cost to furnish and install required insulation board for mains and/or services shall be considered incidental to those items, unless otherwise specified.
- D. **Technical Provisions**
  - 1. Insulation board shall be used above all exposed existing and proposed piping at the connection point to the existing City main. **(PRSP)**
  - 2. The insulation shall be a minimum of 6 – inches thick and placed around the top and side of the pipe. **(MSP)**

**33.3.07**     **UTILITY INSULATED CASING (IC)**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. Insulation insulated casing will not be required for this project. **(PRSP)**

**33.3.08**     **THRUST BLOCKING**

- A. Construct reaction or thrust blocks at all tees, plugs, valves, reducers, caps and at bends deflecting 22-1/2 degrees or more.
- B. Construct thrust blocks at tapping sleeves where the outlet diameter exceeds one-half the diameter of the main being tapped. Limit using metal rods or straps for thrust restraint to those specified on the plans, or where the use of concrete thrust blocks would be impractical. Do not use metal rods or straps without the Engineer's approval.
- C. Construct reaction blocks from concrete having a minimum compressive strength of 2,000 pounds per square inch at 28 days.
- D. Concrete thrust blocking shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs.
  - 1. Thrust blocking dimensions shall be installed per the plan drawings for the respective fitting.
- E. Restraining devices shall be accompanied in tandem with appropriate sized thrust blocking unless otherwise approved by the Engineer.
- F. **Technical Provisions**

1. Use thrust blocks with all fittings, whether push-on, mechanical joint, or restrained joint, unless restraint joint system is designed to provide proper soil loading to provide sufficient restraint to the first non-restrained joint and approved by the Engineer. (PRSP-SID\_MOD)

**33.3.09     ADJUSTING EXISTING UTILITIES AND APPURTENANCES TO GRADE**

- A. The work consists of locating and adjusting to grade existing manholes, lampholes, inlets, water valve boxes or services, and fire hydrants as shown in the Contract Documents, staked in the field or as required in the Contract Documents.
- B. Provide all materials including concrete, brick and mortar, complying with the Specification section for the particular material involved, or if the material is not covered in these Specifications, the material used for adjusting shall be equal, and comparable to that in the existing structure. If extensions for water valve boxes or services and fire hydrants are required beyond the length found to exist, provide items comparable to those in the existing structure.
- C. Bring to required grade all existing manholes, inlets, lampholes and water valve boxes by either lowering or raising in accordance with the details shown in the Contract Documents. Do not lower manholes, lampholes or inlets by removal of portions of the cones or barrel sections. Accomplish downward adjustments by replacement of existing sections with shorter sections. Assure that all structures have a minimum of one 2 - inch concrete adjusting ring and a maximum of 12 - inches of rings under the casting. Do not use brick and/or mortar for adjustment of castings.
- D. On manholes requiring steps, assure that maximum spacing between steps is 16 - inches and that 10 - inches is the maximum distance from the top of the manhole cone section to the first step.
- E. Excavate water valve boxes and services to readily determine whether height adjustment can be made without substituting a longer section. Adjust water valve boxes and services laterally so the valve stems can be operated by the extension. Adjust water services by raising or lowering the curb key stop and extension box.
- F. Adjust manholes, lampholes and water valve boxes to final grade before placing the final pavement surface. If required, make preliminary adjustment to allow placement of base courses and paving adjacent to the manhole, lamphole or water valve.
- G. Provide backfill material conforming to provisions of **SECTION 32 11 23 AGGREGATE BASE COURSE**, 1 - inch Minus Crushed Base Course compacted to the minimum densities specified in **SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK** of these Specifications.
- H. If required, make minor adjustments 5 - feet to 10 - feet in the horizontal location of existing fire hydrants to insure that they are the required minimum distance behind the back of curb. At the time of construction staking, any hydrants which require horizontal adjustment will be located by the Owner/Engineer and the adjusted location will be staked by the Contract Documents.
- I. Make any minor adjustments required as dimensioned in the Contract Documents to the height of existing fire hydrants to insure that they are at a reasonable height above the back of curb. At the time of construction staking, any hydrants which require vertical adjustment will be located by the Engineer and the adjusted height will be staked by the Engineer. Accomplish extension of fire hydrant height only by the use of standard extension spools provided by the hydrant manufacturer.
- J. Before final acceptance, clean all manholes, lampholes, inlets and water valve boxes/services. Assure that all water valve boxes, services and fire hydrants are operational.
- K. All requirements of this section shall apply to new, as well as to existing, manholes, lampholes, valve boxes, water services and fire hydrants.
- L. **Technical Provisions**
  1. Reserved

**33.3.10 ABANDONING EXISTING UTILITIES AND APPURTENANCES**

- A. The following utilities and appurtenances no longer required for the operation of their respective systems and not removed in their entirety during construction shall be abandoned in a manner acceptable to the Engineer.
  - 1. Water mains
    - a. Abandoned in a manner that prevents cross-connection and must be entirely or partially removed to prevent future connections to the abandoned main.
  - 2. Fire hydrants
  - 3. Gate Valves
  - 4. Sewer mains
  - 5. Dosing Tanks
  - 6. Manholes
    - a. Abandoned in accordance with the provisions of **SECTION 33 05 61 CONCRETE MANHOLES** of these Specifications.
- B. **Technical Provisions**
  - 1. Reserved

**33.3.11 RECORDS**

- A. The Contractor shall prepare and maintain an accurate record of underground utility locations and depths.
- B. Depths of installed utilities shall be recorded every 40 – feet to the top of pipe as compared to finish ground elevation along with location of said measurement.
- C. Depths and separations of installed utilities at existing and/or future utility crossings, as applicable, shall be recorded when encountered in addition to measurements every 40 – feet as specified herein.
  - 1. A table has been provided in **SCHEDULE 33 05 00 – A** at the end of this section for convenience. Contractor is responsible to supply necessary data as specified in this section.
- D. The Contractor shall use references such as lot corners, building corners, manholes and other similar surface improvements or monuments.
- E. Said records shall be submitted to the Owner’s Representative upon completion of the work.
- F. **Technical Provisions**
  - 1. Reserved



## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes work associated with utility installations by the horizontal directional drilling method and all work incidental thereto, as shown on the Drawings and as specified herein.

### **33.1.02 REFERENCES**

- A. The current publications listed below form part of this Specification.
- B. Standard  
NSF 60            Drinking Water Treatment Chemicals – Health Effects

### **33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 33</b>	<b>POLYETHYLENE UTILITY PIPE</b>
<b>SECTION 33 05 97.26</b>	<b>UTILITY DETECTABLE MARKINGS</b>
<b>SECTION 33 14 13</b>	<b>PUBLIC WATER UTILITY DISTRIBUTION PIPING</b>
<b>SECTION 33 14 17</b>	<b>SITE WATER UTILITY SERVICE LATERALS</b>

### **33.1.04 SUBMITTALS**

- A. Preconstruction submittal product data shall be furnished as follows:
1. The following work plan and information is required from the contractor and/or horizontal directional drilling Contractor. This work plan and information shall also be supplied to the pipe supplier, should it be requested:
    - a. Work plan shall include for each HDD installation any excavation locations and dimensions, description of the sequence of operations, interfering utilities, bore dimensions and locations including bend radii used, and traffic control schematics.
    - b. A project safety and contingency plan which shall include but shall not be limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, water, pipelines, wastewater and any other subsurface utility in the area.
    - c. An environmental management and noise pollution management plan.
    - d. An HDD schedule identifying daily work hours and working dates for each installation.
  2. The Contractor shall provide equipment data for the drill rig and proposed design of equipment anchoring system and anticipated resistant forces, method to pack-off end of hole, proposed rod size, bend radius, and tabulation of rod hours (date and American Petroleum Institute rating), down-hole tools including drilling tools, reamers, pulling device, and tracking system.
  3. The Contractor shall provide information on drilling fluid generation and management.
  4. The Contractor shall provide a fusion welding quality assurance plan.
  5. The Contractor shall provide certifications of training by the pipe fusing equipment manufacturer(s) stating that the operators of fusing equipment have been fully trained in the use of the fusion equipment used on the Project.

- a. Fusing technicians shall meet the criteria included in the Specifications for the specified type of pipe material.
- B. The following As-Recorded Data is required from the contractor and/or fusion provider to the owner or pipe supplier upon request:
  - 1. Fusion report as described in **SECTION 33 05 33 POLYETHYLENE UTILITY PIPE** of these Specifications.
  - 2. The as-recorded plan and profile will reflect the actual installed alignment, and reflect the horizontal offset from the baseline and depth of cover.
  - 3. Borehole survey instrumentation shall be used to monitor line and grade of the pilot hole. The Contractor shall maintain records documenting the line and grade of the pilot hole. Data shall include, pitch, depth, timestamp, GPS location, downhole fluid pressure, and location where bore crosses other utilities.
  - 4. The Contractor shall provide "As-Built" data based on downhole survey data or a walkover location system that indicates x, y, and z coordinates of the pipe at least every twenty-five (25) feet along the alignment, midpoints if the bore length is less than twenty-five (25) feet, and at all existing and future utility crossing locations, where applicable.
  - 5. Data collected in accordance with "Location and Protection of Underground Facilities" subsection included herein shall be included with the "As-Built" information.
    - a. A table has been provided in **SCHEDULE 33 05 07.13 – A** at the end of this section for convenience. Contractor is responsible to supply necessary data as specified in this section.
  - 6. All fittings, valves, or other appurtenances shall be referenced and shown.
  - 7. A daily project log, along with tracking log sheets shall be provided. Tracking log sheet data shall include inclination, depth, and hydraulic pull-back and rotational force measured.
- C. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- D. **Technical Provisions**
  - 1. All directional drilling operations shall be performed by a qualified directional drilling Contractor with at least (10) years of continuous experience involving work of a similar size, length and configuration to the work required of this project. The lead personnel including the superintendent, the foreman and the lead locator each must have a minimum of five (5) years of experience and must have demonstrated competency and experience to perform the scope of work contained in this contract. The name, experience of each lead individual performing work on this contract, and list of project references shall be submitted. Personnel replaced by the Contractor, on this contract, shall have similar, verifiable experience as the personnel originally submitted for the project. **(PRSP-SID\_OFF)**

**33.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. High density polyethylene pipe and fittings, when specified for horizontal directional drilling, shall meet the requirements as specified in **SECTION 33 05 33 POLYETHYLENE UTILITY PIPE** of these Specifications

C. **Technical Provisions**

1. Reserved

**33.2.02 DRILLING FLUID**

A. Drilling fluid shall be ANSI/NSF 60 (Drinking Water Treatment Chemicals – Health Effects) certified, bentonite-based drilling fluid.

B. **Technical Provisions**

1. Reserved

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. Refer to Related Work sections for applicable installation requirements for specified type(s) of materials, and general installation of utilities.
- B. The directional drilling equipment, as a minimum, shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pull-back of the pipe(s), a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project. All required equipment shall be included in the project safety and contingency plan as submitted per these specifications.
- C. Bore path and alignment shall be designed by the Contractor or his qualified subcontractor. Entry and exit locations and control-point elevations shall be maintained as indicated in the work plan as approved per the submittal requirements of this Section.
- D. Bend radii shown shall adhere to the minimum allowable radii pursuant to the pipe manufacturer/supplier published literature which shall also be supplied in the work plan.
- E. The Contractor shall be responsible for complying with all local, county, state, and federal regulations and the requirements of these Specifications, and shall be fully responsible for all damages arising from the failure to comply.
- F. Where utilities and pipelines are involved the Contractor shall monitor ground settlement or heave directly above and 10 feet before and after the utility or pipeline intersection.
- G. The Contractor shall cease operations when monitoring points indicate any surface disruption. The Contractor shall propose immediate action for review and approval by the Owner's Representative to remedy the problem.
- H. The Contractor shall conduct any necessary field surveys, subsurface investigations and geotechnical investigations necessary to complete the work. Reports of subsurface investigations performed by the Owner are solely for the convenience of the Contractor. The Owner makes no guarantee as to the types of materials to be encountered.
- I. Directional drilling shall consist of the drilling of a small diameter pilot hole at grade and from the locations shown on the Plans. Once the pilot boring is in place and meets the tolerance requirements as specified, the Contractor shall enlarge the hole by push reaming or pull reaming as the Contractor deems appropriate. Upon completion of hole sized to a maximum of 150 percent of the nominal pipe diameter, the Contractor shall pull the pipeline back from the recovery area to the directional drill machine unless alternate methods are proposed by the Contractor and approved by the Owner's Representative.
- J. The Contractor shall utilize a drilling fluid cleaning/recycling system. Entry and exit pits shall be sized and constructed to completely contain the drilling fluid.
- K. The Contractor shall install boring to line and grade shown on plans, unless noted otherwise. Alignment shall be within tolerances specified.

- L. If a stoppage in the forward progress of the project is encountered, the cause of the stoppage shall be determined by the Contractor. When the cause has been identified, the installation method shall be modified to the satisfaction of the Owner's Representative to best suit the actual conditions encountered. Should the stoppage be a result of the Contractor's equipment, materials or method, then all remedial costs will be at the Contractor's expense.

M. **Technical Provisions**

- 1. Reserved

**33.3.02 DRILLING RIG**

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a drill head. The machine shall be anchored to withstand the pulling, pushing and rotating forces required to complete the project.
- B. The drilling rig hydraulic system shall be of sufficient pressure and volume to power drilling operations. The hydraulic system shall be free from leaks.
- C. The drilling rig shall have a system to monitor pull-back hydraulic pressure during pull-back operations.
- D. **Technical Provisions**
  - 1. Reserved

**33.3.03 DRILL HEAD**

- A. The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steer-able drill head and any subsequent pre-reaming heads.
- B. The system must be able to control the depth and direction of the drilling operation.
- C. Drill head shall contain all necessary cutters and fluid jets for the operation, and shall be of the appropriate design for the ground medium being drilled. Contractor shall be responsible for determining the appropriate drill head design for the onsite ground conditions to efficiently and effectively perform the work.
- D. **Technical Provisions**
  - 1. Reserved

**33.3.04 DRILLING FLUID SYSTEM**

- A. Drilling Fluid System:
  - 1. Drilling fluid shall be composed of clean water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean source and shall meet the mixing requirements of the mixture manufacturer(s).
  - 2. The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods. No hazardous additives may be used.
  - 3. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).
  - 4. Drilling fluid shall be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions.
  - 5. No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid unless they have been submitted per this specification.
- B. Mixing System:
  - 1. A drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
  - 2. The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.

3. The mixing system shall continually agitate the drilling fluid during drilling operations.
- C. Drilling Fluid Delivery and Recovery System:
1. The drilling fluid pumping system shall have a minimum capacity to supply drilling fluid in accordance with the drilling equipment pull-back rating at a constant required pressure.
  2. The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.
  3. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.
  4. A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.
- D. Drilling Control System:
1. Calibration of the electronic detection and control system shall be verified prior to the start of the bore.
  2. The drilling head shall be remotely steer-able by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three dimensions:
    - a. Offset from the baseline,
    - b. Distance along the baseline, and
    - c. Depth of cover.
  3. Point of rotation of the head shall also be monitored.
  4. For gravity application and on-grade drilling, sonde/beacon or approved equipment applicable for grade increments of 1/10th of one percent shall be used.
- E. Vacuum Trucks:
1. Vacuum trucks of sufficient capacity to contain 150 percent of the drilling fluid volumes in use.
- F. **Technical Provisions**
1. Reserved

**33.3.05**     **PIPE PULL HEADS**

- A. Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
  - B. Pipe pull heads shall be specifically designed for use with the pipe material used, and shall be as recommended by the pipe supplier.
- C. **Technical Provisions**
1. Reserved

**33.3.06**     **PIPE ROLLERS**

- A. Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.
- B. A sufficient quantity of rollers and spacing, per the pipe supplier's guidelines shall be used to assure adequate support and excessive sagging of the product pipe.

C. **Technical Provisions**

1. Reserved

**33.3.07 LOCATION AND PROTECTION OF UNDERGROUND UTILITIES**

- A. Correct location of all underground utilities that may impact the HDD installation is the responsibility of the Contractor, regardless of any locations shown on the drawings or previous surveys completed.
- B. Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
- C. All existing and future lines and underground utilities, where applicable, shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of HDD installation as determined for the project specific site conditions. It is the Contractor and HDD system operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material. **(TP-1)**
- D. The Contractor shall locate all known utilities located adjacent to or crossing the utility line being installed. Excavate to expose utilities prior to initiating drilling and verify applicable clearances. Clearance shall meet applicable code requirements and the requirements of the directional drilling process.
  1. Description, depth, size, and type of existing utilities crossed during HDD, and top of pipe elevation at said locations shall be indicated on "As-Built" drawings supplied by Contractor.
  2. A table has been provided in **SCHEDULE 33 05 07.13 – A** at the end of this section for convenience. Contractor shall still be responsible to supply necessary data as specified in this section.
- E. The Contractor shall locate and verify the clearance of known structures and foundations/footings located adjacent to or crossing the utility line being installed.

F. **Technical Provisions**

1. Positive verification of existing and future lines as specified in part C of this subsection, shall be recorded in **SCHEDULE 33 05 07.13 – A** or by other means shown depth and/or elevation of said lines or utilities. During the preliminary pilot bore the Contractor shall record the depth and/or elevation of the drill head at these same locations. This information shall be submitted to the Engineer prior to commencing the pipe pullback operations to check for general concurrence to the Contract Documents.
2. All utility locates "pot-holing" performed within non-traveled roadways, shall be filled with non-shrink backfill material requiring no tamping or vibrating material, approved by the Engineer. **(SID\_OFF)**
  - a. Non-shrink backfill shall be furnished in accordance with the provisions of **SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK** of these Specifications. **(SID\_OFF)**
3. All utility locates "pot-holing" performed within traveled roadways, shall be poured to the surface with flowable fill, unless otherwise specified. Flowable fill shall be of a consistency to fill the voids without excess water, and require no tamping or vibrating. Flowable fill shall be allowed a minimum of 3 hours cure time prior to vehicle traffic. The top 4 – inches shall be removed prior to patching/surfacing with specified materials. **(PRSP-FV<sub>19</sub>)**
  - a. Flowable fill shall be furnished in accordance with the provisions of **SECTION 31 23 23.33 FLOWABLE FILL** of these Specifications. **(PRSP-FV<sub>19</sub>)**

**33.3.08 SITE LOCATION PREPARATION**

- A. Work site as indicated on drawings shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made.
- B. Contractor shall confine all activities to designated work areas.

C. **Technical Provisions**

1. Reserved

**33.3.09 DRILLING LAYOUT AND TOLERANCES**

- A. The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations as indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.
- B. Instrumentation shall be provided and maintained at all times that accurately locates the pilot hole, measures drill-string axial and torsional loads and measures drilling fluid discharge rate and pressure. Near real time data shall be available to the Owner's Representative. Data shall include, pitch, depth, timestamp, GPS location, downhole fluid pressure, and location where bore crosses other utilities.
- C. Entry and Exit pit areas shall be constructed so as not to exceed the bending limitations of the pipe as recommended by the pipe supplier/manufacturer, or as controlled by installation method specified in subsection PIPE PULL BACK AND INSERTION included herein.
1. Entry and exit pits shall be constructed and properly braced/shored in accordance with the provisions of **DIVISION 31 EARTHWORK** of these Specification.
2. Pay limits for horizontal directional drilling (considered a trenchless method), shall be in accordance with the provisions of **SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES** of these Specifications.
- D. The piping shall be installed at the minimum depths as specified in **SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES**, or on the Drawings, and shall deviate no more than 6 - inches along the vertical axis and 3 - feet along the horizontal alignment.

E. **Technical Provisions**

1. Reserved

**33.3.10 PILOT HOLE BORE**

- A. Pilot hole shall be drilled along bore path, and electronically monitored. In the event that the pilot bore does deviate from the bore path, it may require Contractor to pull-back and re-drill from the location along bore path before the deviation. The Owner's Representative shall be notified of any deviations from the bore path.
- B. The Contractor shall limit curvature in any direction to reduce force on the pipe during pull-back. The minimum radius of curvature shall be no less than that specified by the pipe manufacturer and as indicated on the drawings.
- C. The Contractor shall notify the Owner's Representative upon completion of the pilot hole to observe alignment prior to reaming and pullback.

