Oregon Parks and Recreation Commission

June 15, 2022

Agenda Item: 8a

Action

Topic: Bullards Beach State Park Sewer Rehabilitation Project

Presented by: Matt Rippee, Deputy Director, Field Services

Project Description:
Staff requests approval for awarding a construction contract exceeding $500,000. The project will replace the main sewer lift station and existing main gravity sewer line that serves all of the RV hookup sites, restroom/shower buildings, park office, maintenance yard and residence. The current piping material is concrete which is experiencing significant infiltration/inflow from high ground water during the winter months. This puts significant strain and wear on our septic lift station and sewage treatment facility.

Construction is scheduled for October 2023 – December 2023. Due to delays in product availability we will be bidding the project during the Spring of 2023 to allow time for the contractor to acquire materials prior to construction.

The project will include the following elements;

- Demolish the existing main gravity sewer line,
- Demolish the existing main sewer lift station,
- Install approximately 2,500 linear feet of new gravity sewer line,
- Install new sewer lift station and controls.

Preliminary estimated construction cost is $750,000. The project will be funded using FIP funds.

Prior Action by Commission: None

Action Requested: Approval

Attachments: #1 – Project Plans
            #2 – Project Specifications

Prepared by: Darrell Monk, Senior Project Manager
GENERAL STRUCTURAL NOTES:

GENERAL

STRUCTURAL DRAWINGS ARE A PORTION OF THE CONTRACT DOCUMENTS AND ARE COMPLEMENTARY TO THE CIVIL AND ELECTRICAL DRAWINGS, THE SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REQUIREMENTS FROM THE CONTRACT DOCUMENTS INTO THEIR SHOP DRAWINGS AND WORK. AS REQUIRED BY THE GENERAL CONDITIONS, THE CONTRACTOR SHALL PROMPTLY REPORT TO THE ENGINEER ANY ERRORS, INCONSISTENCIES, OR OMISSIONS IN THE CONTRACT DOCUMENTS DISCOVERED OR MADE KNOWN TO THE CONTRACTOR.

THESE GENERAL STRUCTURAL NOTES SUPPLEMENT THE PROJECT SPECIFICATIONS REFERENCE THE PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS, NOTES AND DETAILS ON THE STRUCTURAL DRAWINGS SHALL TAKE PRECEDENCE OVER THE GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE GIVEN, CONSTRUCTION SHALL BE AS SHOWN FOR SIMILAR WORK.

CODE REQUIREMENTS:
CONFORM TO THE 2018 OREGON STRUCTURAL SPECIALTY CODE (OSSC), BASED ON THE 2018 INTERNATIONAL BUILDING CODE (IBC).

TEMPORARY CONDITIONS:
THE STRUCTURE IS DESIGNED TO FUNCTION AS A UNIT UPON COMPLETION. THE CONTRACTOR IS RESPONSIBLE FOR FURNISHING ALL TEMPORARY BRACING AND/OR SUPPORT THAT MAY BE REQUIRED AS THE RESULT OF THE CONTRACTOR'S CONSTRUCTION METHODS AND/OR SEQUENCES.

CONTRACTOR'S CONSTRUCTION AND/OR QUESTION SEQUENCES SHALL RECOGNIZE AND CONSIDER THE EFFECTS OF THERMAL MOVEMENTS OF STRUCTURAL ELEMENTS DURING THE CONSTRUCTION PERIOD.

DESIGN CRITERIA

DESIGN WAS BASED ON THE STRENGTH AND DISTORTION CRITERIA OF THE OSC. IN ADDITION TO THE DEAD LOADS, THE FOLLOWING LOADS AND ALLOWABLES WERE USED FOR DESIGN, WITH LIVE LOADS (L.L.) REDUCED PER DISC:

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<thead>
<tr>
<th>GRAVITY SYSTEM CRITERIA</th>
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<tr>
<td>OCCUPANCY OR USE</td>
<td>UNIFORM LOAD</td>
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<td></td>
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<tr>
<td>WTR: WTR APP &amp; TOP 3/4</td>
<td>40 PSI L.L.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>GEOTECHNICAL CRITERIA</th>
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<tbody>
<tr>
<td>DESIGN BASED ON: GCSC TABLE 1804.2</td>
</tr>
<tr>
<td>ALLOWABLE SOIL PRESSURE: 1,300 PSI</td>
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<table>
<thead>
<tr>
<th>WIND CRITERIA</th>
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<tbody>
<tr>
<td>WIND FORCE RESISTING SYSTEM: V = 140 MPH WITH BASIC DESIGN WIND SPEED (3-SECOND SUST)</td>
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<thead>
<tr>
<th>SEISMIC CRITERIA</th>
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<tbody>
<tr>
<td>SITE CLASS: 0</td>
</tr>
<tr>
<td>IMPORTANT FACTOR: N = 1.0</td>
</tr>
<tr>
<td>NSC SPECTRAL ACCELERATION: Sa = 2.03</td>
</tr>
<tr>
<td>SITE RESPONSE: F1 = 1.7</td>
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<tr>
<td>DESIGN SPECTRAL ACCELERATION: Sa = 1.68</td>
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</table>

<table>
<thead>
<tr>
<th>STRUCTURAL OBSERVATIONS</th>
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<tr>
<td>THE STRUCTURAL ENGINEER OF RECORD (SEC) WILL PERFORM STRUCTURAL OBSERVATIONS BASED ON THE REQUIREMENTS OF THE OSC AS AT THE STAGES OF CONSTRUCTION LISTED BELOW. CONTRACTOR SHALL PROVIDE SUPPLEMENTAL ADVANCE NOTICE AND ACCESS FOR THE SECR TO PERFORM THESE OBSERVATIONS.</td>
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<table>
<thead>
<tr>
<th>ITEM</th>
<th>COMMENTS</th>
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<tr>
<td>PRIOR TO FIRST CONCRETE POUR</td>
<td>AFTER REBAR PLACEMENT</td>
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A FIELD REPORT WILL BE SUBMITTED TO THE BUILDING DEPARTMENT FOLLOWING EACH SITE VISIT.

STRUCTURAL OBSERVATION IS FOR THE GENERAL CONFORMANCE OF THE STRUCTURAL DRAWINGS AND DOES NOT ALTER ANY SPECIAL INSPECTION REQUIREMENTS.

SPECIAL INSPECTIONS AND TESTING

SPECIAL INSPECTIONS WILL BE PROVIDED BY THE OWNER BASED ON THE REQUIREMENTS OF THE OSC AS SUMMARIZED IN THE SPECIAL INSPECTION AND TESTING PROGRAM ON SHEETS 54 AND 55. CONTRACTOR SHALL PROVIDE SUFFICIENT NOTICE AND ACCESS FOR THE SPECIAL INSPECTION TO PERFORM THESE INSPECTIONS.

SUBMITTALS

SUBMIT SHOP DRAWINGS AND OTHER SUBMITTALS TO THE ENGINEER PRIOR TO FABRICATION AND CONSTRUCTION OF STRUCTURAL ITEMS. IF THE SUBMITTALS DIFFER FROM OR ADD TO THE STRUCTURAL CONTRACT DOCUMENTS, THEY SHALL BEAR THE SEAL AND SIGNATURE OF A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF OREGON. ANY CHANGES TO THE STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER AND ARE SUBJECT TO REVIEW AND ACCEPTANCE BY THE SECR.

FIELD ENGINEER'S DETAILS DEVELOPED BY THE CONTRACTOR THAT DIFFER FROM OR ADD TO THE STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO THE SEAL AND SIGNATURE OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF OREGON AND SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO CONSTRUCTION.

THE USE OF REPRODUCTIONS OR PHOTOCOPIES OF THE CONTRACT DRAWINGS SHALL NOT BE PERMITTED. WHEN CAN'T OR LIMITS ARE PROVIDED TO THE CONTRACTOR OR SUBCONTRACTORS, IT IS THE RESPONSIBILITY OF THE CONTRACTOR/SUBCONTRACTOR TO REMOVE ALL INFORMATION NOT DIRECTLY REQUIRED TO THE SCOPE OF THE SUBMITTAL AS WELL AS ALL REFERENCES TO OUTSIDE SOURCES.

DELEGATED DESIGN SUBMITTALS SHALL INCLUDE DESIGN DRAWINGS AND CALCULATIONS FOR ITEMS THAT ARE DESIGNED BY OTHERS. DELEGATED DESIGN SUBMITTALS SHALL BEAR THE SEAL AND SIGNATURE OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF OREGON ON EVERY DRAWING SHEET AND ON THE CALCULATION COVER SHEET AND SHALL BE SUBMITTED TO THE ENGINEER AND STRUCTURAL ENGINEER PRIOR TO FABRICATION. CALCULATIONS SHALL BE INCLUDED FOR ALL CONNECTIONS TO THE STRUCTURE, CONSIDERING LOCALIZED EFFECTS ON STRUCTURAL ELEMENTS. DESIGN SHALL BE BASED ON THE REQUIREMENTS OF THE OSC AND AS NOTED UNDER "DESIGN CRITERIA".

SUBMITTALS AND DELEGATED DESIGN SUBMITTALS SHALL INCLUDE THE FOLLOWING:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SUBMITTAL</th>
<th>DELEGATED DESIGN SUBMITTAL</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE MIX DESIGNS</td>
<td>x</td>
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<tr>
<td>CONCRETE REINFORCEMENT</td>
<td>x</td>
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<td></td>
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<tr>
<td>CONCRETE ANCHORAGE</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMBEDDED STEEL ITEMS</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STRUCTURAL STEEL</td>
<td>x</td>
<td>INCLUDES STAINLESS STEEL</td>
<td></td>
</tr>
<tr>
<td>STEEL WELDING PROCEDURES</td>
<td>x</td>
<td>INCLUDES STAINLESS STEEL</td>
<td></td>
</tr>
<tr>
<td>STEEL FASTENERS</td>
<td>x</td>
<td>INCLUDES STAINLESS STEEL</td>
<td></td>
</tr>
</tbody>
</table>

PRECAST CONCRETE LIFT STATION | x |

TABLE NOTES:
1. THE CONTRACTOR SHALL COORDINATE SEISMIC RESTRAINTS OF MECHANICAL, PLUMBING, AND ELECTRICAL EQUIPMENT, MACHINERY, AND ASSOCIATED PIPING WITH THE STRUCTURE. CONNECTIONS TO STRUCTURE SHALL CONFORM TO ASCE 7-18 CHAPTER 13, BE DESIGNED BY AN ENGINEER REGISTERED IN THE STATE OF OREGON, AND SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO FABRICATION.

2. CONTRACTOR SHALL ENGAGE A PROFESSIONAL ENGINEER TO PREPARE AN ASSESSMENT OF ANY EXCAVATIONS THAT MAY REDUCE THE VERTICAL OR LATERAL SUPPORT OF AN EXISTING FOUNDATION AS REQUIRED BY OSC SECTION 2217. THE ASSESSMENT SHALL BE SUBMITTED TO THE BUILDING DEPARTMENT AND SHALL INCLUDE DETAILS AND SEQUENCING FOR CONSTRUCTION OF ANY UNDERPINNING OR BRACING THAT IS REQUIRED.

CONCRETE MIX DESIGNS

CONCRETE MIX SHALL CONFORM TO CHAPTER 18 OF THE OSC. CONCRETE STRENGTHS SHALL BE VERIFIED BY STANDARD CYLINDER TESTS PER ASCE 7-18. CONCRETE MIX TO BE DESIGNED AND PROPORTIONED BY THE CONTRACTOR IN ACCORDANCE WITH ACI 318-14 CHAPTER 9, ACI 318-18 CHAPTER 4 AND THE FOLLOWING INFORMATION:

<table>
<thead>
<tr>
<th>MIX ID</th>
<th>USE</th>
<th>FC (PSI)</th>
<th>TEST AGE (DAYS)</th>
<th>MAX. W/M (RATIO (NOTE 1 &amp; 2))</th>
<th>MAX. AGI (PSI)</th>
<th>EXPOSURE CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALL CONCRETE</td>
<td>4,000</td>
<td>28</td>
<td>0.48</td>
<td>5/4&quot;</td>
<td>F2</td>
</tr>
<tr>
<td>B</td>
<td>BASE SLAB</td>
<td>4,000</td>
<td>28</td>
<td>0.45</td>
<td>5/4&quot;</td>
<td>F2</td>
</tr>
</tbody>
</table>
### GENERAL STRUCTURAL NOTES CONTINUED:

**CONCRETE MIX AIR CONTENT**

<table>
<thead>
<tr>
<th>Max. Aggregate Size</th>
<th>Concrete Subject to Freeze/Thaw (Exposure Class F)</th>
<th>Concrete Subject to Cont. Moisture and/or Bending Chemicals (Exposure Class F, S and E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>3.5%</td>
<td>3.5%</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>6.0%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

A water-reducing admixture conforming to ASTM C492 used in strict accordance with the manufacturer's recommendations shall be incorporated in concrete mix designs. A high-range water-reducing (HRW) admixture conforming to ASTM C492 Type F or G may be used in concrete mixes providing that the slump does not exceed 9". The contractor shall submit concrete mix designs along with test data compliant with ACI 301-16 and ACI 318-14 a minimum of two weeks prior to placing concrete. No water may be added to concrete in the field unless specifically approved in writing by the concrete supplier in conjunction with the concrete mix design.

**FORMWORK, SHORING AND RE-SHORING**

FORMWORK is the contractor's responsibility and shall conform to ACI 319-14 and ACI 349.5. Where new concrete is placed against existing concrete, the existing concrete surface shall be cleaned and roughened to a minimum 1/4" amplitude per ACI 318-14 Section 22.8.2. Provide 3/4" charniers on all exposed concrete edges, unless noted otherwise.

**CONCRETE REINFORCING STEEL**

Concrete reinforcement shall be as listed below:

- **USE**: Foundations, Slab, Column, Wall, and Reinforced Concrete Slab.
- **TYPE**: ASTM A615 Grade 60 or ASTM A836 Grade 60.
- **MATERIAL**: HSLA 50 or HSLA 55.

All reinforcing steel shall be securely tied in place with 8x annealed iron wire. Bars in slabs shall be supported on well-cured concrete blocks on approved metal or plastic chocks as specified by the code manual of standard practice, MSG-1. Reinforcing steel shall be placed in accordance with ACI 318, "A Manual of Standard Practice for Detailing Reinforced Concrete Structures." Reinforcing bars shall not be bent or straightened in the field without approval of the designer. Preheating methods shall be submitted to the designer for approval prior to bending of bars 4" or larger. Lap reinforcement shall be placed in accordance with the typical lap splice length schedule, except as noted on drawings. Use lap length for smaller bars when spacing different bar sizes. Bars spaced with noncontinuous lap shall be spaced no farther than 1/3 bar lap length on 6" centers.

**POST-INSTALLED CONCRETE ANCHORS**

Post-installed concrete anchors shall be the following products, Sika:

- **TYPE**: SikaBond-BR1 2 (S-151-2557)
- **MATERIAL**: SikaBond-SW (E-ES-271)

Anchors shall be installed in strict accordance with the manufacturer's recommendations and product evaluation reports. Embedments specified on drawings are "effective" embedment. Reference manufacturer literature for corresponding actual embedment depths. Do not cut reinforcing in new or existing concrete during installation.

Requests for anchor substitutions shall be submitted to the designer in writing along with evidence of equal or greater capacity to the specified connection.

Anchors exposed to earth or weather shall be protected from corrosion by hot-dip galvanizing or use of stainless steel. Permanently exposed embedded plates and angles shall be hot-dipped galvanized after fabrication, Sika.

### TYP. SLAB LAP SPlice LENGTH SCHEDULE (IN.) - 60 KSI

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Lap Length for Slab Bottom Bars</th>
<th>Lap Length for Slab Top Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>#3</td>
<td>28</td>
<td>34</td>
</tr>
<tr>
<td>#2</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>#1</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

**CONCRETE REINFORCING DETAILS**

At slab openings provide a minimum of two 6" bars over, under and at the sides of the openings. Extend these bars lap distance or a minimum of 3'-6" past the opening, plus one 8". Each face for double-layer reinforcing placed diagonally at each corner of all openings. Refer to typical details for inspection of corner bars. Provide a 2" depressed, placed diagonally at each re-entrant corner in slabs. Shop drawings shall include all special reinforcement listed above.

Sleeves, openings, conduit, and other embedded items not shown on the structural drawings shall be approved by the structural engineer before placing concrete. Conduits embedded in slabs shall not be larger in outside dimension than one third of the thickness of the slab and shall not be spaced closer than three diameters on center. Very all blockouts with civil and electrical requirements.
GENERAL STRUCTURAL NOTES CONTINUED:

STRUCTURAL STAINLESS STEEL

<table>
<thead>
<tr>
<th>SHAPE</th>
<th>MATERIAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLATES AND ANGLES</td>
<td>AISI 316 (UNS S31600 SS316L) GRADE 30</td>
</tr>
</tbody>
</table>

DESIGN, FABRICATION, AND ERECTION SHALL BE IN ACCORDANCE WITH THE "AEIC SPECIFICATION FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS" WITH "COMMENTARY" AND THE "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES", WITH THE FOLLOWING CLARIFICATIONS AND ADDITIONS:

1. CLARIFY SECTIONS 7.5.1 AND 7.5.3 AS FOLLOWS:
   - ERECTION DRAWINGS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER OF RECORD FOR INFORMATION ONLY. THE SEPI IS NOT RESPONSIBLE FOR THE APPROVAL OF ERECTION DRAWINGS.