D. **Technical Provisions**

1. Reserved

**33.3.11 REAMING**

- A. After successfully completing the pilot hole, the bore hole shall be reamed to a diameter which meets the requirements of the pipe being installed. The following table is offered as an estimated guide:

<u>Nominal Pipe Diameter</u>	<u>Bore Hole Diameter</u>
< 8 – inches	Pipe Dia. +4 – inches
8 – inches to 24 – inches	Pipe Dia. X 1.5
> 24 - inches	Pipe Dia. +12 - inches

- B. Multiple reaming passes shall be used at the discretion of the Contractor and shall conform to this specification.

- C. In the event of a drilling fluid fracture, returns loss or other loss of drilling fluid, the Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss. The Contractor shall notify the Owner's Representative immediately of fluid losses.
- D. **Technical Provisions**
  - 1. Reserved

**33.3.12 PIPE PULL-BACK AND INSERTION**

- A. Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not bend past the pipe manufacturer's minimum allowable bend radius, buckle, or otherwise become damaged. Damaged portions of the pipe shall be removed and replaced.
- B. The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the bore hole.
  - 1. The pipe shall be guided into the bore hole to avoid deformation of, or damage to, the pipe.
  - 2. The pipe may be continuously or partially supported on rollers or other Owner's Representative approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during installation.
  - 3. A swivel shall be used between the reaming head and the pipe to minimize torsion stress on the pipe assembly.
- C. Buoyancy modification shall be at the sole discretion of the Contractor, and shall not exceed the pipe supplier's guidelines in regards to maximum pull force or minimum bend radius of the pipe. Damage caused by buoyancy modifications shall be the responsibility of the Contractor.
- D. Once pull-back operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole.
- E. In the event that the pipe becomes stuck, the Contractor may choose to cease the pulling operations to allow any potential hydro-lock to subside. Then if on re-commencement of the pulling operations the pipe remains stuck, the Contractor shall immediately notify the Owner's Representative. The Contractor in consultation with the Owner's Representative will discuss the appropriate recovery plan to be implemented to allow the work to continue. The cost to perform said work shall be the responsibility of the Contractor.
- F. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Any damages caused by the Contractor's operations shall be corrected by the Contractor at the Contractor's expense.
- G. Install tracer cable during pullback operations, if requested. Extend tracer cable to end of carrier pipe and secure. Test continuity of the tracer cable prior to demobilizing. Tracer wire installation shall be in accordance with **SECTION 33 05 97.26 UTILITY DETECTABLE MARKINGS** of these Specifications.
- H. Prior to sealing the annulus space, restoring the access chambers, and backfilling the insertion pit, the installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than four (4) hours for cooling and relaxation. Sufficient excess length of new pipe shall be allowed to protrude into the access chamber to allow for cooling and relaxation and the consequential contraction. **(TP-2)**
- I. Prior to backfilling launching and exit pits, the Contractor shall ensure that new pipe is properly supported and on the required grade. Suitable material approved by the Owner's Representative shall be used immediately under the new pipe as support in order to avoid sagging after backfill and compaction.

J. **Technical Provisions**

1. When fusible pipe (HDPE) is specified, Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous length. **(SID\_OFF)**
2. Pipe cooling and relaxation time as specified in part H of this subsection, shall be increased to a 24 – hour cooling and relaxation period when pipe material used for directional drilling is high density polyethylene (HDPE) pipe. **(SID\_OFF)**

**33.3.13** **PIPE VERIFICATION**

- A. Contractor shall field verify the location, depths, and separations to existing utilities of installed pipe at completion of pull-back procedures in the presence of the Owner’s Representative.
  1. Contractor shall choose method of verification satisfactory to the Owner/Engineer.
- B. Data shall be collected at minimum 30 – foot intervals and all utility crossings, unless otherwise approved by Owner/Engineer.
- C. In the event field verifications show installed pipe does not meet minimum design tolerances and/or clearance, the Contractor shall correct all deficiencies by means approved by Owner/Engineer at their own expense.
- D. **Technical Provisions**
  1. Pre-approved methods of verification are as follows:
    - a. Positive verification via “pot-holes”, Pipe verified in place via sonde/locator **(SID\_OFF)**

**33.3.14** **INSTALLATION CLEANUP**

- A. Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted per the construction documents and jurisdictional standards. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these specifications and all applicable jurisdictional laws.
- B. Contractor shall verify that all utilities, structures, and surface features in the project area are sound.
- C. **Technical Provisions**
  1. Reserved



**PART 1 GENERAL**

**33.1.01 DESCRIPTION**

- A. This Specification includes the fusing, joining and handling of high density polyethylene pipe and fittings for utilities, including standards for dimensionality, testing, quality, and acceptable fusion practices.
- B. References made to ASTM, ANSI, NSF, AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material included herein shall conform to these standards where such standards exist.

**33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - AASHTO M294 Corrugated Polyethylene Pipe (HDPE)
  - AASHTO M252 Corrugated Polyethylene Drainage Pipe
  - AASHTO M294 Standard Spec for Polyethylene Pipe
  - AASHTO MP7 Corrugated Polyethylene Pipe
  - ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
  - ASTM F3124 Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
  - ASTM F3190 Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings
  - ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  - ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
  - PPI – TN42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects
  - PPI – TR33 Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
  - PPI – TR41 Generic Saddle Fusion Joining Procedure for Polyethylene gas Piping
  - NSF 14 Plastics Piping System Components and Related Materials

**33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILLING</b>
<b>SECTION 33 01 12</b>	<b>INSPECTING AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 07.13</b>	<b>UTILITY DIRECTIONAL DRILLING</b>

**33.1.04 SUBMITTALS**

- A. Furnish a manufacturer's certification covering all pipe and fittings furnished, certifying that the pipe and fittings meet applicable Specifications.
- B. Preconstruction submittal product data shall be furnished as follows:
  - 1. Pipe Size
  - 2. Dimensionality

3. Pressure Class per applicable standard
  4. Color
  5. Recommended Minimum Bending Radius
  6. Recommended Maximum Safe Pull Force
  7. Fusion technician qualification indicating conformance with this specification
  8. Pipe fusion and fusion services warranty information
  9. Written procedural documentation for piping products including proper handling and storage, installation, tapping, and testing
  10. Fusion technician qualification indicating conformance with this specification
  11. Manufacturers recommended fusion procedures for the products
- C. The following As-Recorded Data is required from the contractor and/or fusion provider to the owner or pipe supplier upon request:
1. Fusion report for each fusion joint performed on the project, including joints that were rejected. Specific requirements of the fusion technician's joint report shall include:
    - a. Pipe Size and Temperature
    - b. Machine Size
    - c. Fusion Technician Identification
    - d. Job Identification
    - e. Fusion Joint Number
    - f. Fusion, Heating, and Drag Pressure Settings
    - g. Heat Plate Temperature
    - h. Time Stamp
    - i. Heating and Cool Down Time of Fusion
    - j. Ambient Temperature
  2. Approved data-logger device report
  3. As-Recorded Information
    - a. The as-recorded plan and profile will reflect the actual installed alignment, and reflect the horizontal offset from the baseline and depth of cover.
    - b. All fittings, valves, or other appurtenances shall be referenced and shown.
- D. The Heat Fusion Equipment (HFE) Operator shall have taken and passed a written and performance test administered by the Heat Fusion Equipment Operator Training Organization, in accordance with ASTM F3190. The HFE operator shall furnish his/her HFE operator's qualification card received from the Heat Fusion Equipment Operator Training Organization to the Owner's Representative prior to commencing construction operations. **(TP-1)**
- E. Heat Fusion Equipment (HFE) Operators shall be fully qualified to fuse HDPE pipe of the type(s) and size(s) being used. Qualifications for HFE Operators shall be current as of the actual date of fusion performance on the project. **(TP-1)**
- F. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- G. **Technical provisions**
1. Heat Fusion Technicians/Operators as specified in part D and E of this subsection shall have a minimum of 10,000 feet of documented HDPE pipe fusion experience (greater than

3 inches in diameter), and shall be supplied to the Engineer prior to commencing construction operations. (SID\_OFF)

**33.1.05 TESTING**

- A. This section reserved.

**PART 2 PRODUCTS**

**33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. Assure all pipe is clearly marked showing type, class and/or thickness. Lettering must be legible and permanent under normal handling storage conditions.
- C. The pipe shall be warranted for one year from the date of Substantial Completion.
- D. In addition to the standard pipe warranty, the fusion services shall be warranted for one year from the date of Substantial Completion.
- E. **Technical Provisions**
  - 1. Reserved

**33.2.02 HIGH DENSITY POLYETHYLENE (HDPE) WATER PIPE**

- A. High density polyethylene pipe used for pressurized water systems shall be furnished in accordance with the provisions of **SECTION 33 05 33.23 POLYETHYLENE PRESSURE PIPE AND TUBING** of these specifications.
- B. **Technical Provisions**
  - 1. Reserved

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. Fusing, joining and handling of HDPE pipe regardless of application shall be performed following the manufacturer's recommendations and instructions, and as included herein.
- B. Where provisions included herein differ from those established by pipe manufacturer or are not specified herein, the manufacturers methods; when proven more strict, shall govern.
- C. Provide all tools and equipment required to install each type of pipe used.
- D. Water utilities to be installed via open-cut methods shall be installed in accordance with the provisions of **SECTION 33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING** of these Specifications, and as included herein.
- E. Utilities to be installed via trenchless technologies shall be installed in accordance with the provisions of **SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING** of these Specifications as applicable, and as included herein.
- F. **Technical Provisions**
  - 1. Reserved

**33.3.02 DELIVERY AND OFF-LOADING**

- A. The Contractor is responsible for all Contractor furnished material. Replace all defective material or material damaged by handling after delivery by the manufacturer. This includes the furnishing of all materials and labor required to replace installed material discovered damaged or defective before final acceptance of the work, or during the guarantee period.

- B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or Owner's Representative immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.
- C. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Owner or Owner's Representative.
- D. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M55, and all of the pipe supplier's guidelines shall be followed.
- E. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- F. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- G. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.
- H. **Technical Provisions**
  - 1. Reserved

**33.3.03**     **HANDLING PIPE**

- A. Store pipe in a manner that will not result in damage or deformation to the pipe. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- B. Pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.
- C. Prepare pipe on a relatively smooth surface, free of sharp rocks, sticks or debris. Utilize cribbing, pipe stands, rollers or other equipment as necessary to support the pipe. Pipe shall be stored and stacked per the pipe supplier's guidelines.
- D. Lift and move piping using ropes, slings or straps. Do not use unprotected chains, hooks or clamps to lift pipe.
- E. When lifting and moving pipe, provide a minimum of two points of support. Do not support pipes at butt-fused joints.
- F. Sections of pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and rejoined at the Contractor's expense.
- G. Plug all pipes at end of each workday. Provide a watertight plug to prevent entry of foreign materials into the pipe.
- H. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the Owner or Owner's Representative.
- I. **Technical Provisions**
  - 1. Reserved

**33.3.04**     **FUSING EQUIPMENT**

- A. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

1. Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion
  2. Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.
    - a. The heating plates used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be 1/4 - inch larger than the size of the outlet branch being fused.
  3. Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
  4. An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
  5. Datalogging shall be performed in accordance with ASTM F3124.
- B. Other equipment specifically required for the fusion process shall include the following:
1. Pipe rollers shall be used for support of pipe to either side of the machine.
  2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
  3. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
  4. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
  5. Facing blades specifically designed for cutting the pipe material shall be used.
- C. **Technical Provisions**
1. Reserved

**33.3.05 BUTT FUSION JOINING PROCEDURE FOR HDPE**

- A. General
1. This procedure is intended to be used only in conjunction with PPI's Technical Report TR-33 that more fully explains the background, scope and purposes of the PPI generic procedure. This procedure has not been qualified for use with any particular piping product or combination of piping products and must be qualified for use in accordance with 49 CFR Part 192 prior to its use to join PE pipe in a gas pipeline.
  2. These Butt Fusion Joining Procedures shall serve as general guidelines for fusing HDPE in reference to Fusion Procedures lined out in ASTM 2620, in times when manufacturer's specific installation methods differ from those included herein, and prove more strict, manufacturer's standards shall govern.
  3. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications.
  4. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring. Stainless steel inserts shall be used in conjunction with mechanical joining for all HDPE piping.

5. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.
  6. Pipe will be fused by qualified fusion technicians/operators, specified in subsection "Submittals" included herein.
  7. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
  8. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of the pipe material used. The software shall register and/or record the parameters required by the pipe supplier and these Specifications.
  9. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.
  10. At start of each day, the Contractor shall complete fusion weld tests in accordance with manufacturer's recommendations to verify that fusion equipment is operating properly, where manufacturer's weld tests do not exist butt fusion joints shall be tested in accordance with guidelines specified in PPI – TN42, "Making and Testing Sample Butt Fusion Joints".
- B. Secure**
1. Clean the inside and outside of the pipe to be joined by wiping with a clean lint-free cloth. Remove all foreign matter.
  2. Clamp the components in the machine. Check alignment of the ends and adjust as needed.
- C. Face**
1. The pipe ends shall be faced to establish clean, parallel mating surfaces. Most, if not all, equipment manufacturers have incorporated the rotating planer block design in their facers to accomplish this goal. Facing is continued until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaw bushings. Open the jaws and remove the facer. Remove any pipe chips from the facing operation and any foreign matter with a clean, lint-free cotton cloth. Bring the pipe ends together with minimal force and inspect the face off. A visual inspection of this operation should verify that faces are square, perpendicular to the pipe centerline on each pipe end and with no detectable gap.
- D. Align**
1. The pipe profiles shall be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by tightening clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion. Re-face the pipe ends and remove any chips from re-facing operation with a clean, lint-free cotton cloth.
- E. Melt**
1. Heating tools that simultaneously heat both pipe ends shall be used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, the thermometer can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature-measuring device should be used before the first joint of the day is made and periodically throughout the day to insure proper temperature of the heating tool face that contacts the pipe or fitting ends. Additionally, heating tools are usually equipped with suspension and alignment guides that center them on the pipe ends. The heater faces that come into contact with the pipe should be clean, oil-free and coated with a nonstick coating as recommended by the manufacturer to prevent molten plastic from sticking to the heater surfaces. Remaining

molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions. Never use chemical cleaners or solvents to clean heating tool surfaces.

2. Surface temperature range: 400 – 450 °F (204 – 232 °C)
3. Install the heater in the butt fusion machine and bring the pipe ends into full contact with the heater. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure very briefly, it should be released without breaking contact. On larger pipe sizes, initial pressure may be maintained until a slight melt is observed around the circumference of the pipe before releasing pressure. Continue to hold the components in contact with each other, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surfaces all around the pipe or fitting ends, remove the heater. Melt bead size is dependent on pipe size. See table below for approximate melt bead sizes.

<u>Pipe Size</u>	<u>Approximate Melt Bead Size</u>
1 1/4 – inch and smaller	1/32 – inch
Above 1 1/4 – inch through 3 – inch	About 1/16 – inch
Above 3 – inch thorough 8 – inch	1/8 – inch to 3/16 – inch
Above 8 – inch through 12 – inch	3/16 – inch to 1/4 – inch
Above 12 – inch through 24 – inch	1/4 – inch to 7/16 – inch
Above 24 – inch through 36 – inch	About 7/16 – inch
Above 36 – inch through 63 – inch	About 9/16 - inch

**F. Joining**

1. After the heater tool is removed, quickly inspect the pipe ends (NOTE: If a concave melt surface is observed, unacceptable pressure during heating has occurred and the joint will be low quality. Do not continue. Allow the component ends to cool completely, and restart at the beginning. Except for a very brief time to seat the components fully against the heater tool, do not apply pressure during heating.), then immediately bring the molten pipe ends together with sufficient fusion force to form a double rollback bead against the pipe wall.
2. Joining pressure range: 60 – 90 psi
3. For larger manual and hydraulic butt fusion machines, fusion force is determined by multiplying the interfacial pressure, 60-90 psi, by the pipe area. For manually operated fusion machines, a torque wrench may be used to apply the proper force. For hydraulically operated fusion machines, the fusion force can be divided by the total effective piston area of the carriage cylinders to give a hydraulic gauge reading in psi. The gauge reading is theoretical; internal and external drags are added to this figure to obtain the actual fusion pressure required by the machine. The hydraulic gauge reading is dependent upon pipe diameter, DR and machine design. Interfacial pressure and gauge reading are not the same value.

**G. Hold**

1. Hold the joint immobile under fusion force until the joint has cooled adequately to develop strength. Allowing proper cooling times under fusion force prior to removal from the clamps of the machine is important in achieving joint integrity.
2. The fusion force should be held between the pipe ends for the approximate time specified below:
3. Hold time: 11 - minutes per inch of pipe wall thickness  

or

Until the surface of the melt bead is cool to the touch.

4. Avoid pulling, installation or rough handling for an additional 30 minutes. Additional time may be required for pipes with a wall thickness greater than 2 - inches.
- H. Visual Inspection
1. Visually inspect and compare the joint against the manufacturer's recommended appearance guidelines. Visually, the width of butt fusion beads should be approximately 2-2 1/2 times the bead height above the pipe and the beads should be rounded and uniformly sized all around the pipe circumference. The v-groove between the beads should not be deeper than half the bead height above the pipe surface. When butt fusing to molded fittings, the fitting-side bead may display shape irregularities such as minor indentations, deflections and non-uniform bead rollover from molded part cooling and knit lines. In such cases, visual evaluation is based mainly on the size and shape of the pipe-side bead. Visually unacceptable joints should be cut out and re-fused using the correct procedure. (See manufacturer's visual inspection guidelines).
- I. **Technical Provisions**
1. Reserved

**END OF SECTION**

**PART 1 GENERAL**

**33.1.01 DESCRIPTION**

- A. This Specification includes the installation of high density polyethylene pipe and fittings for water utilities, including standards for dimensionality, testing, quality, and acceptable fusion practices.
- B. References made to ASTM, ANSI, NSF, AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material included herein shall conform to these standards where such standards exist.

**33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - ANSI/AWWA C110/A21.10 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
  - ANSI/AWWA C111/A21.11 American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - ANSI/AWWA C153/A21.53 AWWA Standard for Ductile-Iron Compact Fittings for Water Service
  - AWWA C651 Standard for Disinfecting Water Mains
  - AWWA C906 Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch for Water Distribution and Transmission
  - ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
  - ASTM D3035 Standard Specification for PE Pipe (DR-PR) Based on Controlled Outside Diameter
  - ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
  - ASTM F3124 Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
  - ASTM F3190 Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings
  - ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  - ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
  - ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Cross-linked Polyethylene (PEX) Pipe and Tubing
  - PPI – TN42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects
  - PPI – TR33 Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
  - PPI – TR41 Generic Saddle Fusion Joining Procedure for Polyethylene gas Piping
  - NSF 14 Plastics Piping System Components and Related Materials
  - NSF 61 Drinking Water System Components-Health Effects

**33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.
  - SECTION 01 22 19 MEASUREMENT AND PAYMENT**
  - SECTION 01 33 00 SUBMITTAL PROCEDURES**
  - SECTION 01 45 00 QUALITY CONTROL**
  - SECTION 31 05 00 COMMON WORK RESULTS FOR EARTHWORK**
  - SECTION 31 23 33 TRENCHING AND BACKFILLING**
  - SECTION 33 01 12 INSPECTING AND TESTING OF WATER UTILITIES**

**SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES**  
**SECTION 33 05 97.26 UTILITY DETECTABLE MARKINGS**  
**SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING**

**33.1.04 SUBMITTALS**

- A. Furnish a manufacturer's certification covering all pipe and fittings furnished, certifying that the pipe and fittings meet applicable Specifications.
- B. Refer to **SECTION 33 05 33 POLYETHYLENE UTILITY PIPE** of these Specifications for required submittal information.
- C. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- D. **Technical provisions**
  - 1. Reserved

**33.1.05 TESTING**

- A. Testing, filling, flushing, and disinfecting of all water mains and associated pipe and appurtenances shall be performed in accordance with the provisions of **SECTION 33 01 12 INSPECTING AND TESTING OF WATER UTILITIES** of these Specifications.
- B. **Technical Provisions**
  - 1. Reserved

**PART 2 PRODUCTS**

**33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. Pipe shall be made from the same resin meeting the requirements of the Plastic Pipe Institute (PPI) material designation PE 4710 with an ASTM D3350 minimum cell classification of PE 445574C. Pipe shall have a manufacturing standard of ASTM F714. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.
- C. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 °F.
- D. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.
- E. Assure all pipe is clearly marked showing type, class and/or thickness. Lettering must be legible and permanent under normal handling storage conditions.
- F. The pipe shall be warranted for one year from the date of Substantial Completion.
- G. In addition to the standard pipe warranty, the fusion services shall be warranted for one year from the date of Substantial Completion.
- H. **Technical Provisions**
  - 1. Reserved

**33.2.02 HIGH DENSITY POLYETHYLENE PIPE (HDPE) FOR POTABLE WATER**

- A. HDPE pipe shall have a minimum pressure rating of 200 psi (DR11). **(TP-1)**
- B. HDPE pipe shall conform to AWWA C906 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.
- C. HDPE pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

- D. Permanent identification of piping for potable water use shall be provided by co-extruding longitudinal blue stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.
- E. Pipe shall be marked as follows:
  - 1. Nominal pipe size
  - 2. HDPE
  - 3. Dimension Ratio
  - 4. The letters PE followed by the polyethylene grade in accordance with ASTM
  - 5. NSF-61 mark verifying suitability for potable water service
  - 6. Extrusion production-record code
  - 7. Trademark or trade name
  - 8. PPI material designation
- F. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
- G. **Technical Provisions**
  - 1. HDPE pipe as specified in Part A of this Subsection, shall be 125 psi (DR17). **(MSP)**
  - 2. High density polyethylene (HDPE) pipe as specified in this subsection shall be manufactured to ductile iron pipe sizes (DIPS). **(SID\_OFF)**

**33.2.03 CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS**

- A. Plain end butt fused fittings and electrofusion couplings shall be used when joining polyethylene materials. Mechanical (compression) fittings shall be used only when joining polyethylene materials to different piping materials and approved by the Owner's Representative.
- B. The fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- C. Butt fusion fittings:
  - 1. Fittings shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D3350. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.
- D. Electrofusion fittings:
  - 1. Fittings shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.
- E. Ductile Iron Fittings:
  - 1. Ductile iron fittings shall be furnished in accordance with **SECTION 33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING** of these Specifications.
- F. Flanged and Mechanical Joint Adapters: **(TP-1)**
  - 1. Flanged and Mechanical Joint Adapters shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Joint restraint methods are required to be submitted to the Engineer for approval.