2. ADD THE FOLLOWING PARAGRAPH TO SECTION 7.10.3:
   "THE ERECTOR SHALL HAVE THE SOLE RESPONSIBILITY FOR DETERMINING THE MEANS AND METHODS USED TO PROPERLY AND ADEQUATELY BRACE THE FRAME DURING ERECTION."

BOLTS SHALL CONFORM TO THE AISI AND ESSC SPECIFICATION FOR JOINTS. BOLTS SHALL BE SNUG-TIGHT UNLESS NOTED OTHERWISE. BOLTS/NUTS/WASHERS FOR AISI 321 AND AISI 318 ELEMENTS: AISI F563 FOR STAINLESS STEEL STRUCTURAL BOLTS; AISI F714 FOR HEAVY HAY STAINLESS STEEL NUTS; AISI 304/316 STAINLESS STEEL PLAIN WASHERS. PROVIDE AISI A193 B16/B18/B69 BOLTS FOR AOE 2205 DUAL PHASE STEEL, NUTS/WASHERS SHALL HAVE EQUIVALENT CORROSION RESISTANCE.

WELDING SHALL CONFORM TO ANSI D1.1/D1.1M FOR STAINLESS STEEL, AND ANSI D1.1/D1.1M REQUIREMENTS FOR DUAL PHASE STEEL. FILLER METAL FOR DUAL PHASE STEEL SHALL HAVE EQUIVALENT CORROSION RESISTANCE.

PROVIDE WEEP HOLES AT EXTERIOR CLOSED SECTIONS WHERE MOISTURE MAY ACCUMULATE.
## Special Inspections and Testing

### Table 1 - Required Geotechnical Special Inspections

<table>
<thead>
<tr>
<th>System or Material</th>
<th>DDS Code Reference</th>
<th>Code of Standard Reference</th>
<th>Frequency (Note 6)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>soils</td>
<td>1/702.8</td>
<td>OBS-01.4-8.5</td>
<td>x</td>
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### Table 2 - Required Structural Special Inspections

<table>
<thead>
<tr>
<th>System or Material</th>
<th>DDS Code Reference</th>
<th>Code of Standard Reference</th>
<th>Frequency (Note 6)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>fabrications</td>
<td>1/704.2.5</td>
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### Noted Submittals

<table>
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<tr>
<th>Fabric</th>
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<th>Code of Standard Reference</th>
<th>Frequency (Note 6)</th>
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<td></td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>concrete</td>
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<td>ACI 318 1.3</td>
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### Required Submittals

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<th>Code of Standard Reference</th>
<th>Frequency (Note 6)</th>
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### Post Installed Connect Anchors

<table>
<thead>
<tr>
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<th>Code of Standard Reference</th>
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</table>
# SPECIAL INSPECTIONS AND TESTING CONTINUED

## TESTING

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Code of Standard Reference</th>
<th>Frequency (Rate)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Deck Material Identification</td>
<td>1708.4</td>
<td>X</td>
<td>BY THE GEO-TECHNICAL ENGINEER OR QUALIFIED SPECIAL INSPECTOR</td>
</tr>
<tr>
<td>Material Verification</td>
<td>Hаамі, Classification of Controlled Fill Materials</td>
<td>X</td>
<td>BY THE GEO-TECHNICAL ENGINEER OR QUALIFIED SPECIAL INSPECTOR</td>
</tr>
<tr>
<td>Concrete Strength</td>
<td>ASTM C39</td>
<td></td>
<td>EACH 500 CY OR LESS THAN EACH 1000 1/2 T-YIELD PLACED EACH SHIFT. FABRICATE SPECIMENS AT TIME CONCRETE IS PLACED</td>
</tr>
<tr>
<td>Concrete slump</td>
<td>ASTM C143</td>
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<tr>
<td>Concrete air content</td>
<td>ASTM C232</td>
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<td></td>
</tr>
<tr>
<td>Concrete temperature</td>
<td>ASTM C186</td>
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<tr>
<td>Stainless Steel</td>
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<td></td>
<td></td>
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**STRAINING (1%) TESTING OF WELDS**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/000,000</td>
<td>AND 0.1%</td>
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</tbody>
</table>

## STATEMENT OF SPECIAL INSPECTION NOTES

1. SPECIAL INSPECTIONS SHALL CONFORM TO SECTION 1708 OF THE 2018 ODCS, CONTRACT DOCUMENTS AND APPROVED SUBMITTALS. REFER TO TABLES 1 AND 2 FOR SPECIAL INSPECTION AND TABLE 3 FOR TESTING REQUIREMENTS.

2. SPECIAL INSPECTIONS AND ASSOCIATED TESTING SHALL BE CONDUCTED BY AN APPROVED INDEPENDENT INSPECTION AGENCY MEETING THE REQUIREMENTS OF ASTM E59 (MATERIALS). THE INSPECTION AND TESTING AGENCY SHALL FURNISH TO THE CONTRACTOR A COPY OF THEIR SCOPE OF ACCREDITATION. SPECIAL INSPECTORS SHALL BE QUALIFIED PER ANSI D1.8.

3. THE SPECIAL INSPECTOR SHALL OBSERVE THE INDIVIDUAL WORK FOR COMPLIANCE WITH THE APPROPRIATE CONSTRUCTION DOCUMENTS. ALL DISCREPANCES SHALL BE NOTED TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION AND NOTED IN THE INSPECTION REPORTS.

4. THE SPECIAL INSPECTOR AND GEO-TECHNICAL ENGINEER SHALL FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, ENGINEER, STRUCTURAL ENGINEER, CONTRACTOR, AND OWNER. THE SPECIAL INSPECTION AGENCY SHALL SUBMIT A FINAL REPORT STATE THAT THE WORK REQUIRING SPECIAL INSPECTION WAS INSPECTED AND IS IN CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS AND THAT ALL DISCREPANCIES NOTED IN THE INSPECTION REPORTS HAVE BEEN CORRECTED.

5. **INSPECTION TYPES**

   **CONTINUOUS:** THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED.

   **PERIODIC:** THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE CONCLUSION OF THE WORK.

6. SPECIAL INSPECTIONS OF MECHANICAL POST-INSTALLED ANCHORS SHALL BE IN STRICT CONFORMITY WITH THE ICC REPORT AND MANUFACTURER'S INSTALLATION REQUIREMENTS. ANCHOR INSTALLERS SHALL BE QUALIFIED AS REQUIRED BY JURISDICTION REQUIREMENTS.

   a. **Inspection Reports:** Shall identify names of installers.

   b. **Special Inspector shall provide documentation at the end of anchor installations stating that the anchors were inspected for approved anchor evaluation report.**
BASE SLAB SECTION

CRANE BASE CONNECTION

CRANE SUPPORT BEAM SECTION

CRANE SUPPORT BEAM AT CRANE BASE

BASE SLAB REINFORCING PLANS

REINFORCED HYDROPHILIC WATER STOP AROUND PERIMETER, VOLCAT X4-1511 OR EQUAL, ATTACHED TO VOLCAT MB ADHESIVE OR EQUAL.

FIRST RISER SECTION TO BE SUPPORTED INDEPENDENT OF REIN. STEEL.

WETWELL BASE SLAB SEE 3/57 FOR REINF. STEEL.

(1) #6 HOOP CONT.

(2) #6 HOOPS CONT.

# @ 10" O.C. EA. WAY TOP AND BOTTOM

#6 HOOP CONT.

#6 HOOP CONT.

#6 HOOP CONT.

#6 HOOP CONT.

#6 HOOP CONT.

#6 HOOP CONT.

#6 HOOP CONT.

CRANE BASE CONNECTION

CRANE SUPPORT BEAM SECTION

CRANE SUPPORT BEAM AT CRANE BASE

BASE SLAB REINFORCING PLANS

OUTLINE OF WALL MOUNT THERMOMETER BASES X2 (4) #6 ANCHOR BOLTS. VERIFY ANCHOR BOLTS AND COORDINATE ANCHOR LOCATION WITH CRANE WIRE.

CAST FIRST PRECAST RISER SECTION INTO WETWELL SLAB. SHOWN ON SECTION.

WETWELL TOP SLAB REINF. NOT SHOWN

WETWELL TOP SLAB REINF. NOT SHOWN

AMOUNT SLAB REINF. W/ STD. HOOP AT CRANE SUPPORT BEAM

#4 TIES AT 6" O.C. MAX.

#4 TIES AT 6" O.C. MAX.