- G. Thermal Restraint Fittings: **(TP-2)**
1. Electrofusion thrust/flex restraints with concrete encasement shall be installed along the length of the pipe when no restraint is provided by any other means and/or connections are made to an unrestrained section of pipe. Locations/and connections implementing thermal restraints shall be submitted to the Engineer for approval.
  2. Joint restraint may not be sufficient in longer runs of piping where cold flow is more likely to occur. Contractor shall provide thermal restraint in accordance with the manufacturer's recommendations, subject to the approval by the Owner's Representative.
- H. Service Connections: **(TP-3)**
1. Service connections shall be tapped stainless steel saddles designed for HDPE pipe. Service connections shall provide full support around the pipe circumference with a bearing area of sufficient width along the pipe axis, 6 - inch minimum for pipe sizes 4 – inch through 12 inches, to ensure the pipe will not be distorted when the saddle is tightened. HDPE service connections shall not have lugs that will dig into the pipe and be furnished with spring washers to allow for limited pipe expansion and contraction. Taps for water service saddles shall be full-size taps with AWWA taper thread (C.C.) series. The saddle and corporation stop shall be set on the pipe prior to tapping and the tap shall be made through the corporation stop using a standard tapping machine only. Undersized taps will not be allowed.
- I. **Technical Provisions**
1. Transition connections between 6 – inch high density polyethylene pipe and a dissimilar pipe material shall be furnished with a Mechanical joint (MJ x MJ) ductile iron joint or fitting, mechanical joint adapter, and stiffeners as included herein. **(SID\_OFF)**
  2. In place of the thermal restraint fittings for HDPE as specified in part G of this subsection, a butt fusion HDPE wall anchor encased in concrete, shall be furnished for transition connections to a dissimilar pipe material at locations approved by the Owner's Representative and/or as shown on the Plans. **(SID\_OFF)**
  3. Service Connections for HDPE pipe as specified in part H of this subsection, shall be as manufactured by:
    - a. Ford "Series FSP313" Stainless Steel Saddle, or approved equal. **(SID\_OFF)**

## **PART 3 EXECUTION**

### **33.3.01 GENERAL**

- A. Fusing, joining and handling of HDPE pipe regardless of application shall be performed following the manufacturer's recommendations and instructions and as provided in **SECTION 03 05 33 POLYETHYLENE UTILITY PIPE** of these Specifications.
- B. **Technical Provisions**
1. Reserved

**END OF SECTION**

## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes installation of detectable warning devices and signage for utilities and all work included thereto as shown on the Drawings and specified herein.

### **33.1.02 REFERENCES**

- A. This section reserved.

### **33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>

### **33.1.04 SUBMITTALS**

- A. Shop drawings and product data shall be submitted for in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.

B. **Technical Provisions**

1. Reserved

### **33.1.05 TESTING**

A. **Continuity Testing**

1. The Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the Engineer's representative.
2. The continuity test shall be conducted after all backfilling activities have been completed for the section(s) to be tested.
3. To minimize traffic disruptions and pavement damage, the continuity test shall be conducted prior to the final lift in all paved areas.
4. If the trace wire is found to be not continuous after testing, the Contractor shall repair or replace the failed segment of wire at their own expense.

B. **Technical Provisions**

1. Reserved

## **PART 2 PRODUCTS**

### **33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.

B. **Technical Provisions**

1. Reserved

**33.2.02**    **TRACER WIRE**

- A. The wire shall be designed in such a manner as to be able to properly trace all piping without loss or deterioration of signal and without the transmitted signal migrating off the tracer wire.
- B. Open cut installation:
  - 1. The trace wire shall be a minimum 12 AWG copper clad steel or reinforced copper wire.
  - 2. The trace wire shall include a 30 mil HDPE insulation jacket recommended for direct burial.
  - 3. The trace wire shall be rated for use at 30 volts.
  - 4. The trace wire shall meet the American Public Works Association (APWA) Color-Code Standard for Identification of Buried Utilities.
- C. Trenchless installation:
  - 1. The trace wire shall be a minimum 12 AWG copper clad steel or reinforced copper wire with rated break load of 1,330 lbs (260,000 psi).
  - 2. The trace wire shall include a 45 mil, high-density, high molecular weight polyethylene (HMW-HDPE) coating pursuant to ASTM D1248 standard.
  - 3. The trace wire shall be rated for use at 30 volts.
  - 4. The trace wire shall meet the American Public Works Association (APWA) Color-Code Standard for Identification of Buried Utilities.
- D. **Technical Provisions**
  - 1. All tracer wire installed shall be as manufactured by:
    - a. PRO-TRACE HDD-CCS PE45 by Pro-Line Safety Products, or approved equal. **(SID\_OFF)**

**33.2.03**    **TRACER WIRE ACCESS BOX**

- A. The tracer boxes shall be magnetized for ease of locating.
- B. The tracer boxes shall include corrosion-resistant brass wire lugs to prevent corrosion.
- C. The tracer boxes shall allow connection without the removal of the cover.
- D. The tracer box covers shall meet the APWA Color-Code Standard for Identification of Buried Utilities.
- E. **Technical Provision**
  - 1. Tracing wire access boxes shall be as manufactured by:
    - a. Copperhead Industries LLC (Snakepit Access Box), or approved equal. **(SID\_OFF)**
  - 2. Tracing wire access boxes as specified in this subsection, shall be cast iron with a permanently attached 3" x 12" ABS tube with a flared end to secure it in the ground, complete with a cast-iron locking pentagon lid with stainless steel terminal connectors. **(SID\_OFF)**

**33.2.04**    **TRACE WIRE CONNECTORS**

- A. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity.
- B. Except for approved spliced-in connections, tracer wire shall be continuous and without splices from each trace wire access point.
- C. All recommendations of the manufacturer for the trace wire connectors shall be followed.
- D. Connectors shall be compatible with trace wire gauge approved for installation and be of a configuration to allow for "in-line" and/or "lateral" connections as applicable to complete the work.

- E. Connectors shall be rated for direct burial use and filled with silicone sealant to prevent corrosion at connection points and shall be watertight.
- F. The buried connectors shall meet the APWA Color-Code Standard for Identification of Buried Utilities.
- G. **Technical Provisions**
  - 1. Tracer wire connectors shall be as manufactured by:
    - a. TRACER-LOK by Pro-Line Safety Products, 3M DBR water tight connectors, or approved equal. (SID\_OFF)

**33.2.05 DETECTABLE WARNING TAPE**

- A. Underground marking tape shall be a 6 – inch width, detectable marking tape with a minimum 5.0 - mil overall thickness.
- B. The tape shall be manufactured using a 0.8 mil clear virgin polypropylene film, reverse printed and laminated to a 0.35 - mil solid aluminum foil core and then laminated to a 3.75 - mil clear virgin polyethylene film.
- C. The tape and markings shall be imperious to alkalis, chemical reagents, and solvents in the soil.
- D. The tape shall be solid colored or printed using a diagonally striped design for maximum visibility and shall meet the APWA Color-Code Standard for Identification of Buried Utilities.
- E. **Technical Provisions**
  - 1. Detectable Warning Tape shall be as manufactured by:
    - a. Pro-Line Safety Products, Reef Industries, or approved equal. (SID\_OFF)

**33.2.06 UTILITY MARKERS (POSTS)**

- A. The utility marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool.
- B. The utility marker shall be of a constant flat cross-sectional design with reinforcing support ribs incorporated longitudinally.
- C. The bottom end of the utility marker shall be pointed for ease of ground penetration.
- D. The utility marker shall resist displacement from wind and vehicle impact forces. (TP-3)
- E. The utility markers shall be U.V. resistant and provide daytime and nighttime delineation for utilities or other marking applications.
- F. The utility marker shall be wide enough to accommodate a 3 - inch wide reflector or decal.
- G. Decals shall be self-adhesive, retroreflective, and manufactured from quality U.V. resistant materials.
- H. The utility marker shall have a nominal length to provide minimum embedment depth of 18 - inches and maintain the minimum exposed marker length approved by the Engineer. (TP-4)
- I. The utility marker shall meet the APWA Color-Code Standard for Identification of Buried Utilities.
- J. **Technical Provisions**
  - 1. Utility Markers shall be as manufactured by:
    - a. Glasforms, or approved equal (SID\_OFF)
  - 2. Utility Markers shall be furnished with decals that read “AIR/VACUUM VALVE”, “FLUSHING HYDRANT” or “GATE VALVE” respectively, on both sides. (SID\_OFF)

3. Marker posts shall be flexible and able to withstand vehicle impacts as specified in part D of this subsection, over a temperature range of -80°F to 160°F. **(SID\_OFF)**
4. The marker posts nominal length as specified in part H of this subsection, shall be 66 - inches (4 - foot exposed length). **(SID\_OFF)**

**33.2.07 METALLIC UTILITY LOCATOR**

- A. If providing a utility locator is required, the locator shall operate on a 60 Hz signal for passive power locating and frequencies of 512 Hz, 8 kHz, and 83 kHz for active locating.
- B. The locator shall be capable of locating ferrous metals.
- C. The locator shall come with a hard case with high density foam inserts.
- D. **Technical Provisions**
  1. Contractor will not be responsible for providing a utility locator for this project. **(PRSP)**

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. These general construction requirements apply to the installation of detectable warning devices and signage for utilities.
- B. **Technical Provisions**
  1. Reserved

**33.3.02 TRACER WIRE**

- A. The trace wire shall be laid flat and securely affixed to the pipe at a minimum of 10' intervals to ensure that the wire remains adjacent to the pipe.
- B. The trace wire shall be protected from damage during the execution of the works. No breaks or cuts in the trace wire or insulation shall be permitted.
- C. At service saddles, the trace wire shall not be placed between the saddle and the main.
- D. Trace wire access points shall be within public right-of-way or public utility easements. **(TP-4)**
- E. Location of tracing wire access boxes and termination points shall be placed at the location shown on the Drawings and/or as specified herein. **(TP-1) (TP-3)**
- F. Trace wire access points shall be, in general, no more than 500' apart. Where the distance between suitable appurtenances exceeds 500', tracer boxes shall be installed equidistant between the adjacent appurtenances. **(TP-4)**
- G. At the point of connection between cast iron or ductile iron mains with any non-iron main, the tracer wire shall be properly connected to the iron pipe with an exothermic weld or approved equivalent bonding device to maintain electrical continuity. Tracer wire welds or bonding clamps shall be completely sealed with the use of an approved mastic type sealer specifically manufactured for underground use. Mastic shall be applied in a coat a minimum of 2 inches thick and shall be protected from contamination by the backfill material with the use of a plastic membrane.
- H. **Technical Provisions**
  1. Tracer wire is required along all mains and yard hydrant leads, and services. Access points and terminations as specified in part E of this subsection, shall be furnished at each yard hydrant and gate valve locations via a trace wire access box and have zinc anode or grounding rods installed at the connection to existing water services as applicable. Access boxes shall be placed immediately next to each hydrant or as shown on the Drawings. **(SID\_OFF)**
  2. Spliced connections between the main line tracer wire and branch connection tracer wire shall only be allowed at water main tees, crosses or at iron or copper water services where

a portion of the branch connection water main or water service is replaced with a non-iron or non-copper material. The branch connection tracer wire shall be a single tracer wire properly spliced to the main line tracer wire. Where the existing branch connection is neither iron nor copper, then the new branch connection tracer wire shall be properly spliced to the existing tracer wire on the branch connection. **(SID\_OFF)**

3. At all repair locations where there is existing tracer wire, the tracer wire shall be properly reconnected and spliced as outlined above. **(SID\_OFF)**
4. Tracer wire access boxes shall be located at a minimum at all gate valve locations. **(MSP)**
5. At all water main end caps or plugs, a minimum of 6' of tracer wire shall be extended beyond the end of the pipe, coiled and secured for future connections. The end of the tracer wire shall be furnished with a zinc anode or grounding rod buried at the same elevations as the water main. **(SID\_OFF)**
6. For directional drilling, auguring, boring, or pipe bursting installations two (2) tracer wires shall be pulled with each water main crossing. Tracer wires shall be attached to the pipe a minimum of 90° apart as measured radially around the circumference. **(PRSP-SID\_OFF)**

**33.3.03**      **DETECTABLE WARNING TAPE**

- A. Location of detectable warning tape shall be placed at the location shown on the Drawings and/or as specified herein.
- B. Detectable warning tape shall be buried a maximum 18 - inches below finish surface grade. **(TP-1)**
- C. **Technical Provisions**
  1. Placement of detectable warning tape as specified in part B of this subsection, shall be installed 24" to 36" above the top of all open cut water main, as approved by the Engineer. **(SID\_OFF)**

**33.3.04**      **UTILITY MARKERS (POSTS)**

- A. Location of utility markers shall be placed at the location shown on the Drawings and/or as specified herein.
- B. **Technical Provisions**
  1. Utility Markers shall be installed at all blow off hydrant, air/release valve and main-line gate valve locations, located outside of traveled roadways, as approved by the Engineer. **(SID\_OFF)**

End of Section

## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes the installation of all water utilities, fittings, mains, and appurtenances, appurtenant equipment, and all work included thereto as shown on the Drawings and specified herein.
- B. References made to ASTM, ANSI, NSF, AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material included herein shall conform to these standards where such standards exist.

### **33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - ASTM D2000 Rubber Products in Automotive Applications
  - ASTM A193 Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  - ASTM A536 Ductile Iron Castings
  - AWWA C104 Ductile Iron Cement-Mortar Lining
  - AWWA C110 Ductile Iron Fittings
  - AWWA C111 Ductile Iron Joints
  - AWWA C116 Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
  - AWWA C151 Ductile Iron Pipe
  - AWWA C153 Ductile Iron Compact Fittings
  - AWWA C213 Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Steel Water Pipelines
  - AWWA C219 Bolted, Sleeve-Type Couplings for Plain End Pipe
  - AWWA C301 Concrete Cylinder Pipe
  - AWWA C900 PVC Water Main Pipe
  - ANSI/NSF 61 Municipal Drinking Water System Components

### **33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILLING</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 01 12</b>	<b>INSPECTING AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 07.13</b>	<b>UTILITY DIRECTIONAL DRILLING</b>
<b>SECTION 33 05 33</b>	<b>POLYETHELENE UTILITY PIPE</b>
<b>SECTION 33 05 33.23</b>	<b>POLYETHELENE PRESSURE PIPE AND TUBING</b>
<b>SECTION 33 05 97.26</b>	<b>UTILITY DETECTABLE MARKINGS</b>
<b>SECTION 33 14 17</b>	<b>SITE WATER UTILITY SERVICE LATERALS</b>
<b>SECTION 33 14 19</b>	<b>VALVES AND HYDRANTS FOR WATER SERVICE UTILITY</b>

**33.1.04      SUBMITTALS**

- A. Furnish a manufacturer's certification covering all pipe and fittings furnished, certifying that the pipe and fittings meet applicable Specifications.
- B. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.
- C. **Technical Provisions**
  - 1. Reserved

**33.1.05      TESTING**

- A. Testing, Filling, Flushing, and Disinfecting of all water mains and associated pipe and appurtenances shall be performed in accordance with the provisions of **SECTION 33 01 12 INSPECTING AND TESTING OF WATER UTILITIES** of these Specifications.
- B. **Technical Provisions**
  - 1. Reserved

**PART 2      PRODUCTS**

**33.2.01      GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. Materials shall be of the type called for on the Plans or in the proposal and shall be in accordance with the following appropriate requirements. All materials shall meet the applicable ANSI/NSF Standards 60 or 61 including Annex G and be so certified by NSF, UL or other organizations accredited by ANSI to test and certify such materials.
- C. Assure all pipe is clearly marked showing type, class and/or thickness. Lettering must be legible and permanent under normal handling storage conditions.
- D. All ductile iron fittings shall be wrapped w/ polyethylene encasement as specified in **SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES** of these Specifications.
- E. Contractor will be required to have on hand the necessary fittings, valves, adaptors, and other material required to complete the project. If the Contractor is required to return any fittings, valves, etc., the cost of restocking shall be considered incidental to the project.
- F. **Technical Provisions**
  - 1. All nuts and bolts used for buried application shall be Stainless Steel per ASTM A193 with a "manufacturer's standard" coating, unless otherwise approved by Engineer. **(PRSP-GDV<sub>19</sub>)**

**33.2.02      DUCTILE IRON PIPE**

- A. Class 51 wall thickness meeting AWWA C151, American National Standard for Ductile Iron Pipe. **(TP-1)**
- B. Use underground pipe and fittings having mechanical or push-on joints meeting AWWA C111.
- C. Assure the pipe interior is cement mortar lined meeting AWWA C104 requirements. Assure the outside of the pipe surface for underground services is bituminous coal tar base coated 1 mil thick.
- D. **Technical Provisions**
  - 1. In place of pipe specified in part A of this subsection, ductile iron pipe shall meet Special Thickness Class 53 wall thickness meeting AWWA C151, American National Standard for Ductile Iron Pipe, unless otherwise specified. **(PRSP-SID\_MOD)**

**33.2.03**      **POLYVINYL CHLORIDE PIPE**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. PVC pipe will not be required for this project. (PRSP)

**33.2.04**      **CONCRETE PIPE**

- A. This section reserved.
- B. **Technical Provisions**
  - 1. Concrete water pipe will not be required for this project. (PRSP)

**33.2.05**      **HIGH DENSITY POLYETHYLENE PIPE (HDPE)**

- A. Minimum of DR 17 ductile iron pipe size.
- B. High density polyethylene pipe with diameters 4” through 63” shall meet the requirements of AWWA C906.
- C. **Technical Provisions**
  - 1. HDPE pipe installed via directional drilling methods shall be furnished in accordance with provisions of **SECTION 33 05 33.23 POLYETHYLENE PRESSURE PIPE AND TUBING** of these Specifications. (PRSP-FV<sub>19</sub>)
  - 2. High density polyethylene pipe, when specified shall conform to the provisions of **SECTION 33 05 33.23 POLYETHYLENE PRESSURE PIPE AND TUBING**. (PRSP)

**33.2.06**      **MECHANICAL JOINT RESTRAINTS**

- A. Mechanical joint restraints shall be furnished for the type of pipe being installed, as recommended by the manufacturer.
- B. The devices shall have a pressure rating equal to that of the pipe being installed.
- C. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland.
  - 1. Gland body, backup rings, wedges and wedge actuating components shall be ductile iron meeting or exceeding ASTM A536 and be compatible with all mechanical joints that conform to AWWA C111.
  - 2. Mechanical joint restraints shall have a fusion bonded epoxy coating.
- D. Tie rods and nuts shall meet or exceed the requirements of AWWA C111, or ASTM A193.
- E. **Technical Provisions**
  - 1. Mechanical joint restraints shall be fully wrapped in polyethylene encasement. (SID\_OFF)