ADDITIONAL #6 X 6"-8" CENTERED ON ANCHOR BOLTS

#6 HOOP

#6 HOOPS

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

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#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP

#6 HOOP
TECHNICAL SPECIFICATIONS
For

Replace Main Sewer Line at Bullards Beach State Park

Project Number: #25694
Contract Number: #8334
Date: June, 2021

Prepared by:

Jeffrey Wagner
Construction Project Manager
Oregon Parks and Recreation Department
Engineering Services Division
725 Summer Street NE, Suite C
Salem, Oregon 97301
SEALS PAGE for
Bullards Beach Sewer Rehabilitation Project
Project Number: #25694
Contract Number: #8334

Specifications 311000, 312000, 312500, 321216, 330500, and 33100
Curt Vanderzanden, PE
SEALS PAGE for
Bullards Beach Sewer Rehabilitation Project
Project Number: #25694
Contract Number: #8334

Specifications 033000 and 051200
Craig Totten, PE, SE
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SEALS PAGE for
Bullards Beach Sewer Rehabilitation Project
Project Number: #25694
Contract Number: #8334

Specifications 260500, 260501, 260519, 260526,
260529, 260533, 262000, and 262726
Robert C. Klawa, PE
Technical Specifications
for
Bullards Beach
Sewer Rehabilitation

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>01010</td>
<td>SUMMARY OF WORK ................................</td>
</tr>
<tr>
<td>01019</td>
<td>CONTRACT CONSIDERATIONS ................................</td>
</tr>
<tr>
<td>01025</td>
<td>MEASUREMENT AND PAYMENT ................................</td>
</tr>
<tr>
<td>01028</td>
<td>MODIFICATION PROCEDURES ................................</td>
</tr>
<tr>
<td>01062</td>
<td>PERMITS AND FEES ......................................</td>
</tr>
<tr>
<td>01090</td>
<td>REFERENCE STANDARDS ...................................</td>
</tr>
<tr>
<td>01100</td>
<td>SPECIAL PROJECT PROCEDURES ................................</td>
</tr>
<tr>
<td>01300</td>
<td>SUBMITTALS ..............................................</td>
</tr>
<tr>
<td>01410</td>
<td>INSPECTION AND MATERIAL TESTING ....................</td>
</tr>
<tr>
<td>01560</td>
<td>ENVIROMENTAL CONTROLS ..................................</td>
</tr>
<tr>
<td>01650</td>
<td>STARTUP OF SYSTEMS/COMMISSIONING ....................</td>
</tr>
<tr>
<td>01730</td>
<td>MAINTENANCE AND OPERATING INSTRUCTIONS ............</td>
</tr>
<tr>
<td>03000</td>
<td>CAST-IN-PLACE CONCRETE ................................</td>
</tr>
<tr>
<td>051200</td>
<td>STRUCTURAL STEEL FRAMING ............................</td>
</tr>
<tr>
<td>260500</td>
<td>COMMON WORK RESULTS FOR ELECTRICAL ...............</td>
</tr>
<tr>
<td>260501</td>
<td>MINOR ELECTRICAL DEMOLITION ..........................</td>
</tr>
<tr>
<td>260519</td>
<td>LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES</td>
</tr>
<tr>
<td>260526</td>
<td>GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS ....</td>
</tr>
<tr>
<td>260529</td>
<td>HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS ......</td>
</tr>
<tr>
<td>260533</td>
<td>RACEWAY, BOXES AND CONDUITS FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>262000</td>
<td>LOW-VOLTAGE ELECTRICAL DISTRIBUTION ...............</td>
</tr>
<tr>
<td>262726</td>
<td>WIRING DEVICES ..........................................</td>
</tr>
<tr>
<td>311000</td>
<td>SITE CLEARING ............................................</td>
</tr>
<tr>
<td>312000</td>
<td>EARTH MOVING ............................................</td>
</tr>
<tr>
<td>312500</td>
<td>TEMPORARY EROSION AND SEDIMENT CONTROL ..........</td>
</tr>
<tr>
<td>321216</td>
<td>ASPHALT PAVING ..........................................</td>
</tr>
<tr>
<td>330500</td>
<td>COMMON WORK RESULTS FOR UTILITIES ................</td>
</tr>
<tr>
<td>333100</td>
<td>SANITARY UTILITY SEWERAGE PIPING ....................</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.01 SUMMARY
A. These specifications are subject to the administrative and procedural requirements specified in the State of Oregon Standard Conditions for Public Improvement Contracts (January 1, 2006).

1.02 DESCRIPTION OF WORK
A. Location of work is at Bullards Beach State Park, located approximately 2 miles north of Bandon, off Oregon Highway 101, in Coos County, Oregon.
B. Project is to:
1. Remove and replace existing sanitary sewer main line.
2. Reconnect existing lateral sewer connections.
3. Rehabilitate existing sanitary manholes.
4. Make wet well and electrical improvements as shown on the plans.
5. Install pumps and control panel in new wet well and connect to existing sewer force main.
C. Project is for Oregon Parks and Recreation Department (OPRD), referred to hereafter as Owner.
D. The Project Manager and Owner’s Authorized Representative is:

Darrell Monk
Oregon Parks and Recreation Department
725 Summer Street, NE, Suite C
Salem, Oregon 97301-1266
Phone: (503) 298-1879

1.03 CONSTRUCTION STAKEOUT
A. The Project Manager has provided for the Contractor’s stakeout of the construction work in the form of reference and dimensions from existing facilities adjacent to the proposed work and/or survey control points, as shown on the Plans. The Contractor will be solely responsible for laying out the work from the information shown on the Plans, and no additional stakeout will be provided by the Project Manager.

1.04 SPECIFICATION LANGUAGE
A. Portions of the Specifications are written in imperative and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The
words “shall be” shall be included by inference where a colon (:) is used within sentences or phrases. Example: Aggregate: ASTM C33.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION
PART 1 – GENERAL

1.01 SPECIAL PROJECT REQUIREMENTS

A. Work on the project may begin after issuance of Notice to Proceed, but must not interfere with the park operation beyond the project site.

B. The project site will be closed to the general public from January 1st, 2022 to March 27th, 2022.

C. The immediate areas surrounding the construction site shall be open to the public from start of construction until the specified completion date. The Contractor shall coordinate with the Project Manager to provide both access and public safety during construction. Devices required to provide for public safety during construction shall be provided and installed by the Contractor.

D. Construction operations shall be restricted to the hours between 7:00 a.m. and 7:00 p.m.

E. No work shall be performed on any legal holiday or weekends without approval from the Project Manager.

1.02 CONSTRUCTION STAKEOUT

A. The Project Manager has provided reference points for the Contractor’s stakeout of the construction work. The reference points are in the form of reference elevation and coordinates from existing survey control points, as shown on the Drawings. The Contractor will be solely responsible for laying out the work from coordinate point stakeout control shown on the Drawings, and no additional stakeout will be provided by the Project Manager.

1.03 EXISTING UTILITIES

A. In general, the locations of existing major utilities, whether aboveground or underground, are indicated on the Drawings. This information has been obtained from utility maps and field surveys. The Owner does not guarantee the accuracy or completeness of this information. It is understood there may be interfering utilities, service laterals and other underground pipes, drains and structures encountered on underground projects that are not shown or are shown incorrectly on the Plans and/or have not been previously discovered in the field. The Contractor agrees that a reasonable number of these occurrences are usual and ordinary on underground projects and are reflected in the Bid and plan of operation. Furthermore, bidders understand and agree that work in some cases must be done in close proximity to said utilities and underground pipes, drains, and structures not shown or shown incorrectly on the Plans which may require a change in operations and may cause sloughing of the trench, additional traffic control, additional pavement and backfill costs, and time.

B. Determine the exact location of existing underground facilities in advance of construction as necessary to avoid unnecessary damage, maintenance costs; and to ensure continuity of customer service and to verify locations so as not to affect main pipeline installation. All
costs associated with the obtaining of such locating services are to be borne by the Contractor.

C. Contact all utility companies and departments having underground facilities within the construction area and request they locate and mark their utilities. The Contractor shall comply with Oregon “locate law”.

D. Comply with Oregon Administrative Rules Division 952, Relating to Abandoned Underground Facilities. Abandoned Facility means an underground facility that is no longer in service and is physically disconnected from the operating facility that is in service. In addition to notification requirements of this rule, notify Project Manager of any Abandoned Underground Facilities which are discovered during the course of the project.

1.04 SPECIFICATION LANGUAGE

A. Portions of the Specifications are written in imperative and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” shall be included by inference where a colon (:) is used within sentences or phrases. Example: Aggregate: ASTM C33.

1.05 NOTICE

A. Give reasonable notice to occupants of buildings on property adjacent to the Work to permit the occupants to remove vehicles, trailers and other possessions, as well as salvage or relocate plants, trees, fences, sprinkler systems, or other improvements which are designated for removal or which might be destroyed or damaged by work operations.

1.06 TEMPORARY UTILITIES

A. Connections to existing utilities (electric, water, sewer, telephone service) may be allowed as approved by the Project Manager. Contractor to make arrangements for connections. Contractor to pay for cost of connection and use. Exercise measures to conserve energy and water.

B. Provide toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances and regulations pertaining to public health and sanitation.

1.07 CONSTRUCTION FACILITIES

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities from damage during construction and demolition operations.

B. There is limited area for parking, staging and stockpiling at the proposed site. The Contractor is responsible for maintaining parking, staging and stockpiling areas.

1.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipes and other closed or remote spaces.

C. Remove waste materials, debris and rubbish from the site immediately upon such materials
becoming unfit for use in the work. In the event this material is not removed, Project Manager reserves the right, but does not have the duty, to have the material removed and the expense shall be charged to the Contractor.

D. Provide legal, debris disposal off-site.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. All Payments shall be as provided in the State of Oregon Standard Conditions for Public Improvement Contracts. References to other documents in the Drawings and in the Technical Specifications, such as ODOT and ODOT/APWA are not intended to include references to measurement and payment that may exist in those other documents. Specific Measurements for Payment are detailed in this specification Section 01025.

B. If no Item exists for a portion of the Work, include the costs in a related Item.

C. No separate payment will be made for any item that is not specifically set forth in the Solicitation and all costs therefore shall be included in the prices named in the Solicitation for the various appurtenant items of work.

D. Quantities listed in the Contract Document do not govern final payment. Payments to the Contractor will be made only for actual quantities of Contract items performed in accordance with terms of the Contract and for items of work actually performed under Change Orders.

E. Indirect costs, such as supervision and overhead, profit, and the general conditions specified in the Contract, all shall be allocated to each item as applicable for Work defined in the item. No separate payment will be made to the Contractor for these items.

1.02 ITEM MEASUREMENT AND PAYMENT

A. ITEMS:

1. Mobilization: Payment for Mobilization shall be made on a lump sum basis. The amount to be allowed for Mobilization in the partial payment to be made under the Contract will be as follows:

   a) When 5% of the total original contract amount is earned from other items, not including advances on materials, 50% of the amount bid for Mobilization, or 2.5% of the original contract amount, whichever is the least, less normal retainage, will be paid.

   b) When 10% of the total original contract amount is earned from other items, not including advances on materials, 100% of the amount bid for Mobilization, or 5% of the original contract amount, whichever is the least, less normal retainage, will be paid.

   c) Upon completion of all work on the project, payment of any amount bid for Mobilization in excess of 5% of the total original contract amount will be paid.

   d) The above schedule of progress payments for Mobilization shall not limit or preclude progress payments otherwise provided by the Contract.

2. Permit & Fee Allowance:
a) Measurement for Permit Allowance shall be per actual unit cost as documented on official invoices for the following items:

1) Permit Fees
2) Post Construction Surveying.
3) 3rd Party Geotechnical and Pipe Testing Services.

b) Payment shall include full compensation for all materials, equipment, and labor required. Costs for retesting of previous tests and inspections resulting in failure and contractor labor to assist the testing agency will be considered incidental to this bid item.

3. Erosion Control:

a) Measurement for Erosion Control shall be made on a lump sum basis.

b) Payment shall include full compensation for all materials, tools, equipment, and labor necessary for the installation, maintenance, and inspection of erosion control measures, and all other related Work in accordance with the requirements of the Contract Documentation and as shown on the Drawings.

4. Removal of Existing Structures and Obstructions:

a) Measurement for Removal and/or salvage of Existing Structures and Obstructions shall be made on a lump sum basis for all material removed as shown on the Drawings.

b) Payment shall include full compensation for all labor, materials, tools and equipment necessary for the removal of all structures, removal of trees, removal and reinstallation of signs, hauling and legal disposal of excess material off-site, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

5. Trench Restoration – Native Seeding:

a) Measurements shall be made on a per square yard basis installed.

b) Payment shall include full compensation for all materials, equipment, tools and labor necessary for providing and installing native grass seed in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

6. Trench Restoration – Camp Road:

a) Measurement shall be made on a per square yard basis installed.

b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for providing, installing, asphalt pavement, geotextile fabric, and aggregate base rock in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.
7. Trench Restoration – Main Road:
   a) Measurement shall be made on a per square yard basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for providing, installing, asphalt pavement, geotextile fabric, and aggregate base rock in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

8. Trench Restoration –Paver:
   a) Measurement shall be made on a per square yard basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for salvaging, cleaning, and reinstalling pavers in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Sand bedding course, base course, and geotextile fabric are considered incidental to this bid item.

9. Trench Restoration –Sidewalk:
   a) Measurement shall be made on a per square foot basis installed.
   b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for providing, installing, and testing asphalt pavement, geotextile fabric, and aggregate base rock in conformance with the specifications, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

10. Sanitary Sewer Piping - Gravity:
    a) Measurement shall be made on a lineal foot basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing, transportation, and installation of the gravity sanitary sewer pipe including fittings, trench excavation, pipe zone material, backfill, dewatering, tracer wire, removal of existing sewer pipe, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Fittings are considered incidental to this bid item.

14. Sanitary Sewer Cleanouts:
    a) Measurement shall be made on a per each basis installed.
    b) Payment shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the cleanouts including removal of existing cleanouts, fittings, trench excavation, backfill, lid, concrete backfill and ballast, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

15. Reconnect Existing Laterals:
Division 1
01025 – MEASUREMENT AND PAYMENT

16. Sanitary Sewer Manhole Rehabilitation:
   a) Measurement shall be made on a per each basis installed.
   b) Work shall include full compensation for all materials, equipment, tools, and labor necessary for furnishing and installation of the sanitary sewer manhole repair, including resealing joints, lid plugs, chimney seals, backfill, surface restoration, cleaning, surface preparation, dewatering, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

17. Manhole:
   a) Measurement shall be made on a per each basis installed.
   b) Work shall include full compensation of all materials, equipment, tools, and labor necessary for furnishing and installation of a sanitary manhole, including sealing external joints, lid plugs, chimney seals, backfill, surface restoration, cleaning, surface preparation, dewatering, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings.

18. Wetwell Improvements:
   a) Measurement for Sanitary Sewer Pump Station improvements as shown on the plans shall be made on a lump sum basis installed.
   b) Work shall include full compensation for all materials, equipment, tools, and labor necessary for the design, fabrication, furnishing, transportation, and installation of the pumps, check valve, ball valve, gate valves, rail guides, wetwell insert, hatch and cable tray, pump disconnect panel, control panel, piping, and all other related Work in accordance with the requirements of the Contract Documents and as shown on the Drawings. Dewatering, cleaning, and decontaminating the vault to allow for the work to be performed is considered incidental to this bid item.

19. Electrical Improvements, Complete:
   a) Measurement shall be made on a lump sum basis installed.
   b) Payment shall include full compensation for all materials, equipment, and labor to complete installation of power service to the site as shown on the plans, including but not limited to pump installation, utility vaults, primary feeders, transformer and meter. Coordination with PUD is incidental to this bid item.
20. As-Built/O&M Manuals:
   a) Measurement shall be made on a lump sum basis.
   b) Payment will include full compensation for all materials, equipment, and labor to document as-built conditions for Record Drawings to be developed at the end of the project and development of all required O&M Manuals as specified in the technical specifications.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION
SECTION 01028 – MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative requirements for Requests for Information and Proposal Requests.

B. Prior to execution of a change order, the following documents shall be submitted as indicated.

1.02 REQUEST FOR INFORMATION (RFI)

A. General:

1. RFI’s are requests for information originated, prepared and submitted by the Contractor to the Project Manager only when the Contractor is unable to determine from the Contract Documents, the material, process, system or work to be installed. The Contractor will endeavor to keep the number of RFI’s to a minimum. For critical or emergency items, contact Project Manager at once.

2. In the event the Contractor believes that a clarification by the Project Manager results in additional cost or time, the Contractor shall not proceed with the work indicated by the RFI until the Project Manager provides an approved copy of the RFI to the Contractor or until a Proposal Request is fully-executed. A Change Order will be processed to include this type of change.

3. Submit RFI’s on form provided by Project Manager.

4. Number RFI's sequentially; include date submitted.

5. Identify Project, pertinent Plan sheet, detail number, and Specification Section.

6. Specifically identify time response information as required to avoid impact on Construction Schedule or Cost. Project Manager shall endeavor to respond to proper RFI’s within 7 Days, if possible.

B. RFI’s shall include written and graphic solutions proposed by Contractor. Project Manager will determine if Contractor’s proposal is in accordance with Contract Documents and design intent of Project.

1. Contractor’s failure to make a reasonable effort to propose realistic solution may result in RFI's being returned with no action.

2. RFI's that request information that is clearly shown in the Contract Documents will be considered frivolous/improper and will be returned with no action.

C. Contractor to maintain current and accurate RFI Log.
1.03 PROPOSAL REQUEST (PR)

A. General:

1. Contractor shall provide quotations for extra work or changes in work when requested by the Project Manager, on a Proposal Request form to be provided by the Project Manager.

2. Contractor shall provide a detailed itemization of the costs to the degree necessary for evaluation by the Project Manager and shall indicate if a change in the Contract Period is warranted.