**33.2.07**      **MECHANICAL BELL RESTRAINTS**

- A. Mechanical bell restraints shall be furnished for the type of pipe being installed, as recommended by the manufacturer.
- B. The devices shall have a pressure rating equal to that of the pipe being installed.
- C. Restraint device may consist to (2) split body serrated retainers/rings capable of gripping the plain end of the pipe being installed.
  - 1. Serrated retainers shall be ductile iron meeting or exceeding ASTM A536.
- D. Mechanical bell restraints shall have a fusion bonded epoxy coating.
- E. Tie rods and nuts shall meet or exceed the requirements of AWWA C111, or ASTM A193.
- F. **Technical Provisions**
  - 1. Mechanical joint restraints shall be fully wrapped in polyethylene encasement. (SID\_OFF)

**33.2.08     PIPE FITTINGS**

- A. Fittings shall be made of ductile iron having a minimum pressure rating of 250 psi.
- B. Fittings shall be mechanical joint fittings in accordance with either AWWA C153 (Compact) or AWWA C110 (Full Body). **(TP-2)**
- C. Flanged fittings shall not be used for underground installation unless otherwise specified.
- D. Fitting joints shall meet the applicable requirements of AWWA C111.
- E. Fittings shall be furnished with a cement mortar lined interior meeting the applicable requirements of AWWA C104. **(TP-1)**
- F. Exterior coating shall be 1 mil thick bituminous tar, unless otherwise specified. **(TP-1)**
- G. **Technical Provisions**
  - 1. Coatings for all ductile or gray iron pipe fittings as specified in part E and F of this subsection, shall have a fusion bonded epoxy (FBE) exterior and interior coating in accordance with AWWA C116. **(SID\_OFF)**
  - 2. All fittings as specified in part B of this subsection shall be compact mechanical joint fittings having a working pressure rated to 350 psi. **(MPW)**

**33.2.09     PIPE SLEEVES**

- A. Sleeves shall be made of cast or ductile iron having a minimum pressure rating of 250 psi.
- B. Sleeves shall be mechanical joint fittings in accordance with either AWWA C153 (Compact) or AWWA C110 (Full Body). **(TP-1)**
- C. Sleeve joints shall meet the applicable requirements of AWWA C111.
- D. Fittings shall be furnished with a cement mortar lined interior meeting the applicable requirements of AWWA C104. **(TP-2)**
- E. Exterior coating shall be 1 mil thick bituminous tar, unless otherwise specified. **(TP-2)**
- F. Sleeves shall be long body type, with a minimum length of 12”.
- G. A mechanical restraint or mechanically restrained ductile iron sleeve shall be employed to restrain joints between pipes of dissimilar material (i.e. fusible PVC to HDPE), unless otherwise approved by the Engineer.
  - 1. Mechanical restraints for HDPE pipe require insert stiffeners.
- H. **Technical Provisions**
  - 1. All pipe sleeves as specified in part B of this subsection, shall be compact mechanical joint fittings having a working pressure rated to 350 psi.
  - 2. Coatings for all ductile or gray iron pipe sleeves as specified in part E and F of this subsection, shall have a fusion bonded epoxy (FBE) exterior and interior coating in accordance with AWWA C116. **(SID\_OFF)**

**33.2.10     PIPE COUPLINGS**

- A. Coupling components shall be ductile iron meeting or exceeding ASTM A536 and have a minimum pressure rating of 250 psi. **(TP-2)**
- B. Couplings shall meet the applicable requirements of AWWA C219.
- C. Couplings shall be furnished with a fusion-bonded epoxy coating in accordance with AWWA C213.
- D. Gaskets for couplings shall be SBR or NBR compounded for water service per ASTM D2000.
- E. Provide couplings with manufacturer's recommended model for the types of pipe being joined.

F. **Technical Provisions**

1. Pipe Couplings shall be as manufactured by:
  - a. Romac, Rockwell, Dresser, or approved equal. Hymax will not be considered an approved equal. (PRSP-GDV<sub>19</sub>)
2. Steel couplings shall not be used for underground installation unless otherwise specified. (SID\_OFF)

**33.2.11 FLEXIBLE CONNECTORS**

A. This section reserved.

B. **Technical Provisions**

1. Flexible connectors will not be required for this project. (PRSP)

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. Install pipe following the manufacturer's Specifications and instructions. Provide all tools and equipment required to install each type of pipe used.
- B. The Contractor is responsible for all Contractor furnished material. Replace all defective material or material damaged by handling after delivery by the manufacturer. This includes the furnishing of all materials and labor required to replace installed material discovered damaged or defective before final acceptance of the work, or during the guarantee period. (TP-1) (TP-2)
- C. Store all material safely and to prevent damage. Keep pipe interior and other accessories free from dirt and foreign matter at all times.
- D. Deliver and distribute all Contractor furnished pipe at the site. Load and unload pipe, fittings, specials, valves and accessories to prevent damage. Do not permit pipe handled on skidways to skid or roll against pipe already on the ground.
- E. When distributing material at the work site, lay each piece adjacent to its installation point. Repair or replace all damaged pipe at Contractor's expense on the jobsite.
- F. Remove all water in the trench during pipe laying and maintain a dry trench until the pipe ends are sealed. Do not permit the pipe to float. Do not allow any trench water to enter the pipe at any time.
- G. Excavation and backfilling of utility trenches shall be in conformance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILLING** of these Specifications.
- H. Water utilities to be installed via trenchless technologies shall be furnished and installed in accordance with the provisions of **SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING** of these Specifications.
- I. **Technical Provisions**
  1. Sewer service laterals were not located and have not been included on Drawings. Contractor shall have on hand the necessary pipe and fittings to make necessary repairs during the course of construction. Cost for said repairs shall be incidental to the cost of installing water main. (PRSP-FV<sub>19</sub>)

**33.3.02 VALVE OPERATION**

- A. The Owner shall operate all existing valves as necessary. The Contractor shall notify the Engineer's on-site representative that valves need to be operated and which valves need to be on and off. The notification shall be made in writing a minimum of 48 hours before the valves need to be operated excluding Saturdays, Sundays, and Holidays. (TP-1)
- B. The Contractor shall not operate any existing valves except for emergency situations.
- C. The Contractor shall operate all new valves until the date of substantial completion.

**D. Technical Provisions**

1. The “Owner” as specified in Part A of this subsection is the City of Glendive. **(MSP)**
2. In addition to the information stated in parts A through C of this subsection, the Contractor is hereby cautioned that all water valves shall be operative and available at all times. Water valves shall only be operated by City Public Works Department personnel, and only during normal business hours (weekdays between 8:00 AM and 5:00 PM), unless specifically agreed to. The Contractor is required to request valve operation to the Engineer four (4) working days prior to the requested time. The Engineer shall have two (2) full working days to receive and review each request prior to forwarding it to The City. The City requires a minimum of 48 hours notice on any involvement that will require City personnel to be on the job. **(PRSP-SID\_MOD)**

**33.3.03 CONNECTING TO EXISTING WATER MAINS**

- A. Make all connections to existing water mains in use unless otherwise specified. Furnish the special fittings, as shown on the plans, and all other material required. Make all necessary excavations to assure gradual transition between the new and existing water main, and perform all necessary backfilling.
- B. Where the connection of new work to old requires a service interruption and customer notification, the Engineer and the Contractor are to mutually agree upon a date for connections to permit adequate time to assemble labor and materials, and to notify all affected customers. All notifications are the Contractor’s responsibility.
- C. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. All equipment, materials, and labor that the Contractor plans to have available shall be coordinated with the Owner and Engineer in order to ensure the work is done in the minimum amount of time.
- D. When the connection is made by using tapping sleeves and valves, the outside of the existing main and inside of the sleeve and valve shall be thoroughly cleaned with a solution of chlorinated lime and water. After installing tapping sleeve and valve and before tapping existing main, place calcium hypochlorite inside the sleeve and valve. When connection to existing fittings and the existing main has been opened, place calcium hypochlorite inside existing fitting.
- E. Existing valves or gates used to isolate certain structures may not be watertight and some leakage may occur. The Contractor shall provide the necessary temporary plugs and/or plumbing facilities to handle any leakage.
- F. All materials and equipment (including emergency equipment) necessary to expedite tie-ins shall be on hand prior to the shutdown or existing services or utilities.
- G. **Technical Provisions**
  1. No overnight water outages shall be allowed. **(SID\_OFF)**
  2. Work shall proceed continuously (around the clock) if necessary to complete the connections in the minimum time. Operation of valves or other appurtenances on existing facilities, when required, shall be by or under the direct supervision of the Municipal Owner. **(SID\_OFF)**
  3. Contractor shall allow ample time for existing mains to drain prior to making connections. Contractor shall be cautioned that existing gate valves may not have a 100% kill on existing mains, requiring Contractor to complete necessary connections in a “wet condition”. **(SID\_OFF)**

**33.3.04 LAYING OF PIPE**

- A. Inspect the pipe and pipe coating for damage or defects before installation. Lay pipe without damaging the pipe coating. Repair all pipe coating damage following the manufacturer’s instructions before laying the pipe. When using belt slings to lower the pipe into the trench, remove the slings without damaging the pipe coating.

- B. Lay pipe to the specified lines and grades with fittings and valves at the required locations. Plumb all valve stems.
- C. Grade and alignment on un-graded streets will be provided using hubs set parallel to the pipe line, and on graded streets from established points on the existing curbs or sidewalks, when directed by the Engineer. Excavate pipe trenches to the lines and grades given or to the standard cover depth specified. Trenching and excavation for piping shall be performed in accordance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILL** of these Specifications.
- D. Transfer lines and grades to the pipe from hubs or from existing concrete curbs or sidewalks as an incidental part of this work.
- E. Use implements, tools and facilities satisfactory to the Engineer for the safe and convenient prosecution of the work. Carefully lower all pipe, fittings and valves into the trench using a derrick, rope or other tools or equipment, without damaging pipe materials and protective coatings and linings. Do not drop or dump materials into the trench.
- F. Take every precaution to prevent foreign material from entering the pipe as it is placed in the line. During laying operations, do not permit debris, tools, clothing or other materials to be placed in the pipe. At times when pipe laying is not in progress, close the open ends of the pipe using a watertight plug or other approved methods to prevent material entering the pipe.
- G. Place pipe bedding in the bottom of the trench meeting provisions of **SECTION 31 23 33 TRENCHING AND BACKFILL**. Voids may be left in the bedding material to remove pipe slings and for pipe bells to allow support along the full length of the pipe barrel.
- H. Long radius curves, either horizontal or vertical, may be laid with standard pipe with deflections at the joints where approved. If the pipe is shown curved on the plans and no special fittings are shown, assume that the curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.
- I. The Contractor shall determine the method of deflection or curving where required but not specified, methods shall not cause pipe to deflect in a manner that exceeds manufacturers recommendations. Additional payment will not be made for laying pipe on planned curves, nor for field changes involving standard pipe lengths deflected at the joints.
- J. Do not exceed the applicable material and joint Specifications of AWWA or the pipe manufacturer's recommendations at pipe joints for various types of pipe. When rubber gasketed pipe is laid on a curve, joint the pipe in a straight alignment and then deflect to the curved alignment. Excavate trenches to accommodate deflections and curves.
- K. Thrust blocking for tees, plugs, valves, reducers, caps and bends deflecting 22 1/2 - degree or more shall be furnished and installed in accordance with the provisions of **SECTION 31 05 00 COMMON WORK RESULTS FOR UTILITIES** of these Specifications.
- L. Cut pipe for inserting valves, fittings or closure pieces in a neat and workmanlike manner without damaging the pipe or coating and leaving a smooth end at right angles to the pipe axis. Do not cut pipe using an oxyacetylene torch.
- M. **Technical Provisions**
  - 1. Reserved

**33.3.05 PIPE JOINTING**

- A. Rubber Gasket, "Push-On" Joints
  - 1. Follow the manufacturer's recommendations for jointing of pipe and fittings with a rubber gasket, "push-on" type. Wipe the rubber gasket and gasket seat inside the bell clean with a cloth. Wipe the plain end of the adjoining pipe clean, lubricate and insert into the bell to make contact with the gasket. Force the plain end "home" using a crow bar, fork tool, or jack assembly.

**B. Mechanical Joints**

1. Thoroughly brush the bell and the outside of the spigot of the mechanical joint fitting with a wire brush to remove all loose rust or other foreign material just before assembly. Brush the cleaned surfaces with soapy water just before slipping the gasket over the spigot end and into the bell.
2. Center the spigot end of the pipe or fitting in the bell before jointing is begun. Once the gasket is in place, bring the gland up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Partially tighten the bolts, alternately around the socket, maintaining approximately equal tension until the final tension is reached.
3. Use the following bolt torque range for the joints:

<u>Bolt Size</u>		<u>Range of Torque</u>	
<u>Inch</u>	<u>(Millimeters)</u>	<u>Ft. – Lb.</u>	<u>(Joules)</u>
5/8	(16)	40 – 60	(54 – 81)
3/4	(19)	60 - 90	(81 – 122)
1	(25)	70 - 100	(95 – 135)
1 - 1/4	(32)	90 - 120	(122 – 163)

4. Apply the torque loads with torque measuring or indicating wrenches, or apply using regular socket wrenches, checked with torque wrenches.
5. If the joint is not sealed using the maximum torque indicated above, disassemble and re assemble the joint after thorough cleaning. Do not overstress bolts to provide the seal.
6. Anti-seize compound shall be applied to each bolt in accordance with the manufacturer's recommendations.

**C. Technical Provisions**

1. All pipe joints located within 19 – feet either side of ductile iron fittings shall be restrained, unless otherwise approved by Engineer. **(SID\_OFF)**

**END OF SECTION**

## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes the installation of water services, fittings, joints, appurtenances, equipment, and all work included thereto as shown on the Drawings and specified herein.

### **33.1.02 REFERENCES**

- A. The current publications listed below form a part this Specification.
- B. Standards
- |             |  |
|-------------|--|
| ASTM B88    | Standard Specification for Seamless Copper Water Tube  |
| ASTM D2239  | Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter        |
| ASTM D2737  | Standard Specification for Polyethylene (PE) Plastic Tubing  |
| ASTM D3350  | Standard Specification for Polyethylene Plastics Pipe and Fittings Materials                                   |
| AWWA C800   | Underground Service Line Valves and Fittings   |
| AWWA C900   | Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.                           |
| AWWA C901   | Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. Through 3 In., for Water Service                             |
| AWWA C909   | Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. and Larger                                 |
| ANSI/NSF 61 | Municipal Drinking Water System Components   |
| WW-T-799F   | Federal Specification: Tube, Copper, Seamless, Water (for use with solder-flared or compression type fittings) |

### **33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILLING</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS</b>
<b>SECTION 33 01 12</b>	<b>INSPECTING AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 07.13</b>	<b>UTILITY DIRECTIONAL DRILLING</b>
<b>SECTION 33 05 97.26</b>	<b>UTILITY DETECTABLE MARKINGS</b>

### **33.1.04 SUBMITTALS**

- A. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.

B. **Technical Provisions**

1. Reserved

### **33.1.05 TESTING**

- A. Testing, Filling, Flushing, and Disinfecting of all water mains/services and associated pipe and appurtenances shall be performed in accordance with the provisions of **SECTION 33 01 12 INSPECTION AND TESTING OF WATER UTILITIES** of these Specifications.

B. **Technical Provisions**

1. Reserved

## **PART 2 PRODUCTS**

### **33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. Materials shall be of the type called for on the Drawings or in the proposal and shall be in accordance with the following appropriate requirements. All materials shall meet the applicable ANSI/NSF Standards 60 or 61 including Annex G and be so certified by NSF, UL or other organizations accredited by ANSI to test and certify such materials.
- C. **Technical Provisions**
  - 1. The exact size and type of existing water service are unknown. Contractor shall verify size and type of existing service and acquire the necessary fittings, valves, adaptors, and other material required to complete the project. This includes having a small quantity of service line fittings not necessarily called out on the plans. If the Contractor is required to furnish or return any fittings, valves, etc. the cost of supplying and/or restocking the necessary fittings shall be considered incidental to the project. **(PRSP-FV<sub>19</sub>)**
    - a. All water service connections shall have a 1" nominal diameter. **(PRSP-FV<sub>19</sub>)**

### **33.2.02 WATER SERVICE PIPE**

- A. Pipe shall be clearly marked showing type, class and/or thickness. Lettering must be legible and permanent under normal handling and storage conditions.
- B. Standard sizes for water services are ¾, 1, 1 ½, 2, 4, 6, or 8 – inches.
- C. Polyethylene water service pipe, when specified, shall conform to ASTM D3350 and AWWA C901. Having a minimum pressure rating of 200 psi operating pressure. **(TP-1)**
- D. Copper water service pipe, when specified, shall be Type K, conforming to WW-T-799 or ASTM B88, and in accordance with AWWA C800, with compression couplings to connect to existing service lines.
  - 1. Straight lengths shall be used for 1 ½-inch and 2-inch services.
- E. Under no circumstances shall service pipe be constructed of galvanized steel.
- F. **Technical Provisions**
  - 1. Water service pipe as specified in Part C of this Subsection, shall be CTS DR 17 PE4710 HDPE conforming to ASTM D2737, 125 psi minimum operating pressure. **(SID\_OFF)**

### **33.2.03 SERVICE CLAMPS (SADDLES)**

- A. Service clamps shall conform to AWWA C800 and be compatible with both the water main to be tapped and the water service pipe and fittings being installed as specified herein.
- B. Assure service clamps for water mains provide full support around the circumference of the pipe with a bearing area of sufficient width along the axis of the pipe so the pipe is not distorted when the clamp is tightened.
- C. Tightening lugs shall be provided that will not damage the pipe during installation.
- D. **Technical Provisions**
  - 1. Reserved

### **33.2.04 CORPORATION STOPS**

- A. Corporation stops shall be made of brass, conform to AWWA C800, and be compatible with the service clamps, water service pipe, and fittings being installed as specified herein.
- B. Corporation stops shall be ball-type valves.

C. **Technical Provisions**

1. Corporation stops shall be as manufactured by:
  - a. Mueller (Series 300 & 110 - B25008), Ford “Quick Joint” (Q Series - FFB1000XQ), A.Y. McDonald “McQuick” (Q Series – 74701BQ), or approved equal. **(SID\_OFF)**
2. Corporation stops shall have inlets of standard AWWA Taper C.C. threads and outlet connections of compression or Insta-Tite connections. **(PRSP-GDV<sub>19</sub>)**

**33.2.05 CURB STOPS**

A. Curb stops shall be brass, conform to AWWA C800, and shall be compatible with the water service pipe being installed as specified herein.

B. Curb stops shall be ball-type valves.

C. **Technical Provisions**

1. Curb Stops shall be as manufactured by:
  - a. Mueller 300 Series ball valve, Mueller B-25155, Ford B44- XXXMQ series "Quick Joint" connection, or approved equal. **(PRSP-GDV<sub>19</sub>)**
2. Curb stops shall be Minneapolis pattern and screw box mount with a bronze plug and tee head key. Valve shall be one-quarter turn full on-off. Inlet/outlet connections shall be compression connections or Insta-Tite with both connections being of the same type. **(PRSP-GDV<sub>19</sub>)**

**33.2.06 CURB BOXES**

A. Metal curb boxes shall be extension type compatible with the curb stops being installed as specified herein.

B. Curb stop boxes shall be furnished with a 2-inch cast iron curb stop box lid with an integrally cast brass bushing and cast iron pentagon plug.

C. **Technical Provisions**

1. Curb boxes shall be as manufactured by:
  - a. Mueller H-10300 series, Mueller H-10380 series, Ford EM2-65 series, A.Y. McDonald 5614 and 5615, or approved equal. **(PRSP-GDV<sub>19</sub>)**
2. Curb boxes shall be furnished having an extended length that will allow for approximately 6 – inches of adjustment up or down from finish grade. **(SID\_OFF)**

**33.2.07 SERVICE PIPE COUPLINGS**

A. Service pipe couplings shall conform to AWWA C800 and be either compression or stab in type couplings sized and configured for the material of the pipes being joined.

B. Stainless steel pipe inserts will be required when coupling to polyethylene pipe and at all compression or pack joint connections.

C. Stainless steel inserts for stab-in type couplings are required only if specifically recommended by the manufacturer.

D. **Technical Provisions**

1. Couplings shall be as manufactured by:
  - a. Mueller H15403, Ford C44-xx-Q style, McDonald 4758Q for 3/4, 1, 3/4 by 1, and 1 by 1 1/2 – inch, or approved equal; **(PRSP-GDV)**
2. Fittings required for connections into existing service lines shall be brass compression type fittings. **(SID\_OFF)**

**33.2.08**      **METER PIT**

- A. Meter pits shall be of the coil type, furnished with brass fittings meeting AWWA C800 and ANSI/SNF 61.
- B. The meter pit shell shall be PVC with minimum wall thickness of 0.300 - inches, 18 – inches in diameter, and furnished to meet the depth of bury for the water main/service being installed.
- C. Meter pit shall be furnished with a cast iron side-locking lid.
- D. Coils shall be 1 – inch polyethylene tubing.
- E. **Technical Provisions**
  - 1. Meter pits will be utilized for the air-release valve assemblies for this project. **(MSP)**
  - 2. Refer to Section 33 14 19 for the specifications on the combination air-release valve.
  - 3. Meter pits shall be as manufactured by:
    - a. Mueller Thermal-Coil, Ford Coil Pit Setter, A.Y. McDonald Coil Pit Setter, or approved equal. **(SID\_OFF)**

**PART 3 EXECUTION**

**33.3.01**      **GENERAL**

- A. The Contractor shall install pipe and appurtenances following the manufacturer’s recommendations and instructions. The Contractor shall provide all tools and equipment required to install each type of pipe used.
- A. The Contractor is responsible for all Contractor furnished material. Replace all defective material or material damaged by handling after delivery by the manufacturer. This includes the furnishing of all materials and labor required to replace installed material discovered damaged or defective before final acceptance of the work, or during the guarantee period.
- B. All materials shall be stored safely to prevent damage. Pipe interiors and other accessories shall be kept free from dirt and foreign matter at all times.
- C. The Contractor shall load and unload delivered pipe, fittings, valves, and accessories in a manner that will prevent damage.
- D. The Contractor shall distribute material to the work site, such that each piece is laid adjacent to its installation point for Contractor inspection prior to installation.
- E. All water must be removed from the trench during installation. A dry trench shall be maintained until the pipe ends are sealed and the trench is backfilled.
- F. Excavation and backfilling of utility trenches shall be in conformance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILLING** of these Specifications.
- G. Water utilities to be installed via trenchless technologies shall be furnished and installed in accordance with the provisions of **SECTION 33 05 07.13 UTILITY DIRECTIONAL DRILLING** of these Specifications.
- H. **Technical Provisions**
  - 1. Reserved

**33.3.02**      **TAPPING**

- A. Tapping shall be performed with an approved tapping machine, using clean, sharp drill taps and/or shell cutters.
- B. Direct tapping into AWWA C900 PVC pipe without service saddles is not permitted.

- C. 3/4 - inch and 1 - inch taps may be made directly into the barrel of ductile iron pipe without using service saddles. The direct tap shall be to a depth exposing a maximum three threads of the corporation stop.
- D. Direct tap sizes shall be a maximum of 1 1/2 - inch for 6 - inch diameter mains, and 2 - inch for larger mains.
- E. **Technical Provisions**
  - 1. Contractor shall tap the newly installed water mains unless specified otherwise.

**33.3.03 SERVICE LINE INSTALLATION**

- A. The Contractor shall provide all work and materials for the complete service line installation, including all water service pipe, taps, service clamps, corporation stops, curb stops and boxes, and fittings as indicated on the Drawings.
- B. Curb stops and points of connection to existing service lines shall be as shown on the Drawings or as specified herein. Final locations shall be verified in the field and approved by Engineer.
- C. Contractor shall verify connection procedures for existing water service lines encountered during construction that were not included on the Drawings prior to proceeding with the work.
- D. Polyethylene water service lines shall be bent into a figure “S” adjacent to the water main in a horizontal plane to avoid a rigid connection. Vertical “S” bends will not be allowed.
- E. **Technical Provisions**
  - 1. Reserved

**END OF SECTION**

---

**PART 1 GENERAL**

**33.1.01 DESCRIPTION**

- A. This Specification includes the installation of all water utility distribution valves, hydrants, and appurtenant equipment and all work included thereto as shown on the Drawings and specified herein.
- B. References made to ASTM, ANSI, AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material included herein shall conform to these standards where such standards exist.
- C. Furnish a manufacturer's certification covering all pipe and fittings furnished, certifying that the pipe and fittings meet applicable Specifications.

**33.1.02 REFERENCES**

- A. The current publications listed below form a part of this Specification.
- B. Standards
  - AWWA C104 Ductile Iron Cement-Mortar Lining
  - AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems
  - AWWA C110 Ductile Iron Fittings
  - AWWA C111 Ductile Iron Joints
  - AWWA C151 Ductile Iron Pipe
  - AWWA C153 Ductile Iron Compact Fittings
  - AWWA C500 Gate Valves
  - AWWA C502 Fire Hydrants
  - AWWA C504 Butterfly Valves
  - AWWA C507 Ball Valves
  - AWWA C509 Gate Valves
  - AWWS C515 Reduced-Wall, Resilient Seated Gate Valves for Water Service
  - AWWA C550 Protective Interior Coatings for Valves and Hydrants
  - AWWA C900 PVC Water Main Pipe
  - ASTM A48 Gray Iron Castings
  - ASTM A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
  - ASTM A536 Ductile Iron Castings
  - ANSI/NSF 61 Municipal Drinking Water System Components

**33.1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILLING</b>
<b>SECTION 33 01 12</b>	<b>INSPECTING AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 97.26</b>	<b>UTILITY DETECTABLE MARKINGS</b>
<b>SECTION 33 14 13</b>	<b>PUBLIC WATER UTILITY DISTRIBUTION PIPING</b>
<b>SECTION 33 14 17</b>	<b>SITE WATER UTILITY SERVICE LATERALS</b>

**33.1.04 SUBMITTALS**

- A. Shop drawings shall be submitted for valves, hydrants and other appurtenances and shall be submitted in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES** of these Specifications.

B. **Technical Provisions**

1. Reserved

**33.1.05 TESTING**

- A. Testing, Filling, Flushing, and Disinfecting of all water mains/services and associated pipe and appurtenances shall be performed in accordance with the provisions of **SECTION 33 01 12 INSPECTION AND TESTING OF WATER UTILITIES** of these Specifications.

B. **Technical Provisions**

1. Reserved

**PART 2 PRODUCTS**

**33.2.01 GENERAL**

- A. Refer to Related Work sections for applicable product details if not included herein.
- B. Flanged pipe and fittings shall not be used for buried lines unless noted otherwise on the Drawings.
- C. **Technical Provisions**
1. All valves shall be equipped with thrust blocking in accordance with the provisions of **SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES** of these Specifications. **(SID\_MOD)**

**33.2.02 GATE VALVES**

- A. Gate valves shall be iron body, resilient-seated or double disc conforming to pressure rating specified in AWWA Standard C509 or C500. **(TP-3)**
- B. Assure stem seals are double “O” ring seals capable or replacing the seal above the stem collar with the valve under pressure in full open position.
- C. All gate valves shall be mechanical joint with 2-inch operating nut; or dimensions meeting the municipal body’s current standards, and shall be opened by turning counter-clockwise.
- D. Gate valves shall have a non-rising stem and shall have a clear waterway opening equal to the full nominal diameter of the valve.
- E. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.
- F. Valves to be equipped with push-on or mechanical joints for pipe connections, and unless otherwise specified shall be thrust blocked.
- G. Each valve shall have the maker’s monogram or initials, pressure rating and year of manufacturer cast on the body.
- H. All direct buried gate valves shall be wrapped with polyethylene encasement conforming to the requirements of AWWA C105.
- I. **Technical Provisions**
1. Gate Valves shall be as manufactured by:
    - a. Mueller, American Darling, Kennedy, or approved equal **(PRSP-SID\_MOD)**
  2. Gate valves shall have a fusion bonded epoxy (FBE) exterior coating. **(SID\_OFF)**
  3. Pressure rating for Gate Valves as specified in part A, of this subsection, shall be pressure rated per AWWA C509/C515. **(PRSP-SID\_MOD)**
  4. Unless designated otherwise, resilient seated gate valves shall be used on lines from 3 inch up to and including 12 - inch. **(PRSP-SID\_MOD)**

**33.2.03 BUTTERFLY VALVES**

- A. This section reserved.

B. **Technical Provisions**

1. Butterfly valves will not be required for this project. (PRSP)

**33.2.04 PLUG VALVES**

A. This section reserved.

B. **Technical Provisions**

1. Plug valves will not be required for this project. (PRSP)

**33.2.05 COMBINATION AIR RELEASE/VACUUM VALVE (MSP)**

- A. The combination air valve shall conform to AWWA C512 and perform the functions of an air release valve and an air & vacuum valve.
- B. Valves 3-inch and smaller shall have a 1-inch NPT inlet and outlet with a minimum 150 PSI pressure rating.
- C. The valve body and cover shall be made from cast iron conforming to ASTM A126 Class B. The cover shall be bolted to the body and all internal components shall be replaceable through the cover.
- D. The float ball shall be spherical and made from Type 316 stainless steel. Non-metallic float balls are not acceptable.
- E. The seat shall be replaceable and made from Buna-N rubber or other suitable elastomer compounds.
- F. The exterior of the valve shall be shop coated with enamel primer.

G. **Technical Provisions**

1. Combination air release/vacuum valve shall be manufactured by:
  - a. GA Industries Model 945 or approved equal. (MSP)

**33.2.06 VALVE BOXES**

- A. Valve boxes for gate valves and plug valves shall be three piece cast iron, adjustable screw type valve box, with a 5 1/4 - inch shaft diameter.
- B. The bottom part of the box shall have a bell conforming to the perimeter of the valve. (TP-4)
- C. Valve box shall be of sufficient length for the pipe bury. (TP-3)
- D. Valve box castings shall be hot coated inside and outside with a rust resisting coating.
- E. Covers shall be provided with slots for easy and quick removal, and have an arrow indicating the opening direction.
- F. Covers shall be unlabeled with the exception of valves on potable water lines which have the word "WATER" cast onto the lid.
- G. The valve box covers shall be extra deep and fit the valve box snugly to prevent rattles or tipping due to traffic.
- H. Assure that valve box and corresponding valve nut set true vertical and demonstrate to the Engineer's satisfaction that the key may be placed easily on the nut without interference from the valve box walls. If key does not easily fit to the nut, excavate, reset the box, and if necessary the valve, and repeat the test.

I. **Technical Provisions**

1. Valve Boxes shall be manufactured by:
  - a. Sigma, Tyler or approved equal (PRSP-GDV<sub>19</sub>)
2. All valve boxes as specified in this subsection shall be furnished with a 2" valve box riser as furnished by Trumbull, or approved equal. (SID\_OFF)
3. Depth of cover and valve box length will vary along the project. Contractor shall have on hand variable lengths and extensions in order to complete the work.

4. Valve box base as specified in part B of this subsection shall be 8560 style #6 base. (PRSP-GDV<sub>19</sub>)

**33.2.07 VALVED TAPPING SLEEVE**

- A. This section reserved.
- B. **Technical Provisions**
  1. Valved tapping sleeves will not be required for this project. (PRSP)

**33.2.08 FIRE HYDRANTS**

- A. This section reserved.
- B. **Technical Provisions**
  1. Fire hydrants will not be required for this project. (PRSP)

**PART 3 EXECUTION**

**33.3.01 GENERAL**

- A. Wrap all direct bury cast iron pipe and fittings including hydrants, valve boxes, and other metal parts and surfaces in polyethylene encasement.
- B. For related general pipe and appurtenance information, refer to the provisions of **SECTION 33 14 13 PUBLIC WATER UTILITY DISTRIBUTION PIPING** of these Specifications.
- C. Trenching and Excavation shall be performed in accordance with the provisions of **SECTION 31 23 33 TRENCHING AND BACKFILL** of these Specifications.
- D. **Technical Provisions**
  1. None

**33.3.02 VALVES**

- A. Set and joint gate valves, butterfly valves, and plug valves to the pipe as specified for pipe laying and jointing. Set valves with operating nut vertical. Center and plumb valve boxes over the operating nut to prevent shock or stress being transmitted to the valve.
- B. Valve Boxes
  1. Center and plumb valve boxes over the valve operating nut. Set valve box tops flush with the ground surface or street surfacing.
  2. Place bedding gravel around all water main valves and under the valve box bottom to drain any water entering the valve box.
  3. When specified, install valves with thrust blocks and anchor rods meeting minimum requirements as lined out in **SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES** of these Specifications, verify with Engineer if rebar is required.
- C. **Technical Provisions**
  1. Reserved

**END OF SECTION**

---

## **PART 1 GENERAL**

### **33.1.01 DESCRIPTION**

- A. This Specification includes, but is not limited to, the furnishing and installation of one (1) factory-built, factory delivered, grade mounted automatic water booster pumping station with all equipment factory installed on a welded steel, structurally reinforced base, and enclosed by a factory manufactured modular building with other appurtenant structures as specified in the Contract Documents and this section.
- B. The internal equipment shall include three pumps and motors, piping and valves, fittings, supports, control valves(s), ventilation system, heater, automatic central control panel with starters and breakers, all internal wiring, and other appurtenances as specified in the Contract Documents and this section.
- C. The pumping station shall be complete when delivered and will not require internal contractor construction except to install the electrical power service through the service conduit provided for that purpose, to connect the underground main water and floor drain piping to the required points from the manufacturer, install gutters/downspouts/splash blocks and other work as may be listed in the Contract Documents.
- D. The pumping station shall meet the requirements of Montana Circular DEQ 1, Chapter 6, Pumping Facilities.
- E. References made to ASTM, ANSI, NSF, AWWA, USASI or AASHTO designations shall be the latest revision at the time of call for bids; all specified material including pipe, fittings, valves, and others included herein shall conform to these standards where such standards exist.

### **33.1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following items of Related Work are specified and included in other sections of these Specifications.

<b>SECTION 01 22 19</b>	<b>MEASUREMENT AND PAYMENT</b>
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>
<b>SECTION 03 05 00</b>	<b>COMMON WORK RESULTS FOR CONCRETE</b>
<b>SECTION 31 05 00</b>	<b>COMMON WORK RESULTS FOR EARTHWORK</b>
<b>SECTION 31 23 33</b>	<b>TRENCHING AND BACKFILLING</b>
<b>SECTION 32 05 00</b>	<b>COMMON WORK RESULTS FOR EXTRERIOR IMPROVEMENTS</b>
<b>SECTION 33 01 12</b>	<b>INSPECTING AND TESTING OF WATER UTILITIES</b>
<b>SECTION 33 05 00</b>	<b>COMMON WORK RESULTS FOR UTILITIES</b>
<b>SECTION 33 05 07.13</b>	<b>UTILITY DIRECTIONAL DRILLING</b>

### **33.1.03 SUBMITTALS**

- A. Pre-Bid Submittal Documents
  - 1. Along with the requirements for post-bid submittal documents per the below requirements, all alternate manufacturers submitting on alternate equipment, without exception, shall furnish to the Engineer 14 days prior to the bid date, containing at a minimum:
    - a. A plan view of all mechanical equipment, piping and devices necessary to system operation and with NEC electrical clearances;
    - b. An affidavit signed by an officer of the station manufacturer attesting to the fact that the building and building manufacturer intended for use on the project has in the past obtained State of Montana Certification for the building to be provided or certification that they will provide any and all modifications necessary to obtain said certification at no additional cost to the Owner. Building shall meet the requirements of the International Building Code (IBC), as adopted by the State of Montana, at the time the building permit is applied for.

2. Alternate station manufacturers shall have a minimum of 200 units of similar type stations installed and operated for no less than 10 years. A certificate of conformance with this requirement shall be furnished by the manufacturer.
3. References: A list of five (5) domestic municipal potable water supply installations of equivalent size, capacity and scope including the required controls in potable water service where equipment manufactured by the booster system manufacturer is currently in service. Include contact name, telephone number, and mailing address of the municipality(s) of installation, Engineer, Owner, and date of installation.
4. Standards and Agency Testing: List the standards and agency listing governing the fabrication, construction, assembly, wiring, and mounting of the components, assemblies and furnished booster system as stipulated herein. Include a full-size photocopy of the manufacturer's Underwriters Laboratories (UL) label attesting to the compliance of the station equipment under the Packaged Pumping Systems (QCZJ) UL Listing Category and/or Intertek Testing Services (ETL) label attesting to the compliance of the station equipment under Packaged Pumping Systems. The ETL label shall state the station conforms to UL STD 778 and is certified to CAN/CSA STD C22.2 No. 108. This listing is to be signed by an officer of the company and so notarized.
5. The Engineer shall review the pre-bid submittal documents and respond within seven (7) days of the bid opening.

**B. Post-Bid Submittal**

1. Equipment submittals shall be bound in a minimum of two (2) hard paper copies and two (2) electronic copies on CD or flash drive. The submittals shall contain a minimum of two (2) full size (22"x34") drawings. One drawing shall cover the station chamber with equipment and one drawing with the electrical control schematic. The pump station drawing shall be to scale and be specific to this project with a minimum of three (3) different views and illustrate the National Electrical Code (NEC) clearances. The submittal booklets shall be complete with data sheets covering all individual components that make up the pump station and the UL/ETL file number under which the manufacturer is listed, service department personnel statement as detailed in the specifications, and shall be complete with the manufacturer's formal warranty policy. Each submittal shall be complete with a full-size copy of the manufacture's UL/manufacture logo Package Pumping Systems label.
2. Station manufacturer shall list the factory service manager, his/her telephone number and his/her number of years with the company.

**33.1.04 QUALITY INSURANCE**

- A. The equipment shall be designed, constructed, and installed in accordance with the best industry practices and methods and shall operate satisfactorily when installed as shown on the contract drawings and operated per manufacturer's recommendations.

**33.1.05 THIRD PARTY INSPECTION LISTING**

- A. The station manufacturer shall be required to affix to the station an Underwriters Laboratories (UL) label attesting to the compliance of the station equipment under the Packaged Pumping System (QCZJ) UL Listing Category and/or Intertek Testing Services (ETL) label attesting to the compliance of the station equipment under Packaged Pumping Systems. The ETL label shall state the station conforms to UL STD 778 and is certified to CAN/CSA STD C22.2 No. 108.

**33.1.06 GENERAL LIABILITY INSURANCE**

- A. The water pumping station manufacturer shall furnish premise/operations and products/completed operations general liability insurance from an insurance company with a rating of A-V according to the most recent Best's Key Rating Guide, in an amount equal to \$5,000,000 per occurrence.
- B. The insurance certificate must be included with the manufacturer's submittal. The coverage must be provided by an insurance carrier licensed and admitted in the state of manufacture.

### **33.1.07      OPERATION AND MAINTENANCE MANUALS**

- A. Submit three (3) complete operations and maintenance manuals in hard copy form bound in three ring binders and one (1) copy of the complete operation and maintenance manual in electronic form.
  - 1. Contact name, address, and telephone number of the equipment manufacturer's Service Department and Parts Department.
  - 2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
  - 3. Operating, maintenance, and troubleshooting information.
  - 4. Complete maintenance parts list.
  - 5. Complete connection, interconnecting, and assembly diagrams.
  - 6. Approved shop drawings including complete electrical information and schematic diagrams.
  - 7. Station manufacturer shall provide an installation supervision service report attested to by the technician, Owner and Engineer.

## **PART 2   PRODUCTS**

### **33.2.01      GENERAL**

- A. Within this specification and on the contract drawings, certain components are listed by name and/or model number for at least one (1) manufacturer's specific product as the basis for design. These listed components have been chosen because of the Engineer's and Owner's knowledge and experience with these listed components. No components other than those listed are acceptable unless specifically approved by the Engineer prior to the fabrication of the station.

### **33.2.02      MANUFACTURER**

- A. The pump station shall be as manufactured by the following:
  - 1. Dakota Pump Incorporated; Mitchell, South Dakota.
  - 2. Or Approved Equal.
- B. Alternate manufacturers may propose on the equipment set forth in these documents, through a bidding Contractor, provided the alternate manufacturer takes no exception to the contract documents and manufacturer provides the **PRE-BID SUBMITTAL DOCUMENTS** listed above.
- C. In the event the awarded contractor obtains Engineer's approval for equipment substitution, the Contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the Engineer prior to acceptance. Contractor shall reimburse the Engineer for Engineer's time to review substituted materials, equipment, and required accommodations.
- D. It will be assumed that if the cost to the Contractor is less for the proposed substitution, then the contract price shall be reduced by an amount equal to the savings.
- E. The specifications and drawings for the factory-built equipment do not necessarily include all the details for the design and fabrication for the factory-built equipment. The drawings are schematic, but the specifications call out strict requirements to known methods, components, and assemblies that must be in a full, complete, and functional pump station. As such, the manufacturer shall accept and hold complete responsibility for the functionality of the pump station.