B. Contractor to maintain current and accurate Proposal Request log.

C. A Proposal Request shall not be interpreted as an authorization to proceed with extra or changed work. Contractor shall not proceed with the work indicated in the Proposal Request until the Project Manager provides a fully-executed copy. A Change Order will be processed to include approved Proposal Requests.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)
SECTION 01062 – PERMITS AND FEES

PART 1 – GENERAL

1.01 DESCRIPTION

   A. This section describes the permitting requirements for the project that are in addition to those indicated in the State of Oregon Standard Conditions for Public Improvement Contracts, including the roles and responsibilities of the Project Manager and the Contractor.

1.02 PERMITS

   A. Permits will be obtained by Oregon Parks and Recreation Department (OPRD) from the City of Bandon are in effect for work. The permits can be reviewed at the OPRD headquarters at 1115 Commercial Street NE in Salem.

   B. Contractor shall obtain all required electrical and plumbing over the counter permits.

   C. Comply with applicable terms and conditions contained in such permits.

   D. Contractor shall obtain all other permits necessary to complete the project.

1.03 FEES

   A. Contractor shall provide a certified third-party inspection firm to provide testing such as but not limited to asphalt compaction testing, backfill compaction testing, etc. as described in the technical specifications.

   B. Contractor shall utilize a surveyor licensed in the State of Oregon to perform record drawing documentation as detailed in Specification 333100 Sanitary Utility Sewerage Piping.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION
SECTION 01090 – REFERENCE STANDARDS

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. All Work shall conform to the issue of following referenced standards which is current at date of receipt of bids. Whenever the following abbreviations are used in these Contract Documents, they are to be construed the same as follows.

AA    -- Aluminum Association
AASHTO   -- American Association of State Highway and Transportation Officials
ACI    -- American Concrete Institute
ACM    -- American Construction Manual
AISC    -- American Institute of Steel Construction
APA    -- American Plywood Association
APWA   -- American Public Works Association
ASTM   -- American Society for Testing and Materials
AWPA   -- American Wood Preservers' Association
AWS    -- American Welding Society
AWWA   -- American Water Works Association
NEC    -- National Electric Code (Oregon Amended)
ODOT   -- Oregon Standard Specifications for Highway Construction by the Oregon Department of Transportation
ODOT/APWA -- 2002 Oregon Standard Specifications for Construction by the Oregon Department of Transportation and Oregon Chapter of APWA
OSHA   -- Occupational Safety and Health Administration
QPL    -- Qualified Products Listing by the Oregon Department of Transportation, Materials and Research Section
UPC    -- Uniform Plumbing Code State of Oregon, Plumbing Specialty Code
WCLIB  -- West Coast Lumber Inspection Bureau

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 01100 – SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SPECIAL PROJECT REQUIREMENTS

A. Contractor is advised that this is a public recreation facility. The parking lot and camp site will be closed as required for on-site construction operations. Contact the Park Manager, a minimum of 15 days in advance, to schedule closure of additional areas to the public during the construction period.

B. All construction debris shall be disposed of in such a manner that it cannot enter the waterway.

C. Care shall be taken to prevent any petroleum products, chemicals or other deleterious material from entering drainage ways or waterways.

D. All areas disturbed or newly created by the construction activity, shall be seeded, sodded, revegetated or given some other type of protection against subsequent erosion and returned back to its original condition.

1.02 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipes and other closed or remote spaces.

C. Remove waste materials, debris and rubbish from the site immediately upon such materials becoming unfit for use in the work. In the event this material is not removed, Project Manager reserves the right, but does not have the duty, to have the material removed and the expense shall be charged to the Contractor.

1.03 TEMPORARY UTILITIES

A. Connections to existing utilities (electric, water, sewer, telephone service) may be allowed as approved by the Project Manager. Contractor to make arrangements for connections. Contractor to pay for cost of connection and use. Exercise measures to conserve energy and water.

B. Provide toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances and regulations pertaining to public health and sanitation.

PART 2 – MATERIALS (not applicable)

PART 3 – EXECUTION (not applicable)

END OF SECTION
PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section specifies transmittal instructions, the number of copies of Contractor submittals to be provided, and distribution of those submittals as required in the State of Oregon General Conditions for Public Improvement Contracts (B.18).

PART 2 – MATERIALS (not applicable)

PART 3 – EXECUTION

3.01 SUBMITTALS

A. General:

1. For each required submittal, the Contractor shall submit four (4) copies of all the required information not less than fourteen (14) Days prior to purchase and/or installation. Two (2) will be returned to the Contractor. Individual sheets shall not exceed 22 inches x 34 inches.

2. Submittals regarding material and equipment shall be accompanied by Submittal/Transmittal Form. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections for which the submittal is required. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer’s package, or are so functionally related that expediency indicates checking or review of the group or package as a whole.

3. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: “XXX”; where “XXX” is the sequential number assigned by the Contractor. Resubmittals shall have the following format: “XXX Y”; where “XXX” is the originally assigned submittal number and “Y” is a sequential letter assigned for resubmittals, i.e., A, B or C being the 1st, 2nd and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of Submittal 25.

B. Deviation from Contract: Submit a request for substitution for deviations from the Specifications or Plans. Include the reason for the deviation and cost differential for the deviation. Deviations from the Contract shall be authorized in writing by the Project Manager.

C. Submittal Completeness: Submittals which do not have all the information required to be submitted are not acceptable and will be returned without review.

D. The Project Manager reserves the right to ask for submittals that are not referenced in this document.
3.02 REVIEW PROCEDURE

A. The Project Manager will review the submittal and return it to the Contractor. The returned material will consist of two (2) marked up copies of the submittal. The returned submittal will indicate one of the following actions:

1. If the review indicates the material, equipment or work method is in general conformance with the Plans/Specifications, the submittal copies shall be marked “Approved.” In this event, the Contractor may begin to incorporate the material/equipment/work method covered in the submittal.

2. If the review indicates the submittal is insufficient or that limited corrections are required, the submittal copies may be marked “Approved as Noted.” The Contractor may begin to implement the work method or incorporate materials/comments covered in the submittal in accordance with the corrections/comments noted.

3. If the review reveals the submittal is insufficient or contains incorrect data and the comments require revision and resubmittal, the submittal copies shall be marked “Not Approved, Resubmit”. In this case, the Contractor shall not then undertake work covered by this submittal until the submittal has been revised, resubmitted and returned to the Contractor with a marking of “Approved” or “Approved as Noted”.

4. If the review reveals the material, equipment, or work does not require submittal, then the submitted copies shall be marked “Review Not Required Per Contract Documents.” In this event, the Contractor may begin to incorporate the material/equipment/work covered by the submittal and no further action is required.

3.03 EFFECT OF REVIEW OF CONTRACTOR’S SUBMITTALS

A. A mark of “Approved” or “Approved as Noted” shall mean the Project Manager has no objection to the Contractor, upon the Contractor’s own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

B. The Contractor shall furnish to the Project Manager the following items for equipment, articles and materials incorporated in the work:

1. Submittals for items identified in individual specification sections.

2. Manufacturer’s special tools and special accessories normally furnished by the manufacturer and which, by their specific nature and special design, are suited for convenient and expeditious adjustment, maintenance and repair.

3. Two (2) sets of installation instructions, parts lists; routine preventative maintenance and operation manuals; corrective maintenance instructions; Plans and other like data pertinent for maintenance and repair.
4. Manufacturer’s and dealer’s warranties and guarantees which are normally available to purchasers. Such warranties and guarantees shall be made effective to the Owner as the purchaser.

END OF SECTION
SECTION 01410 – INSPECTION AND MATERIAL TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes the responsibilities of all parties pertaining to testing and inspections for quality control.

1.02 CONTRACTOR’S RESPONSIBILITY FOR QUALITY CONTROL

A. Testing required by regulation or permit or by individual specification sections.

B. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship, to produce work of specified quality.

C. Comply fully with manufacturer’s instructions.

D. Should manufacturer’s instructions conflict with Contract Documents, request clarification from Project Manager before proceeding.

E. Furnish copies of quality assurance documentation to the Project Manager prior to end of job.

1.03 TESTING

A. The Project Manager may make tests of the work at any time during construction of the Work, during the production, fabrication, or preparation and use of materials, parts, products and equipment. Contractor shall provide access for performance of these tests, including the excavation of shelves in the backfill trench for the safe performance of density testing.

B. Project Manager reserves the right to require samples and to test products for compliance with pertinent requirements irrespective of prior certification of the products by the manufacturer.

C. When such tests of the Work are necessary, as determined by the Project Manager, such tests will be made by and at the expense of Owner unless otherwise specified. The Contractor shall provide such facilities and cooperate as required for collecting and forwarding samples and furnish the required samples without charge and in ample time to permit testing prior to use, and provide safety measures and devices to protect those who take the samples.

D. In the absence of any reference specification, materials shall meet the specifications and requirements of the American Society for Testing and Materials (ASTM), or the American Association of State Highway and Transportation Officials (AASHTO). When there is not pertinent coverage under ASTM or AASHTO, the material shall meet specifications and requirements of applicable commercial standards. Lacking such coverage, materials shall meet requirements established by reputable industry standards for a high-quality product of the kind involved.
E. Cost for re-testing due to Contractor’s nonconformance to specified requirement or testing performed for the convenience of the Contractor shall be charged to the Contractor and withheld from any payment due.

PART 2 - MATERIALS (not applicable)

PART 3 - EXECUTION (not applicable)
SECTION 01560 – ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies environmental mitigation and temporary environmental controls required to be maintained during construction. Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any federal, state, or local authority.

PART 2 - MATERIALS

2.01 SUBMITTALS

A. Submittal: Develop and maintain for the duration of the contract an Erosion Control Plan (ECP) that will effectively incorporate and implement environmental protection precautions. The Contractor’s ECP shall include methods and interim facilities to be constructed and/or used concurrently during construction to control erosion in such a manner as to ensure that sediment and sediment-laden water does not enter any drainage system, roadways, or violate applicable water quality standards. The ECP shall be in strict conformance with the requirements of the permits. Visible or measurable erosion which enters, or is likely to enter, a public storm and surface water system, wetland or stream is prohibited. The ECP shall include the name of the Contractor’s employee authorized to supervise and enforce compliance with the ECP and telephone number(s) to contact that person at any time.

B. The ECP shall be submitted and approved prior to initiating clearing activities.

C. In the event a regulatory agency or jurisdiction determines the ECP to be inadequate to protect the environment:
   1. The Contractor shall immediately stop the affected work in progress until adequate environmental protection measures are implemented.
   2. The Contractor shall modify the ECP to meet the requirements of said regulatory agencies or jurisdictions and provide the Project Manager with the revisions to the ECP within five (5) Days of the notice of deficiency.

2.02 EROSION CONTROL

A. Temporary Sediment Fences:
   1. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers.
   2. Filter fabric fence shall have manufactured stitched loops for 2”x2” post installation. Stitched loops shall be installed on the up-hill side of the sloped area, with posts spaced a maximum of 6 feet apart.
   3. Where practical, the filter fabric shall be purchased in a continuous roll to the length required to avoid the use of joints.
4. The physical integrity of all materials shall be sufficient to meet the requirements of their intended use and withstand normal wear and tear.

B. Straw Bale Sediment Barrier/Bio-Filter Bags: Standard 40 to 60-pound rectangular bales of cereal grain or seed straw. Wooden stakes (2”x2”x 3 feet) shall be used for straw bales and bio-filter bags.

C. Plastic Sheeting: Polyethylene and have a minimum thickness of 6 mil.

PART 3 – EXECUTION

3.01 SITE MAINTENANCE

A. Dust shall be minimized by the Contractor to the extent practicable, utilizing all measures necessary including, but not limited to:

1. Sprinkling haul and access roads and other exposed dust-producing areas with water.

2. Use of covered haul equipment.

3.02 STREET CLEANING

A. Prevent dirt, mud, and dust from escaping trucks departing the work site, by covering dusty loads and cleaning truck tires before leaving the construction site.

B. All streets in the construction area used by Contractor’s trucks or any other equipment hauling material to and from the area, whether within the Contract limits or adjacent thereto, shall be kept clean by the Contractor and shall be continuously serviced by the Contractor’s use of sprinkling trucks to control dust. All cleaning and sprinkling shall be at the Contractor’s expense. Violations of these requirements are sufficient grounds for the Project Manager to order the streets in question to be cleaned by others. The expense of the street cleaning will be charged against the Contractor and cost withheld from Contractor's payments.

3.03 NOISE CONTROL

A. Comply with all local controls and noise level rules, regulations and ordinances.

B. Each internal combustion engine used on the job, or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler.

C. Noise levels for scrapers, pavers, graders, backhoes and trucks shall not exceed 90 dBA. For other equipment, noise levels shall not exceed 85 dBA. Equipment that cannot meet these levels shall be quieted by use of improved exhaust mufflers, noise attenuation barriers or other means approved by the Project Manager.

D. If special circumstances or emergency conditions require work beyond the hours as specified, the Contractor shall:

1. Notify the Project Manager 72 hours in advance of any proposed extended work
hours for preauthorization. The Contractor’s written request shall specify the work to be performed and the circumstances that warrant the request. The request shall include any additional measures to mitigate noise generated by this construction activity, if deemed necessary by the Project Manager.

2. If an emergency situation occurs that warrants extended hours, the Contractor shall notify the Project Manager immediately upon determining the need for this work.

3.04 TREE AND PLANT PROTECTION

A. The Contractor shall minimize vegetation removal during his construction operations.

B. The Contractor shall protect all existing ornamental landscaping and trees from damage by construction activities. Work areas shall be carefully located and marked to reduce potential damage. Trees shall not be used as anchors for stabilizing working equipment. Work performed adjacent to ornamental landscaping and trees shall include protecting each tree or ornamental with a high visibility perimeter barrier fence. The barrier fence shall be an orange snow fence or approved equal. The Contractor shall not remove any ornamental landscaping or trees without written approval from Project Manager.

C. Where existing vegetation or landscaped areas have been removed or disturbed by the Contractor’s operations, the site shall be regraded and restored by the Contractor as soon as practicable, with no additional cost to the Owner.

D. If ornamental landscaping or trees are damaged or destroyed by the Contractor’s operations without prior authorization by the Project Manager, the Contractor shall replace the ornamental landscaping or tree in species, size and grade to the satisfaction of the Project Manager, at no cost to the Owner. The Contractor shall maintain the replacement ornamental landscaping for a period of 8 weeks, and replacement trees for a period of one year, to assure a satisfactory replacement. Replacement ornamental plantings or trees that are dead or dying, as determined by the Project Manager, at the end of the 8 week or one-year establishment period shall be replaced by the Contractor to the satisfaction of the Project Manager and at no cost to the Owner. Should it not be practical to replace the ornamental landscaping or tree, the Contractor shall pay damages in accordance with requirements of the Project Manager. In the event the Contractor does not perform this replacement work in a timely manner as determined by the Project Manager, the Project Manager reserves the right to have the work performed by others. The expense of replacing ornamental landscaping or trees will be charged against the Contractor and the cost withheld from Contractor’s payments.

3.05 ADDITIONAL TREE PROTECTION

A. A critical root zone (CRZ) shall be established for all trees on-site that need protection. The CRZ shall be the area between the tree trunk and a surrounding protective barrier fence. The protective barrier fence shall be placed at a minimum distance of the dripline for broad-crowned trees (usually deciduous) and 1.5 times the dripline for narrow-crowned trees (usually conifers). For asymmetrical crowns, the dripline shall be determined at the crown’s widest point. The Project Manager shall have the discretion to require fencing to be placed at a distance of a 1-1.5’ radius for each inch of tree diameter at 4.5’ (diameter breast height) if he/she feels that the dripline does not provide adequate protection. Regardless of diameter, fencing shall be placed at a minimum of 6’ from the
trunk of a tree. No disturbance of any kind shall take place within the fenced area (CRZ). Fencing shall not be removed or relocated without approval from Project Manager.

B. When roots greater than 2” diameter are exposed, root pruning with a saw shall take place under the supervision of the Project Manager.

C. When tree removals are required, stumps shall be ground rather than pulled when roots are intertwined with the root systems of adjacent trees. Stumps may be pulled when there is no danger of interfering with the roots of adjacent trees.

D. The Project Manager may request that a 6-10” layer of mulch be applied over the critical root zones of trees on site before any construction activity begins to help reduce soil compaction. Following construction, the mulch shall be reduced to a depth of 4”. The Project Manager may also request travel lanes for heavy equipment.

E. Contractor shall monitor tree health throughout the construction process and notify Project Manager immediately of any damages to trees as a result of construction activities. Contractor shall not implement any tree care practices without approval from Project Manager.

F. Trenching & Tunneling:

1. When trenching is utilized, it shall be done as far from the tree trunk as possible. For trees less than 7” in diameter, trenching should be avoided under the dripline. A general guideline for a minimum trenching distance is .5’ for each inch of trunk diameter measured at 4.5’ (dbh). The following table lists minimum distances for tree diameters:

<table>
<thead>
<tr>
<th>Tree diameter (dbh-4.5’)</th>
<th>Minimum trenching distance from trunk</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-12”</td>
<td>5-6’</td>
</tr>
<tr>
<td>14-16”</td>
<td>7-8’</td>
</tr>
<tr>
<td>18-20”</td>
<td>9-10’</td>
</tr>
<tr>
<td>22-24”</td>
<td>11-12’</td>
</tr>
<tr>
<td>26-28”</td>
<td>13-14’</td>
</tr>
<tr>
<td>30-32”</td>
<td>15-16’</td>
</tr>
</tbody>
</table>

2. In some cases, trenching inside of the minimum distance is unavoidable. When roots greater than 2” diameter are encountered while trenching inside of the minimum distance, equipment operation shall cease and roots shall be exposed by hand digging. Roots shall then be pruned cleanly with a saw to the depth of the required excavation, and on the edge of the trench closest to the tree. No root pruning shall take place without Project Manager’s supervision.