**33.2.03 BUILDING DESIGN CRITERIA**

- A. The station building enclosure shall be a factory assembled, modular structure attached to the station base structure and requiring no additional assembly at the job site
- B. The building design criteria shall:
  - 1. Withstand snow load based on ASCE 7-05 Ground Snow Loads for the state and county of installation
  - 2. Withstand wind loads based on ASCE 7-05 for wind speeds
  - 3. Be designed for site specific seismic requirements based on local conditions by the Available Ground Motion Parameters according to ASCE 7-05 and IBC 2012 or as adopted by the State of Montana at the time a building permit is applied for and a live floor load of 125 PSF
  - 4. Be sized, at a minimum, so that National Standards mandated clearances are maintained above, below, and around equipment for proper and safe servicing, removal, and reinstallation of equipment
  - 5. Be a minimum of 9'-0" wide and 20'-0" long by 8'-0" inside height and constructed directly on a fabricated steel base. The steel base shall be a minimum of 9'0" wide and 20'0" long.

**33.2.04 BUILDING CONSTRUCTION**

- A. The materials specified are specifically chosen to be resistant to moisture degradation and infestation and to be maintainable.
- B. Insulation values shall be a minimum R-26 for the walls and R-35 for the roof. Insulation shall be foam-in-place polyurethane material applied between the interior and exterior sheathing forming a closed cell bounded by the steel framing. The insulation shall be applied to the walls and ceiling in ¾" – 1½" passes to create a thickness as required to meet the R-values listed above. The physical properties shall meet or exceed the following tests and standards:

1. Density, (core)(pct)	ASTM D-1622	1.70-1.95
2. Tensile Strength (psi)	ASTM D1-623 (Type C)	57-65
3. Water Absorption (lb/sqft)	ASTM D-2842	0.02-0.05
4. Closed Cell Content (%)	ASTM D-2856	85-95
5. K Factor (initial Btu in/hr)	ASTM C-518	0.135-0.142
- C. A framing design incorporating industry standard specifications and standards shall develop a structure meeting or exceeding the building design criteria.
- D. The building structure shall be fabricated using 2x6 standard wood studs, minimum grade SPF, and shall be installed on 16" centers. The wood roof truss shall be fabricated using a minimum of 2x4 lumber with a bottom cord of 8". The size, placement and spacing of studs and joist shall be in accordance with design criteria and material standards. The walls shall include a single bottom plate and a double top plate. The bottom plate shall be rated for ground contact. The wood roof system shall include wood trusses placed 16" on center, covered with plywood. The plywood shall be covered with 30# underlayment.
- E. The interior wall and ceiling sheathing shall be 5/8" thick, exterior, CDX grade plywood.
- F. All interior wall and ceiling surfaces shall be covered with FRP (fiberglass reinforced plastic) sheeting utilizing corner and seam moldings. The FRP sheeting shall include a pebble grain gloss white finish. The individual wall faces shall be covered with one continuous sheet. The FRP sheets shall be glued to the plywood sheathing requiring no fasteners. Corner moldings of like FRP material shall be installed and finished in a workmanlike manner.
- G. Openings in the sidewalls and/or roof shall be fully framed out and supported using single or multiple framing members sufficient enough to support and fasten those devices or equipment items such as hatches, HVAC equipment, pipe passages, conduit passages, door and/or window openings, and other special purpose openings as may be required. The attachment of the HVAC and door to the

building at a framed opening shall be done fully according to the device manufacturer's mounting instructions.

### **33.2.05 HEAVY DUTY STEEL DOORS**

- A. The double leaf door shall be manufactured of 18-gauge galvanized steel and shall be 6'-0" wide by 7'-0" tall. The door shall be full flush construction and 1-3/4" thick. The door shall be reinforced, stiffened, insulated, and sound deadened with a solid polystyrene foam board permanently bonded to the inside of each face skin. The lock and hinge edge of the door shall be welded with a center hairline seam the full height of the door. The lock edge shall be reinforced full height by a 14-gauge continuous one-piece channel extruded templating. The hinge edge shall be reinforced full height by a 14-gauge continuous one-piece channel, formed and tapped for hinges. Top and bottom of the door shall be closed with 16-gauge channels. The door shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of prime paint. Door closure and rim panic shall be reinforced with 14-gauge channels.
- B. The door shall be fully mounted in a frame produced for pre-hanging of commercial 1-3/4" doors. The door shall be a lockset, exterior level handle, top-mounted door closer with a hold-open device, and an exterior overlapping astragal with weather seal on the active leaf.
- C. The door and frame shall be finished with a two-component, aliphatic/acrylic polyurethane coating (color to be selected by Owner) with a high gloss finish. The coating shall be resistant to a wide range of solvents and chemicals under splash and spill conditions. The coating system shall be V.O.C. compliant.

### **33.2.06 MOUNTING AND FASTENING**

- A. The building shall be fabricated and securely attached to the steel base structure with 3/8" lag bolts welded to the station base. The lag bolt shall be secured with a washer and nut on the center of the bottom wall plate. A steel 1-1/2" x 2" x 1/8" angle shall be welded to the station base. The angle shall mate with the inside of the building. The space between the building frame and steel base shall include a sill sealed gasket to prevent wind and water leakage.
- B. The number and location of the lag bolts shall be as determined by structural analysis so as to maintain to the live load and wind load ratings as specified and to resist shearing and tearing in the process of transporting and placing the finished station. Spacing not to exceed 48".

### **33.2.07 SIDING**

- A. The building exterior shall include a composite panel, smooth on the back side with an aggregate finish on the front side of the panel. The panel shall be 1/4" thick and include pebble/stone material (color to be selected by Owner). The panels shall be installed with trim strips and corners to match. The rock panels shall be installed per the manufacturer's recommendations.

### **33.2.08 FACTORY INSTALLED TRUSSED ROOF SYSTEM**

- A. The building manufacturer shall provide wooden roof trusses, plywood sheathing, and 30# underlayment felt to be factory applied and covered by the roof system to form a gabled roof system with a center ridge line running the long dimension of the building. The roof system shall include a 3:12 minimum roof pitch with a 10" overhang on all sides. The trusses shall be covered by 5/8" CDX plywood.
- B. Aluminum fascia and soffits shall be installed on the building by the building manufacturer. The materials for the fascia and soffit shall be complimentary in texture (color to be selected by Owner).
- C. The roof system shall be designed and stamped by a Registered Professional Engineer in the State of Montana.

### **33.2.09 METAL ROOF SYSTEM, GUTTERS AND DOWNSPOUTS**

- A. The roof sheathing shall be 24-gauge standing seam, metal ribbed gabled roof (color to be selected by Owner). The panels shall meet UL Standard 2218, Class 4 impact resistant and Class A fire resistant rating.

- B. The ridgeline of the roof shall be covered end to end with a broken edge panel open along the sides to create a roof vent along both sides of the entire ridgeline. The top of the broken edge panel along the ridgeline shall cover over the top of the standing seams to provide a finished appearance.
- C. Five inch (5"), "K" style, 0.040" roll-formed, seamless, 3105 H24 aluminum gutters shall be installed for the full length of each eave (color to be selected by Owner). Gutters shall extend at least 1" beyond each end of each eave. Provide 0.040" aluminum drop edge and fascia flashing (color to be selected by Owner). Gutters shall be fastened to substrate with hidden aluminum fasteners at not more than 24" on center. Fasteners shall penetrate substrate at least 1". Tripolymer, single component sealant shall be used to seal outlet tubes and endcaps. Downspouts shall be 3" x 4", 0.040", color to match gutters. Gutters, downspouts, and fasteners shall be Kynar 500® coated. Downspouts shall terminate in a 45-degree elbow. A precast concrete splash pad shall be provided for each downspout. Downspouts and splash pads shall be located on the east side of the pumping station and shall direct roof runoff to the north or south, respectively.
- D. Gutters and downspouts shall be field-installed by the Contractor.

**33.2.10 REGISTERED PROFESSIONAL ENGINEER REVIEW**

- A. The base substructure, building, and the means of attaching the building including type, size, location, and embedment depth of the anchors to the foundation shall be reviewed and stamped by a State of Montana Registered Professional Engineer.

**33.2.11 BUILDING SUBSTRUCTURE**

- A. The base/floor system substructure shall be fabricated of steel plate and standard structural steel shapes of the sizes and weights sufficient to bear the loading placed on the base by shipping and operation.
- B. The substructure shall be designed to support the building live and dead loads plus the burden imposed by loading, transporting, and unloading of the equipment.
- C. The base shall consist of a minimum 3/8" steel floor plate and 8" reinforcing beam/channels as required. All steel members shall be joined by electric arc welding, with welds of adequate section for the joint involved. Where possible, all joints shall be welded on both sides of the base and shall be continuous and watertight.

**33.2.12 SKID INSULATION**

- A. The steel skid underside shall be insulated with an isocyanurate (flame retardant urethane) foam insulating material. The insulation shall be applied in each of the spaces between the structural members and the interior perimeter of the skid by spray and other approved methods. Insulation values shall be a minimum of R-20. The insulation shall have an ASTM E-84 flame spread rating of less than 30.
- B. The insulation shall be applied in 3/4" – 1 1/2" passes to create a thickness as required to meet the R-values listed above. The physical properties shall meet or exceed the following tests and standards:

1. Density, (core)(pct)	ASTM D-1622	1.70-1.95
2. Tensile Strength (psi)	ASTM D1-623 (Type C)	57-65
3. Water Absorption (lb/sqft)	ASTM D-2842	0.02-0.05
4. Closed Cell Content (%)	ASTM D-2856	85-95
5. K Factor (initial Btu in/hr)	ASTM C-518	0.135-0.142

**33.2.13 FLOOR DRAIN AND FLOOD VENT**

- A. The station shall include a fabricated floor drain connection. The floor drain opening shall be 12" wide by 18" long. The floor shall be covered with a 2" yellow industrial pultruded grating. The bottom of the floor drain shall include a 1/4" steel plate sloped to one end. A 4" I.D. threaded hub for connection of a drain line shall be provided on the equipment base. The installing contractor shall be responsible for furnishing and installing grout around the installed pipe.

- B. One (1) 16" x 8" (nominal dimensions for 16" on center stud spacing) insulated flood vent shall be installed at floor level to prevent flooding of the structure in the event of a pipe rupture or other catastrophic failure of a pressurized component. Color shall match siding color as nearly as practicable. Floor vent shall be Model No. 1540-520 as manufactured by Smart Vent® or approved equal. Flood vent shall be installed on the east wall as south as practicable.

**33.2.14 PIPING/CONDUIT FLOOR PENETRATION**

- A. Where suction and discharge piping, or any other pressure piping, passes through the station floor plate and base sub-structure, that area of the floor shall be provided with a grout sleeve made of steel pipe with sufficient annular diameter to pass a full-size pipe flange for the pipe size shown.
- B. The sleeve shall be welded into the floor plate. Following start-up of the station, the installing contractor shall be responsible for furnishing and installing grout to close the opening around the installed pipe. The installing contractor shall allow the station to operate for a minimum of two weeks prior to grouting the opening around the installed pipe.
- C. The same accommodation listed above shall be made for conduit penetrations and the floor drain. Sleeve shall be made of steel plate in lieu of steel pipe.

**33.2.15 FLOOR COATING AND CORROSION PROTECTION SYSTEM**

- A. After all welding has been completed, all surfaces of the structure shall be factory blasted to remove all rust, mill scales and weld slag. All weld spatter and surface roughness shall be removed by grinding. Surface preparation shall comply with SSPC-SP10 specifications. The blast profile on the steel shall be 1.5 – 2.5 mils in depth and be of a sharp, jagged nature. Surfaces shall be free of grit dust.
- B. Following the cleaning, all weld areas shall be coated by hand brushing using Devoe High Performance Coatings Bar-Rust 235 multi-purpose epoxy coating.
- C. The structure and other exposed metal shall receive a 4-8 mils dry or 5.9-11.7 mils wet coating of Devoe High Performance Coatings Bar-Rust 235 multi-purpose epoxy coating. The high solids coating shall be an advance technology epoxy and have exceptional corrosion protection. The coating shall be suitable for salt and freshwater immersion. Solids by volume shall be 68%, ±2%.
- D. The floor area of the steel base shall have a non-skid coating of a two component, 100% high performance aromatic polyuria spray elastomer system with zero volatile organic compounds, 100% solid. The coating shall offer high performance and superior elastomeric protection for various substrates. The coating shall be designed as a user-friendly product for moisture insensitive applications because of its pure polyuria chemistry and offer exceptional adhesion properties for properly prepared substrates. The high-performance formulation shall produce an excellent skin formation for chemical resistance and moisture protection.
- E. Both the Iso "A" side and Resin "B" side shall be preconditioned between 70-90°F before application. Iso "A" and Polyol "B" components must be pumped by low-pressure transfer pumps to a suitable high-pressure proportional pumping system.
- F. Temperature Settings:
 

1. Iso "A" Block Heater	140-160°F
2. Resin "B" Block Heater	140-160°F
3. Hoses (Iso and Polyol)	140-160°F
- G. Hydraulic Pressure Setting:
 

1. Equipment Hydraulic Pressure	2,000-2,500 PSI
---------------------------------	-----------------
- H. Chemical Technical Data:
 

1. Mix Ration by Volume: Gel Time:	1A:1B 6-9s
2. Tack Free Time:	9-12s

3. Viscosity (cps) @77° F:
  - a. "A" Iso Side: 1,000 ±100
  - b. "B" Resin Side: 370±50
4. Material Density (lbs/gal) @ 77°F:
  - a. "A" Is Side: 9.5
  - b. "B" Resin Side: 8.4
- I. All tests shall be performed by OCM Test Laboratories to meet American Association for Laboratory Accreditation (A2LA) and by ISO 17025 Certified.
- J. The chemical resistance testing for the coating shall be per ASTM D543 for immersion in fluids methods. Additional product certifications shall include USFDA Coatings for Incidental Food Contact Applications Certified by Keller and Heckman LLP and MIL-STD-810F.
- K. A touch-up kit containing Devoe epoxy coatings, as specified above, shall be provided for the coating of all field welds and for repair of any scratches or abrasions that have occurred during shipment or installation.
- L. The walkway shall be covered with industrial, rubber safety matting. The mat shall be a heavy duty, ½" minimum thickness compounded of open slot design with a safety patter to promote sure footing. The underside of the mat shall include a pattern to permit aeration and drainage. The floor mat shall not be glued to the floor.

**33.2.16 PUMP OPERATING CONDITIONS – PUMP STATION**

- A. The pump station shall be capable of delivering the fluid medium at the following capacities and heads when operating at 0 feet minimum suction pressure.
- B. Pump #1
  1. The pump shall be vertical multi-stage as manufactured by Grundfos or G&L
  2. Design Point: 10GPM @ 75 feet TDH
  3. Maximum Point: 117.8 ft
    - a. NPSHr: 11.73 ft
    - b. Pump Efficiency at Design Point: 46.2%
    - c. Rated Motor Power: ½ HP
    - d. Motor Speed: 3550 RPM
- C. Pump #2
  1. The pump shall be vertical multi-stage as manufactured by Grundfos or G&L
  2. Design Point: 35GPM @ 75 feet TDH
  3. Maximum Point: 136.8 ft
    - a. NPSHr: 17.57 ft
    - b. Pump Efficiency at Design Point: 56.3%
    - c. Rated Motor Power: 1.5 HP
    - d. Motor Speed: 3550 RPM
- D. Pump #3
  1. The pump shall be horizontal end-suction centrifugal as manufactured by Grundfos, G&L, or Cornell
  2. Design Point: 80GPM @ 75 feet TDH

3. Maximum Point: 102.6 ft
  - a. NPSHr: 9.81 ft
  - b. Pump Efficiency at Design Point: 61.53%
  - c. Rated Motor Power: 3 HP
  - d. Motor Speed: 3550 RPM

**33.2.17 PUMPS – VERTICAL, MULTI-STAGE**

- A. The pump end shall be of the vertical multi-stage design with the motor mounted directly to the top of the pump. The pumps shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer. The pump shall be capable of operating continuously at temperatures from 5°F to 245°F and working pressures of 250 PSI. The vertical multi-stage pump shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point. All pump bearings shall be lubricated by the pumped liquid. The pump impellers shall be secured directly to the pump shaft by means of splined shaft arrangement. The suction/discharge base shall be ANSI Class 250. ANSI flanged bases shall be a slip ring (rotating flange) design.
- B. Pump Construction shall include the following requirements:
  1. Suction/discharge base, pump head: Ductile Iron
  2. Motor stool, base plate: Cast Iron (ASTM Class 30)
  3. Flange rings: Ductile Iron (ASTM 65-45-12)
  4. Shaft: 316 or 329 Stainless Steel
  5. Impellers, diffuser chambers, outer sleeve: 316 Stainless Steel
  6. Impeller wear rings: 316 Stainless Steel
  7. Shaft journals and chamber bearings: Silicon Carbide
  8. O-rings: EPDM
  9. Shaft coupling: Cast Iron (ASTM Class 30)
- C. Pumps shall be equipped with a high temperature mechanical seal assembly with Tungsten Carbide/Carbon or Tungsten Carbide seal faces mounted in stainless steel components.
- D. The pump motor shall be sized to ensure the pump is non-overloading when operating on the specified pump curve. The motor shall be of the horsepower, voltage, phase and cycle as shown on the drawings. Motor design shall be Totally Enclosed Fan Cooled, direct coupled to 3550 RPM, 3 phase, 60 hertz, 230/460 volt, with a NEMA C face electric motor operating with a minimum service factor of 1.15. Motor shall be furnished with class “F” insulation. Lower motor bearing shall be adequately sized to ensure long motor life. The motors shall be premium efficient for use with variable speed drives.
- E. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-10.40.1.

**33.2.18 PUMPS – CLOSED COUPLED, HORIZONTAL END-SUCTION, CENTRIFUGAL**

- A. The pump end shall be of the centrifugal, horizontal end-suction design with the motor mounted on a bedplate. The pump shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer. The pump shall be capable of operating continuously at temperatures from 5°F to 245°F and working pressures of 250 PSI. The centrifugal, horizontal end-suction pump shall have a minimum rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point. The pump impellers shall be secured directly to the driver shaft with no separate coupling between them. The suction/discharge base shall be ANSI Class 250.

- B. Pump shall be bronze fitted, single stage with close grain cast iron construction. The pump casing shall have a bronze replaceable wear ring. The impeller shall be bronze, of the enclosed type, and statically and dynamically balanced. The one-piece pump/motor shaft shall be stainless steel. The pump shall be a single mechanical shaft seal of the Ni-Resist type, and properly vented to the suction connection.
- C. The pump motor shall be sized to ensure the pump is non-overloading when operating on the specified pump curve. The motor shall be of the horsepower, voltage, phase and cycle as shown on the drawings. Motor design shall be Totally Enclosed Fan Cooled, close-coupled to 3550 RPM, 3 phase, 60 hertz, 230/460 volt ball-bearing with a standard horizontal electric motor operating with a minimum service factor of 1.15. Motor shall be furnished with class "F" insulation. Lower motor bearing shall be adequately sized to ensure long motor life. The motors shall be premium efficient for use with variable speed drives.

**33.2.19 PUMP/MOTOR VIBRATION ISOLATION PADS**

- A. The pump/motor assembly shall be mounted to a fabricated steel base built specifically for the pump/motor to be mounted. Each mounting or attachment point shall be complete with a vibration isolation pad. The pad will be in two (2) parts, a ¼" base layer followed by a 5/8" upper layer and be a nominal 2" x 2" square size for pump/motor combinations weighing up to 1,500 pounds.

**33.2.20 PUMP SUPPORT STANDS**

- A. The pump support stands shall be fabricated of structural shapes with double "H" configuration of solid, continuous legs, and double webbing between the legs for rigidity. The base of the legs shall be flanged and continuously welded to the steel floor. The upper end of the legs shall be flanged.

**33.2.21 PIPING-TRANSMISSION**

- A. Piping shall be steel conforming to material specification ASTM A-53(CW) for nominal pipe size four (4) inches and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specifications ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively.
- B. Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.
- C. Suction and discharge header piping shall be fabricated utilizing weld tees and/or weld reducing tees to maintain smooth water flows and minimize hydraulic losses in the transition from the pump branch piping to the header piping. Under no circumstances shall any pump branch or bypass piping connections be made by cutting a hole in the pipe and welding a branch take off.
- D. All welded steel piping shall conform to compact ductile iron fitting dimensions, minus flanges. Swaged pipe is not permitted.
- E. The piping sizes shall be as shown on the drawing.
- F. Size 10 inch and below – Schedule 40
- G. Size 2.5 inch and below – Schedule 40, 304 Stainless Steel

**33.2.22 PIPE WELDING**

- A. All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittal, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.
- B. Shop welders shall be certified in accordance with ASME BPVC Section IX or AWS D1.1. Certification shall be done by an independent testing laboratory giving certification for the weld positions for which the tests were performed.

**33.2.23 PIPE SURFACE PREPARATION**

- A. All piping inside and outside surfaces shall be prepared by grit blasting, or other abrasive blasting, prior to any welds taking place to minimum SP-6 finish.

**33.2.24      PIPE CUTTING**

- A. Piping of 4" diameter and smaller may be cut by saw.
- B. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts.

**33.2.25      PIPE WELDING TECHNIQUES**

- A. Pipe welds shall be performed by metal added, inert gas shielded arc welding (MIG) techniques wherein the weld heat settings, the wire feed speed, and the traverse speed of the work below the welding are numerically set to assure proper weld fusion and penetration and repeatable welds.
- B. In all cases, short circuit transfer spray transfer, or pulse-arc transfer modes of the gas metal arc welding process shall be used.
- C. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used.
- D. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed.
- E. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed.
- F. Completed pipe welded assemblies shall create no internal obstruction, restriction, or create any unintended sources of water deflection.
- G. Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to ensure that at a minimum the total weld thickness shall be equal to the thinnest of the two pieces being welded together.
- H. The pipes shall be sand blasted, as specified elsewhere, before pipe weld and after pipe weld, before fusion bonded epoxy is applied.
- I. The discharge piping shall include an aluminum quick connect coupling with dust cap plumbed to the exterior of the building. The discharge piping shall include a threaded coupling to angle discharge down at an approximate 45-degree angle to a proposed concrete splash block.

**33.2.26      WELD STANDOFFS**

- A. No welding shall be performed on fusion bonded coated piping after the coating process has been performed.
- B. Where any piping is to be welded after the application of fusion bonded epoxy coating to the inside of the pipe, at the point of the weld, a weld standoff must be welded to the pipe prior to the coating. The weld shall be made to the standoff and not onto the pipe.

**33.2.27      PIPE SUPPORTS**

- A. Pipe supports by minimum sizing for:
  - 1. 8" and small piping shall be 2" x 3" x 3/16" wall rectangular tubing;
  - 2. 10" and larger piping shall be 3" x 4" x 1/4" wall rectangular tubing;
  - 3. 6" and larger piping shall be provided with "kick" bracing projecting fully from the underside of the pipe to the floor at an angle of no less than 15° from vertical out at a right angle to the run of the pipe being supported. These "kick" braces shall be in addition to the vertical pipe supports called out above.
- B. Pipe supports are to be fully welded at both end points to the pipe and steel floor where required.

- C. Where components are to be supported and may require disassembly at some time, the supports for these components shall be welded at the bottom and bolted at the top by use of a bolt yoke welded to the top of the support and bolted into the flange connection picking up at least three bolts.

**33.2.28 RISE PIPE VERTICAL SUPPORTS**

- A. The inlet and outlet vertical riser pipes shall each be provided with two (2) structural steel, angle pipe supports welded to the weldment plates on the vertical riser pipe down to the floor. These supports shall be opposed by at least 180 degrees around the pipe. The minimum member size for these supports shall be 3" x 4" x ¼" tubular steel.

**33.2.29 FUSION BONDED EPOXY INTERNAL COATING**

- A. The internal surfaces of piping to be fusion bonded coated shall be coated with "Nap Gard" fusion bonded epoxy coating.
- B. Interior piping service shall be cleaned and be free of mill scale, oil dust and rust. A liquid cleaner/phosphate in a pressure applied system may be used to remove all oil and contaminants and oven dried. Once dried, the piping shall be blast cleaned to a minimum of SSPC-SP6 commercial blast cleaning and pre-heated to 450°F. The fusion bonded coating shall be electrostatically applied allowing for an even uniform coat of 10 mils.
- C. The coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material.
- D. 304 stainless steel piping is not required to be fusion bonded epoxy coated.
- E. Prior to shipment of the station, the station manufacturer shall provide in writing to the Engineer certification that the fusion bonded epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:
  - 1. Date of application;
  - 2. Material manufacturer and product designation including a product data sheet for the coating;
  - 3. Applier of the fusion bonded coating name, address, and phone number;
  - 4. Notarized signature of an officer of the station manufacturing company stating the fusion bonded epoxy coating was applied to AWWA Standard C213, latest revision.
  - 5. 304 stainless steel piping may be used in lieu of epoxy coated/lined pipe. Where dissimilar pipe materials are joined, an isolator shall be employed.

**33.2.30 COATING – CORROSION PROTECTION**

- A. All interior and exterior surfaces of the exposed steel structure, transmission piping, and fitting shall be grit blasted equal to commercial blast cleaning (SSPC-SP6). Following fabrication, all exposed surfaces of the station, interior and exterior, shall be coated to the following requirements:
- B. Weldment Prime Coating
  - 1. All weldments will be pretreated by hand to provide additional corrosion protection using the same product as the base coat. Following the pretreatment, full coating application shall take place.
- C. Base Coating
  - 1. The base coating shall take place immediately after surface preparation. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings.
- D. Top Coating
  - 1. Following the base coating application, a full finish coating application shall take place. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant

properties. The epoxy system shall be self-priming and require no intermediate coatings. The base and finish coats shall provide a total dry mil thickness of 8.0 mils.

E. Post-Assembly Coating

1. Following assembly and just prior to shipping, there shall take place a thorough cleaning of the floor of the station followed by a rolled-on coating of the two-part epoxy coating to cover over any scuffing or scarring that might have occurred during assembly.

**33.2.31 SERVICE CONNECTIONS ON INTERNAL PIPING**

- A. All plumbed devices within the station eventually requiring service, such as control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings.

**33.2.32 RESTRAINING POINTS**

- A. The main inlet and outlet piping to the station shall each be provided with two (2) restraining points as welded on "eyes" or similar device welded to the underside of the base structure framing to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections.

**33.2.33 COUPLINGS AND DISMANTLING JOINTS**

- A. The station piping shall include dismantling joints to prevent binding and facilitate removal of associated equipment. Dismantling joints 3" and larger shall be Romac DJ400 series, Romac DJ405 series, Viking Johnson, Smith-Blair, Victaulic, or approved equal. Compression type, restrained couplings such as Straub Grip-L or Straub Metal-Grip are not permitted.
- B. If compression couplings, flanged coupling adapters (FCA), or flexible connectors/expansion joints are used, they shall include a minimum of two (2) zinc coated steel threaded rods across the joint with appropriate bolted restraining points.
- C. Unions shall be used for piping 2-1/2" and smaller.

**33.2.34 ELASTOMER PIPE CONNECTOR**

- A. The inlet side of each pipe shall include an elastomer connector to help isolate vibration and noise in the piping system. The elastomer connector shall be of a single sphere design, constructed of neoprene and nylon with bias-ply tire reinforcing cord to provide a 225 psi working pressure rating to a minimum of 120°F. The elastomer connector shall pass through the plate steel flanges designed to grip the connector so the connector seals without gaskets when the flange bolts are drawn up.
- B. A control joint limiting pipe connector movement shall be supplied with each pipe connector.

**33.2.35 LINE PRESSURE GAUGES**

- A. Nine (9) pressure gauges, one for each pump suction (compound) and discharge (standard) line, one for main full-diameter suction (compound) pipeline prior to the strainer and one after the strainer (compound), and one for main full-diameter discharge (standard) pipeline shall be supplied with the station.
- B. Gauge ranges shall be Vacuum – +60 psi (Compound) for the suction gauge and 0-100 psi discharge gauge. Pressure gauge range and scale graduations shall be in psi and feet of water.
- C. Gauges will be 4-1/2" in diameter per ASME B40.100 and shall be graduated in psi. Rated accuracy shall be ±0.5% of full scale and the operating temperature of -40°F to +150°F. Additional error when temperature changes from referenced temperature of 60°F ±0.4% for every 18°F rising or falling (percentage of span). Standard features shall include a black fiberglass-reinforced thermoplastic case, black aluminum pointer, white aluminum with black lettering, dampened movement option, copper alloy C-type bourdon tube, copper alloy (0.6mm restrictor, copper alloy with 1/4" NPT lower mount pressure connection with M4 internal tap and be weather resistant (NEMA 3 / IP54).
- D. The 1/4" high pressure ball isolation valve standard features shall include a one piece brass body (UNI 5705-65), PTFE self-lubricating seats with flexible-lip design, double seal system to all the valve to be operated in both directions, chrome plated brass ball, blowout-proof brass stem with

Viton O-ring, nylon black wedge handle that clearly shows ball position, and NPT taper ANSI B.1.20.1 connections.

- E. All gauges shall be panel mounted off the pipeline and be connected with copper tubing to their respective sensing point. The gauge trim tubing shall be complete with both isolation and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point will not be accepted.
- F. In addition to the individual suction and discharge gauges for each pump, the main (full diameter) suction and discharge pipes entering and exiting the station shall have a compound gauge on the suction line and a standard pressure gauge on the discharge line.
- G. The main suction and discharge gauges shall be panel mounted off the main full-diameter pipelines and be connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Tubing shall be as outlined below in STATIC AND SENSING LINES.

### **33.2.36      STATIC AND SENSING LINES**

- A. All gauge, switch, and transmitter sensing lines shall be a minimum ½" OD white polypropylene tubing run from the sensing point and a ball valve to the point of device mounting. Tubing shall have a rated working pressure of 225 psi @ 73°F. The pilot tubing shall be run in a workmanlike manner with elastomeric/stainless steel mounting straps to securely hold the tubing to be free of street and vibration. The alignment and organization of the sensing lines shall be continuously rising.

### **33.2.37      SAMPLE TAP**

- A. A single right angle outlet, smooth nose, NSF 61 approved, stainless steel sample tap shall be provided on the suction and discharge header pipe.
- B. The sample tap shall not be connected closer than 5 feet to any fitting used to connect a pressure transducer.

### **33.2.38      HOSE BIB WITH VACUUM BREAKER**

- A. A standard hose bib with valve and vacuum breaker shall be provided on the suction header pipe.

### **33.2.39      BALL VALVES**

- A. Ball valves shall be NSF 61 approved, 2-piece, full-port design with blow-out proof stem. The seats, packing, and seal shall be PTFE. Ball valves shall be provided with an adjustable stem packing nut. The body and retainer shall be lead free brass (DZR). The ball shall be lead free brass (DZR), chrome plated for sizes ¼" to 1" and 316SS for sizes 1-¼" to 4". The handle shall have a distinctive white "lead free" handle grip and blue "lead free" hanging tag. The valves will be NPT x NPT threaded pattern. Maximum working pressure shall be 600 psi up to 2" and 400 psi for sizes 2-½" to 4".
- B. 1.5" and smaller ball valves shall be stainless steel ball valves with stainless steel body. The nut and handle shall be forged steel with zinc plating or stainless steel. The stem, body and body end cap shall be stainless steel.

### **33.2.40      ISOLATION BUTTERFLY VALVES**

- A. Butterfly valves shall meet the requirements of AWWA C-504 and be NSF 61 approved with cast iron ASTM A-126 B Class B bodies. Valve stems shall be 416 stainless steel.
- B. 2" isolation valves shall be lug style butterfly valves with cast iron bodies and aluminum bronze disks. Molded-in resilient seats shall provide bubble-tight shutoff to 250 psi. Round, polished disc and hub edges shall provide 360° concentric seating, minimum flow restriction, lower torques and long seat life. The molded-in liner shall be EPDM. The upper housing shall be polyester. The upper and lower inboard bearings shall be bronze.
- C. 3" and larger isolation valves shall be flanged style butterfly valves with cast iron bodies and Ni-Chrome edge discs. Valve seats shall be synthetic compound. Valves shall have seats that are simultaneously molded in, vulcanized and bonded to the body. The sleeve type bearings shall be corrosion resistant and self-lubricating. Packing shall be self-adjusting Chevron type.

- D. Hydrostatic and seat leakage tests shall be conducted in strict accordance with AWWA Standard C504. Valves 6" and smaller shall be provided with 10-position lever lock handles with throttle plates incorporating an infinite position stop, a memory stop, and a padlocking device for either fully open or fully closed position.
- E. 2" Butterfly valve manufacturer:
  - 1. Keystone, Model 222
  - 2. Bray, Series 31
  - 3. Or Approved Equal
- F. 3" to 4" Butterfly valve manufacturer:
  - 1. Pratt
  - 2. DeZurik
  - 3. Or Approved Equal

**33.2.41 ISOLATION GATE VALVES**

- A. Gate valves shall meet the requirements of AWWA C-509 and be NSF approved. Gate valves shall be resilient seated and utilize a non-rising stem. The wedge shall be cast iron completely encapsulated (except for guide and stem nut areas) with polyurethane rubber. The polyurethane sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM D429. Stems shall be cast bronze with integral collars. The stuffing box shall be the o-ring seal type with two rings located above the thrust collar; the two rings shall be replaceable with the valve fully open and subject to full rated working pressure. There shall be two low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area.
- B. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure.
- C. Gate valve manufacturer
  - 1. Clow Valves
  - 2. Mueller
  - 3. Or Approved Equal

**33.2.42 SILENT CHECK VALVES-WAFER STYLE**

- A. Silent check valves shall be NSF 61 approved, wafer style, non-slam (silent) and made to set between ANSI Class 125 flanges. Silent check valves shall close as the forward flow diminishes and fully close at zero velocity preventing flow reversal and resultant water hammer. The valve shall be capable of operating in the horizontal or vertical position.
- B. The valve design shall incorporate a center guided, spring loaded disc while having a short linear stroke that generates a flow area equal to the nominal valve size. The valve shall be provided with a replicable guide bushing held in position by the spring. Valve seats shall be fully retained with full size threads and sealed with an o-ring to provide zero leakage.
- C. The body of the check valve shall cast iron meeting ASTM A126 Class B. The plug and seat shall be bronze and conform to ASTM Designation B-584. The guide bushing shall be bronze copper alloy and conform to ASTM Designation B-584. The compression spring shall be ASTM A313 type 316 stainless steel with ground ends. The valve interior and exterior shall be coated with NSF 61 fusion bonded epoxy coating. Valve shall be rated for 200 psi CWP.
- D. Silent check valves smaller than 2" shall include threaded ends.

- E. Silent check valve manufacturer
  - 1. Valmatic 1400-BN
  - 2. Pratt 720
  - 3. Or Approved Equal

**33.2.43 FLOW METER**

- A. The discharge flow meter shall be Neptune T-10 water meter with a Tricon/E3 Transmitter.
- B. Remote reading capability shall be per City of Glendive requirements. Outputs shall enable measuring total throughout in gallons and flow in gallons per minute. Station supplier is responsible for providing necessary and compatible equipment and/or appurtenances.
- C. Station manufacturer is responsible for providing upstream and downstream straight pipe runs as required by meter manufacturer.

**33.2.44 STRAINER**

- A. The pump station shall be supplied with a H-style strainer with a maximum opening of 0.078 inches.
- B. The strainer body and cover shall be ductile iron ANSI B16.62 with fusion bonded epoxy coating. The cover seal shall be a Buna-N synthetic rubber and the strainer basket shall be 316 stainless steel.
- C. Strainer manufacturer
  - 1. Cla-Val X43H
  - 2. Or Approved Equal

**33.2.45 AIR RELEASE VALVES**

- A. The pump station shall be supplied with two air release valves. The air valve shall be of the simple lever type and shall be capable of automatically releasing accumulated air from a fluid system while that system is in operation under pressure.
- B. A viton orifice button shall be used to seal the valve discharge orifice when the valve is in a closed position to assure drop tight shut-off. The orifice diameter will be sized for use within a given operating pressure range to insure maximum discharge capacity.
- C. The body and cover shall be of cast iron. With the exception of the viton orifice button, the leverage mechanism, the float and all other internal trim shall be of stainless steel. The stainless steel float shall be designed to be capable of withstanding a pressure in excess of 1,000 psi.
- D. Air release valve manufacturer
  - 1. Valmatic 15A
  - 2. Pratt
  - 3. Or Approved Equal

**33.2.46 PRESSURE RELEASE VALVES**

- A. The pump station shall be supplied with a pressure relief valve. The valve shall be hydraulically operated, single diaphragm actuated. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls. Valve body and cover shall be epoxy coated inside and out. The stainless steel seat with integral bearing shall be of the solid, one-piece design.
- B. The diaphragm assembly shall contain a non-magnetic stainless steel stem of sufficient diameter to withstand high hydraulic pressures. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface or a positive, drip tight shut off. No center

guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary.

- C. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The diaphragm shall be fully supported in the valve body and cover by machined surfaces that support no less than one-half on the total surface area of the diaphragm in either the fully open or fully closed position.
- D. The pressure relief pilot shall be direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is normally held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. The pressure relief valve shall be supplied with the Dura-Kleen® stem (KD option).
- E. The pilot control system shall include isolation valves and a closing speed control.
- F. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.
- G. A valve position indicator shall be installed on the main valve cover and shall consist of a brass indicator rod fastened to the main valve stem which moves up and down inside a clear Pyrex tube contained in a brass housing open on two sides to permit clear vision of the brass indicator rod.
- H. Pressure Release Manufacturer
  - 1. Cla-Val 50-01
  - 2. Or Approved Equal

**33.2.47      HYDRO-PNEUMATIC PRESSURE TANK**

- A. Two (2) 132 gallon, pre-charged steel hydro-pneumatic pressure tanks with replaceable rubber bladder shall be provided. Tanks shall be constructed of ASME approved steel, rated for 125 psi working pressure and fitted with lifting rings. Tanks shall be Wessels model FXA500, or approved equal.

**33.2.48      FROST FREE HOSE BIB**

- A. The station shall include a frost-free hose bib with vacuum breaker on the exterior of the building.

**33.2.49      PRESSURE TRANSMITTERS**

- A. The pump station shall be supplied with three separately mounted pressure transmitters to monitor the suction pressure (one prior to the strainer and one after the strainer) and discharge pressure. Each pressure transmitter shall sense gauge pressure of a predetermined span and transmit a 4-20mA signal to the programmable logic controller. The pressure sensor shall feature a thin film measuring cell which is welded directly to the process connection ensuring high accuracy in a compact housing. No separate seal shall be required. The unit shall be manufactured of 630 stainless steel in a one-piece design that eliminates moisture ingress. The transmitter shall be manufactured by IFM, or approved equal.

**33.2.50      FACTORY AND FIELD PRESSURE TESTING AND DISINFECTION**

- A. After the station piping and valves have been manufactured, the station piping system, including pumps, piping, fittings and all valves that make up the entire station piping shall be first tested with high-pressure air to test for leaks. High-pressure air shall be pumped into the piping system and a soap solution shall then be sprayed on any welded joints for leak indication.
- B. Prior to shipping, the pumping unit shall be factory tested to ensure that the individual pumping units meet the head and flow conditions specified. The flow rate and added head shall be observed and reported to the Engineer at the following operating points using design points of 10gpm, 35gpm, and 80gpm:
  - 1. Design operating point
  - 2. Ninety percent (90%) of design flow

3. Eighty percent (80%) of design flow
- C. The flow rate and added head shall be measured at the pump discharge. The acceptable tolerance for flow is  $\pm 5\%$ . The acceptable tolerance for added head is  $\pm 3\%$ . The acceptable tolerance for power is  $+4\%$ . The aforementioned tolerances shall be measured and reported at the design operating point. The unit shall not be shipped until the Engineer has review and approved the performance data provided by the manufacturer.
  - D. When the station plumbing is completed, the pressure piping within the station (including valves, pumps, control valves and fittings) and connections that make up the entire system shall be hydrostatically tested at a pressure of 200 psi. The test pressure shall be applied for a minimum of 120 minutes (2 hours), during which time all joints, connections, and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.
  - E. The results of the testing shall be transmitted in writing to the Engineer prior to shipment of the station and shall note test pressure, time at full pressure, and be signed by the Quality Control Manager or test technician.
  - F. The completed installation shall again be pressure tested between the nearest isolation valves located outside the pumping station or as outlined above with no leakage or pressure drop.
  - G. Upon completion of the pressure test, the pumping station and appurtenant piping to the nearest isolation valves located outside the pumping station shall be disinfected in accordance with AWWA C651, continuous feed method.
  - H. After disinfection and final flushing and before the station is connected to the distribution system, two consecutive sets of bacteriological samples shall be collected from the station. Bacteriological tests shall be conducted in accordance with AWWA C651.

**33.2.51**      **PORTABLE DESK**

- A. A portable desk shall be supplied with the building. The desk shall be McMaster Carr 40795T72, or as approved by the Owner.

**33.2.52**      **GFCI UTILITY RECEPTACLES**

- A. Three duplex ground fault indicating utility receptacles shall be conveniently located inside the station. Receptacle circuit shall be protected by a thermal magnetic circuit breaker.

**33.2.53**      **LED INTERIOR LIGHT**

- A. There shall be a minimum of three (3) 45W LED, 500k color temp (bright white), enclosed, frosted polycarbonate, vapor tight, 48inch minimum length, light fixtures installed within the equipment enclosure. Each set of lights shall be controlled by a separate switch. The light switches shall be of the nightglow type and be conveniently located adjacent to the active leaf of the door. Lights shall be MaxLite, or approved equal.

**33.2.54**      **LED EXTERIOR LIGHTING**

- A. One exterior light shall be provided near the station entrance door on the exterior wall of the pump station. The light shall be a low-profile LED design with rugged one-piece, die-cast aluminum hinged removable door and black box. A motion sensor shall be provided. The motion sensor shall be adjustable for range, delay, and time the light stays on after activated (between one and ten minutes). Exterior light shall be capable of being enabled/disabled via a wall-mounted switch. Lighting fixture shall be Cooper Lumark Crosstour, or approved equal, 18W LED, 500k color temp (bright white).

**33.2.55**      **HEATER**

- A. A 3,000W electric space heater with a minimum capacity of 10,240 BtuH and controlled by an adjustable thermostat shall be provided to regulate the temperature in the pump station. The heater shall have a fan to provide even heat distribution throughout the building. The heater is considered a back-up heat source to the HVAC unit.

**33.2.56**      **HVAC UNIT**

- A. The unit shall be one-piece wall-mounted, factory-assembled, precharged, prewired, tested and ready to operate. The unit shall have a limited warranty of 5 years on parts and compressor. The unit performance shall be certified in accordance with Air Conditioning and Refrigeration Institute Standard for Unitary Air Source air conditions or latest standard.
- B. The two (2) ton cooling capacity unit shall be supplied with weatherproof housing, one washable filter and include a remote adjustable thermostat. The supplemental heater shall be 5kW. The unit shall include twin indoor blowers.
- C. The manufacturer shall provide heat loss calculations substantiating the size of the heating unit to be provided.
- D. HVAC manufacturer:
  - 1. Bard Manufacturing
  - 2. Or Approved Equal

**33.2.57**      **DEHUMIDIFIER**

- A. One (1) dehumidifier, incorporating a fan to circulate air over the evaporator coils, shall control humidity in the pump station. It shall be provided complete with a humidistat and a thermostat that will de-energize the chilling mechanism and allow the fan to operate, if the humidity and temperature conditions are such that the condenser coils freeze. The dehumidifier shall have a minimum rating of 25 pints per day at 80 degrees Fahrenheit and 60% relative humidity. Condensate shall be piped to the floor drain, using 1/2" polyethylene tubing.

**33.2.58**      **ELECTRICAL DESIGN, ASSEMBLY & TEST**

- A. The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this pumping equipment. The manufacturer shall maintain at a regular place of business a complete electrical design, assembly, and test facility to assure continuity of electrical design with equipment application. Control panels designed, assembled, or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this pumping equipment will not be approved.

**33.2.59**      **CONFORMANCE TO BASIC ELECTRICAL STANDARDS**

- A. The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508A and the National Electrical Code (NEC), NFPA 70 latest revision so as to afford a measure of security as to the ability of the eventual Owner to safely operate the equipment.
- B. No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.

**33.2.60**      **U.L. LISTING**

- A. All service entrance, power distribution, control, and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (UL) Standard 508A "Industrial Control Panels." The UL label shall also include an SE service entrance equipment. The panels shall be shop inspected by UL or constructed in a UL recognized facility. All panels shall bear a serialized UL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel or Service Equipment Panel.
- B. A photocopy of the UL labels for this specific project shall be transmitted to both the Project Engineer and the Contractor for installation within their permanent project files, prior to shipment of the equipment covered under these specifications.

**33.2.61**      **CONTROL SYSTEM**

- A. The power distribution center and electrical controls shall be mounted in NEMA Type 1 gasketed fabricated steel enclosure. The enclosure shall have a full opening door, mounted on heavy piano

hinges. Suitable type latching devices shall be provided on the door. Starters, breakers, relays, timers and wiring raceway shall be neatly arranged on a removable steel back plate. All circuit breaker operators, selector switches, indicating lights, and single-phase items shall be mounted on or through die cut openings in the enclosure door. A duplex grounding type convenience outlet shall be mounted in die cut openings on the side of the enclosure, for operation of 115-volt devices. It shall not be necessary to open this enclosure, except for adjustment of controls. Additional enclosures may be used as necessary to meet power and control requirements.

- B. The station shall be supplied with a single-phase load center. The load center shall be UL listed (Panelboards No. 67) and be suitable for use as service entrance equipment when installed in accordance with the national electrical code. The enclosure shall maintain optimum wire-bend spacing. The panel shall be supplied with the appropriate size and number of breakers.
- C. Properly sized, heavy duty, molded case thermal-magnetic air circuit breakers shall be provided for branch circuit disconnect service and for over-current protection of all control, motor and auxiliary circuits.
- D. To protect the electrical system and equipment from damage due to excessive line surges caused by lightning or other circuit disturbances, a secondary surge arrester shall be supplied with the pump station controls. The arrester shall comply with ANSI standard C62.11-1987. The arrester shall be available in a one-pole, two-pole or three-pole version, and be suitable for both indoor and outdoor use. The arrester shall be permanently sealed in a LEXAN housing. The permissible line-to-line voltage of the system to which the arrester is applied depends on the circuit configuration, grounding, and voltage regulation. The secondary surge arrester shall be Square D SDSA1175 for single phase applications.

**33.2.62      EQUIPMENT GROUNDING**

- A. Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electric Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans, and pressure switches.
- B. All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The buss shall serve as a bond between the earth ground and the equipment ground wires. Exposed ground wire(s) shall be completely enclosed in PVC conduit.

**33.2.63      PANEL MOUNTING HARDWARE**

- A. The booster station shall be supplied with a wall-mounted, factory-assembled electrical panel.
- B. Panel shall be mounted directly to the interior 5/8" plywood underlayment. Mounting hardware shall adequately support electrical panel and electrical components.
- C.

**33.2.64      ELECTRICAL SERVICE**

- A. The electrical service provided for this station will be single phase, 60 hertz, 230 volt. Wiring of the station shall be in accordance with the National Electric Code. All internal wiring shall be installed in conduit. The station shall be completely wired at the factory, except for power feed lines.

**33.2.65      ELECTRICAL CONDUIT AND WIRING**

- A. All service entrance conduits, power and signal, shall be rigid galvanized steel or gray Schedule 80 PVC conduit, individually sized to accept the inbound service conductors and telemetry/telephone/radio cables.
- B. These service entrance conduits shall be installed by the installing contractor from the main power or control panel through the cutout provided in the building floor

- C. All wiring within the equipment enclosure and outside of the panel enclosures shall be run in conduit except where watertight flexible conduit is properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized.
- D. Devices and appliances furnished by the original manufacturer with a UL approved rubber cord and plug may be plugged into a receptacle.
- E. Equipment enclosure conduits shall be rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections, in minimize size 3/4" or larger, sized to handle the type, number, and size of equipment conductors to be carried. All motor conduits shall be increased by one size from the size required by the motor HP.
- F. The conduiting shall be in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.
- G. Where flexible conduit connections are necessary, the conduit used shall be liquid-tight, flexible, totally nonmetallic, corrosion resistant, nonconductive, UL listed conduit sized to handle the type, number and size of equipment conductors to be carried in compliance with Article 351 of the National Electric Code.
- H. Motor circuit conductors shall be sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125% of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.
- I. Control and accessory wiring shall be sized for load, type MTW/AWM (machine tool wire / appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NTMA and as listed by UL AWM, except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.
- J. All wiring in the control panel shall be number-coded.

**33.2.66     VARIABLE FREQUENCY DRIVES**

- A. A variable frequency drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor shall be provided for each pump motor.
- B. The VFD shall convert incoming single-phase power to three-phase power to the pump motors.
- C. The VFD package shall be UL listed as a complete assembly and enclosed in an integrated UL Type 1 enclosure, assembled and tested by the manufacturer in an ISO0991 facility. The VFD tolerated voltage window shall allow for VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
- D. All VFDs shall have the same customer interface, including digital display and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameters settings as per an aid for start-up of multiple VFDs.
- E. The keypad shall include hands-off-auto selections and manual speed control. The drive shall incorporate bumpless transfer of speed reference when switching between hand and auto modes. There shall be fault reset and help buttons on the keypad. The help button shall include online assistance for programming and troubleshooting.
- F. There shall be built-in time clock on the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clocks shall be used to date and time stamp faults and record operating parameters at the time of fault. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output replays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
- G. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The application macros shall provide on command to reprogram all parameters and customer

interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

- H. The VFDs shall have cooling fans that are designed for easy replacement. Operating temperature will be monitored and used to cycle the fans on and off as required. The VFDs shall be capable of starting into a costing load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
- I. The VFDs shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trail time, and time between attempts shall be programmable.
- J. The overloading rating of the drive shall be 110% of its normal duty current rating for one (1) minute every ten (10) minutes, 130% overload for two (2) seconds. The minimum full load current rating shall meet or exceed the values in the NEC/UL Table 430-105 of 2-pole motors.
- K. The VFDs shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection for AC line transients. The 5% impedance may be from dual (positive and negative DC buss) reactors or 5% AC line reactors. VFDs with only one DC reactor shall add AC line reactors.
- L. The VFDs shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOVs (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
- M. The VFD shall be capable of sensing a loss of load (broken belt/broken coupling) and signal the loss of load condition. Relay outputs shall include programmable time displays that will allow for drive acceleration from zero speed without signaling false underload condition.
- N. If the input reference (4-20mA or 0-10V) is lost, the FD shall give the user one of the following options, as selected by the user:
  - 1. Stopping and displaying a fault
  - 2. Running a programmable preset speed
  - 3. Hold the VFD speed based on the last good reference received
  - 4. Cause a warning to be issued
- O. The VFDs shall have programmable sleep and wake functions to allow the drive to be started and stopped from the level or process feedback signal.
- P. All VFDs shall have the following adjustments
  - 1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load
  - 2. Two (2) PID setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control
  - 3. Two (2) programmable analog inputs shall accept current or voltage signals
  - 4. Two (2) programmable analog outputs (0-20mA or 4-20mA)
  - 5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices
  - 6. Three (3) programmable digital Form-C relay outputs
  - 7. Seven (7) programmable preset speeds
  - 8. Two (2) independently adjustable accel and decel ramps with 1-1800 second adjustable time ramps
  - 9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the FD or operating at high carrier frequency only at low speeds.
  11. The VFD shall include password protection against parameter changes.
- Q. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values shall be capable of being displayed at all times.
- R. The VFDs shall have an RS-485 port as standard. The standard protocols shall be Modbus RTU. All protocols shall be certified by the governing authority. Serial communications capabilities shall include, but not be limited to; run-stop control, speed set adjustment, current limits, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps, each phase), voltage (each phase), percent torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indicators and settings shall be transmitted over the serial communications buss—keypad Hand or Auto selected, bypass selected, the ability to change the PID setpoint. A minimum of 15 field parameters shall be capable of being monitored. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function.
- S. All VFDs through 50HP shall be protected from input and output power mis-wiring. The VFDs shall sense this condition and display an alarm on the keypad.
- T. The variable speed drive shall be ABB ACS580, or approved equal.

**33.2.67      ALARMS CONDITIONS AND OUTPUTS**

- A. The following alarms/status points shall be included within the pump station and wired back to the interface panel. Provide indication as to the positions of the HAND-OFF-AUTOMATIC selector switches on the pumps.
1. Unauthorized entry alarm on door. The unauthorized entry alarm will be obtained by the use of a keyed push button switch in conjunction with a normally closed limit switch mounted at the entrance of the chamber and wired in series to an adjustable on delay timer. When the entrance hatch is raised the limit switch contact will close initiation the on-delay timer that can only be deactivated by the use of the keyed switch. The keyed switch shall be mounted separately and unmarked in the entrance tube or on the front of the control panel.
  2. Phase fail/power status alarm
  3. Low suction pressure alarm
  4. High discharge pressure alarm
  5. Fire/smoke alarm
  6. High station temperature alarm
  7. Low station temperature alarm
  8. Flow meter
  9. Current monitoring
  10. Station flooded alarm

**33.2.68      LOCAL INDICATION ALARM**

- A. To provide a local indication of an alarm condition, a flashing red beacon light, UL listed and approved for outdoor weatherproof installation shall be installed. Light shall include shatter resistant

Lexan lens and acrylic dome with stainless steel clamping rings. The lamp shall be easily replaced with bayonet base type bulbs.

**33.2.69**      **PUMP MOTOR RUN TIME METER/EVENT COUNTER**

- A. The control panel shall contain a running time meter supplied for each pump to show the cumulative number of hours of operation. The meter dial shall register in hours and tenths of hours up to 99999.9 hours before repeating. The control panel shall also include an event counter for each pump so that the number of pump starts for each pump can be observed.

**33.2.70**      **ELECTRICAL DEVICES**

- A. Multi-position switches including Hand-Off-Automatic switches shall be oil tight, 3-position maintained, and be located on the main control panel door.
- B. Indicating lights shall be oil tight with a full voltage pilot light.
- C. Nameplates shall be furnished on all panel front mounted switches and lights.
- D. Switches
  - 1. Pump #1, 3-position
  - 2. Pump #2, 3-position
  - 3. Pump #3, 3-position
- E. Lights
  - 1. Red – low suction pressure
  - 2. Green – pump #1 in operation
  - 3. Green – pump #2 in operation
  - 4. Green – pump #3 in operation
  - 5. Red – high discharge pressure

**33.2.71**      **PROGRAMMABLE LOGIC CONTROLLER**

- A. The programmable logic controller shall be a MicroLogix 1400 as manufactured by Allen Bradley. I/O shall be supplied to accommodate all control processes in the system while providing for a 10% spare density for future use. The station manufacturer shall be responsible for the programming and satisfactory operation of the PLC system.
- B. All communication between the PLC, HMI's and modems shall be via ethernet cables. An unmanaged ethernet switch shall be provided at each location where these devices are present. The switch shall have a minimum of 5 ports and be equal to a Phoenix Contact SFN5TX.
- C. The programming shall be supplied to the Owner on transferrable media and shall be fully commented and documented. OEM coding, locking, or making proprietary any portion of the control system programming will not be accepted.

**33.2.72**      **CONTROLS SCREEN**

- A. A 5.7" color touch screen HMI shall be supplied with the pump station. The unit shall be equal to a Magellan as manufactured by Schneider Electric or equal by Maple Systems. The HMI shall display the following:
  - 1. Suction Pressure
  - 2. Discharge Pressure
  - 3. Tank Levels/Pressures
  - 4. Pump Status
  - 5. Set Points
  - 6. Flow

7. Run Times

8. Alarms

**33.2.73      MONITORING SYSTEM**

- A. The control panel shall be provided with a web-based monitoring system integrated into the control panel hardware / software equipment. This functionality shall utilize the pump station PLC and shall not require any additional RTU devices. The monitoring system will include a cellular modem and applicable software that will enable the PLC system to monitor pump status, monitor discharge pressure signals, and monitor tank level signals to the Owner's web accessible computer, tablet, or smart phone.
- B. The Owner will provide internet access, including expenses, for their monitoring devices. In addition to the monitoring, the system shall allow the factory automation engineers / technicians the ability to modify PLC programming remotely, if needed, during start-up services. The monitoring system shall include a 90-day basic trial subscription to commence on the day of start-up.
- C. The monitoring system shall be Cloud 9.

**PART 3      EXECUTION**

**33.3.01      GENERAL**

- A. An adjustable spreader-type lifting device, built to lift the building structure without impinging the lifting chains/cables on the building sidewalls, shall be provided by the installing contractor for the purpose of unloading structure from trailer.
- B. The contractor shall be required to provide a crane, spreader bars, and rigging to set the station on the foundation. The foundation shall be built by the Contractor per the construction drawings. Following setting of the station, the Contractor will be required to anchor the station to the foundation. The installing contractor shall install a 5-1/2" wide, self-adhesive, foam sill seal prior to setting the station on the concrete foundation. An asphaltic mastic may be substituted for the foam sill seal. A double layer of 6mil polyethylene (PE) vapor barrier shall be placed over the aggregate base prior to setting the station on the concrete foundation. Joints in the PE vapor barrier shall be lapped a minimum of 12". The Contractor shall supply and install the hot-dipped, galvanized steel anchor bolts and nuts.
- C. Prior to installation, the Contractor shall secure building and electrical permits from the State of Montana or Dawson County, as applicable.

**33.3.02      SHIPPING AND DELIVERY**

- A. The specified equipment shall be delivered by the manufacturer FOB DESTINATION and the station manufacturer shall hold the full responsibility for the condition and completeness of the equipment upon its delivery.
- B. The Engineer shall hold the right to inspect the equipment prior to unloading and setting so as to assure the quality and condition of the equipment is in no way deficient. The inspection of the equipment does not in any way alleviate the Contractor from verifying that the equipment meets the standards as described in the Contract Documents.
- C. If in the view of the Engineer, the equipment is deficient when delivered, delivery shall be refused.

**33.3.03      INITIAL START-UP AND TRAINING**

- A. Without exception, the station manufacturer is directly responsible for station start-up and operator training. Third party contractors are not allowed to start up the station nor the equipment herein. As such, the start-up factory service technician shall be a technician employee of the station manufacturer. Manufacturers representatives are not deemed acceptable to provide the start-up service. The services of the technician shall be provided for two (2) separate trips as follows:
  - 1. One (1) trip of two (2) days of service to inspect and certify the installation prior to startup and instruct Owner's personnel in proper operation and maintenance of the equipment.

2. One (1) trip of one (1) day of service to inspect and instruct Owner's personnel in proper operation and maintenance of the equipment at either seventeen (17) months following delivery on-site of eleven (11) months following operation start up, whichever occurs first.

**33.3.04      WARRANTY**

- A. The warranty is the sole responsibility of the station manufacturer and that manufacturer's warranty shall be provided in written form and included in the submittal documents covering the specified equipment and the Operation and Maintenance Manuals provided with said equipment.
- B. The station warranty shall provide the Owner with a single source responsibility for all components specified herein and the system as a whole. The single source shall be the station manufacturer. Third party suppliers, service contractors, and "pass-through" warranties are not acceptable.
- C. Manufacturer's warranty shall contain at a minimum: period of one (1) year commencing upon successful start-up and acceptance by the Owner (Substantial Completion), after authorized manufacturer's start-up. Substantial Completion of the entire project shall constitute the Owner's acceptance unless otherwise agreed to by the Owner, Engineer, and Contractor.
  1. The warranty period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.
  2. The manufacturer's warranty shall cover all equipment, components, and systems provided in or with the station by the manufacturer of the station, exclusive of those components supplied by and/or installed by others independent of the manufacturer of record for this station.
  3. The warranty shall provide for the station manufacturer to bear the full cost of labor and materials for replacement and/or repair of faulty or defective components so there shall be no cost incurred by the Owner for this work during the warranty period.
  4. The manufacturer's warranty policy is amended only by the items considered consumable, i.e. lightbulbs, filters, oil and grease, pump seals, pump packing, lubricants, and other maintenance items consumed by usage.
  5. The warranty pertains only where the equipment has been operated in strict accordance with the manufacturer's instructions and requirements. Evidence of misuse or modification to the equipment voids the warranty.
- D. If the submitted written manufacturer's warranty does not meet the minimum requirements set forth above, that submittal will forthrightly be rejected.

**END OF SECTION**