3. Soil removed from the trenches shall be replaced as soon as possible. Exposed, pruned, or broken roots shall not be allowed to dry out prior to final backfill. Building materials, compacted soil, or soil with a permeability significantly different than the surrounding natural soil shall not be used to fill trenches.

Where feasible, a combination of trenching and tunneling may be utilized. Trenching may be used in gaps between trees where root damage is not an issue. When the trench approaches a tree’s root zone, tunneling may be implemented until safely out of the root
zone. Another guideline is to replace trenching with tunneling when roots 1” in diameter are encountered. The following table lists some tunneling distances for tree diameters:

<table>
<thead>
<tr>
<th>Tree diameter</th>
<th>Minimum tunneling distance from any side of tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-9”</td>
<td>5’</td>
</tr>
<tr>
<td>10-14”</td>
<td>10’</td>
</tr>
<tr>
<td>15-19”</td>
<td>12’</td>
</tr>
<tr>
<td>Over 19”</td>
<td>15’</td>
</tr>
</tbody>
</table>

4. Tunneling is the preferred method over trenching for root protection. Tunneling at a minimum depth of 2’ is recommended; 3-4’ is safer. It is best to tunnel at least 1-2’ away from the tree trunk in order to avoid a conflict with a taproot.

G. Grade Changes in root zones can cause significant damage and death of trees. Raising the grade can suffocate roots; lowering the grade can be detrimental as valuable feeder roots are destroyed. If enough larger roots are removed, the tree may pose a risk from reduced stability. Changing the grade within the root zone of any tree on the site shall be avoided and shall be approved by the Project Manager.

3.06 DEWATERING AND WATER CONTROL

A. The Contractor shall not divert storm drainage or sewer flow through any portion of new sewer or any other new facility until after that portion of the pipeline to be used has been field-acceptance tested in accordance with the Specifications, and until specific written approval from the Project Manager has been received. No direct water from construction activities shall be diverted to new or existing sanitary sewer.

B. Maintain excavations free from water while construction is in progress. Keep trenches and other areas free from water as required to permit continuous progress of, or to prevent damage to, the work or the work of others.

3.07 FISH AND WILDLIFE HABITAT

A. The requirements of local, state, and federal agencies charged with wildlife and fish protection shall be adhered to by the entire construction work force.

B. All equipment to be used in the work shall be cleaned prior to mobilization to the site, to prevent noxious and non-native seed contamination of the site.

3.08 EROSION CONTROL

A. Execute the approved ECP.

B. Temporary Sediment Fences:

1. Filter fabric fence shall have a minimum vertical burial of 6 inches. All excavated material from filter fence installation shall be firmly re-deposited along the entire trenched area on the uphill side of the fence.

2. The filter fabric shall be installed to follow the contours where feasible. The fence posts shall be spaced a maximum of 6 feet apart and driven securely into
the ground a minimum of 24 inches.

3. Sediment fences shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs, relocations or additions shall be made immediately.

4. At no time shall more than one foot of sediment be allowed to accumulate behind a sediment fence. Sediment should be removed or regraded into slopes, and the sediment fences repaired and reestablished as needed.

C. Straw Bale Sediment Barrier/Bio-Filter Bags: This method may be used to divert runoff around active work areas or into sediment filtration/sedimentation areas.
   1. Bio-filter bags can be used in drainage ditches and/or swales.
   2. Straw bales and bio-filter bags shall be secured with stakes driven through them and into the ground to a minimum depth of 12 inches. Straw bales shall be keyed into the existing ground 2 to 4 inches.
   3. At no time shall more than one foot of sediment be allowed to accumulate behind a straw bale sediment barrier and/or bio-filter bag system. Sediment should be removed or regraded into slopes, or new lines of barriers installed uphill of sediment-laden barriers.

D. Plastic Sheeting:
   1. Spoils piles and exposed earth slopes shall be covered in wet weather or if wet weather is anticipated. Plastic sheeting shall be installed and maintained tightly in place by using sandbags or tires on ropes with a maximum 10 feet grid spacing in all directions. All seams shall be taped or weighted down full length and there shall be at least 12-inch overlap of all seams. For seams parallel to the slope contour, the uphill sheet shall overlap the downhill sheet. No runoff shall be allowed to run under the plastic covering.
   2. Drainage from areas covered by plastic sheeting shall be controlled such that no discharge occurs directly onto uncontrolled, disturbed areas of the construction site.

E. Excavated materials shall be placed on the uphill side of the excavation except when there are overriding safety requirements or lack of available space. In no case shall excavated material be placed in streams, watercourses, or wetlands without required permits.

F. Vegetative Buffer Protection: Areas within or adjacent to the project may have steep slopes, or buffers of associated streams, watercourses, or wetlands that need to be avoided and protected from disturbance. The Contractor shall limit disturbance to existing vegetation in these areas to the extent possible. In no case shall the Contractor cause disturbance in associated streams, watercourses, or wetlands without required permits.

G. Under no circumstance shall Contractor’s vehicles or equipment enter a property adjacent to a stream, watercourse, or other storm and surface water facility, or a wetland without
an ECP having been approved by the Project Manager and implemented.

H. The Contractor shall not drag, drop, track, or otherwise place or deposit, or permit to be deposited, mud, dirt, rock or other such debris into any part of the public storm or surface water system, or any part of a private storm or surface water system. The Contractor at the Contractor’s expense shall immediately remove any such deposit of material. No material shall be washed or flushed into any part of the storm or surface water system without erosion control measures installed to the satisfaction of the Project Manager.

I. The Contractor shall maintain the facilities and techniques contained in the approved ECP so as to continue to be effective during the construction or other permitted activity. If the facilities and techniques approved in an ECP are not effective or sufficient as determined by the Project Manager, the Contractor shall revise the plan upon notification by the Project Manager. Upon approval of the revised plan by the Project Manager, the Contractor shall immediately implement the additional facilities and techniques. In cases where erosion is occurring, the Project Manager may require the Contractor to install interim control measures prior to submittal of the revised ECP.

J. The Contractor shall ensure that all necessary pollution control equipment, supplies, or materials are available to implement the ECP.

K. Filter fabric fences, sediment barriers and other erosion control devices shall be removed by the Contractor when they have served their useful purpose, but not before the upslope area has been permanently protected and stabilized.

3.09 CULTURAL RESOURCES

A. Attention is directed to the National Historic Preservation Act of 1966 and 36 CFR 800, which provide for the preservation of potential historical, architectural, archaeological or cultural resources (hereinafter "cultural resources").

B. The Project Manager intends to conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources and fair compensation to the Contractor for delays resulting from such cultural resources investigations.

C. Monitoring: In the event potential cultural resources are uncovered during subsurface excavations at the worksite, the following procedures will be instituted:

1. Project Manager will issue a verbal work suspension directing the Contractor to cease all construction operations at the location of a potential cultural resources discovery. Project Manager will contact a professional archaeologist to evaluate the significance of the find. A written work suspension order will be issued within four hours of the verbal work suspension order.

2. Such work suspension will be effective until such time as the qualified archaeologist can evaluate the potential cultural resources for their significance and make recommendations to the State Historic Preservation Officer. Any work suspension direction will contain the following:

   a) A clear description of the work to be suspended.
b) Any instructions regarding issuance of further orders by the Contractor for material services.

c) Specific direction to the Contractor to minimize the work suspension costs (i.e., work elsewhere while archaeologist is evaluating find).

d) Estimated duration of the temporary suspension.

3. If the archaeologist determines the cultural resource is eligible to be nominated to the National Register of Historic Places, Project Manager may extend the duration of the work suspension order in writing.

4. Equitable adjustment of the construction Contract time will be made for temporarily suspended work in accordance with the General Conditions.

3.10 FINES

D. Contractor shall be responsible for all fines incurred from non-compliance with regulations of governing authorities.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes general requirements for the commissioning of the Work, starting, testing, and operating the completed Work, including systems and equipment, until substantial completion is achieved and the completed Work, including systems or equipment, is accepted by the Project Manager.

B. Contractor shall cooperate, coordinate and schedule activities with the Project Manager in the operation, maintenance, and adjustment of the Work.

1.02 DEFINITIONS

A. Commissioning: The series of activities necessary to bring a component, system, or unit process from installation to readiness for substantial completion. Commissioning includes, but is not limited to, field testing, dry testing, wet testing, performance testing, manufacturer's checkout, start-up, and operational demonstration.

B. Start-up: Narrowly defined as placing a component, system, or unit process on-line. Can be a commissioning activity or a normal operating activity.

C. Operational Demonstration: A commissioning activity performed by the Contractor wherein the Contractor operates and maintains a fully functional component, system, or unit process for a period of time after stable operation has been achieved.

D. Field Testing: Testing performed on-site by the Contractor to satisfy requirements of the manufacturer and Contract Documents.

E. Manufacturer's Checkout: Field inspection, testing, adjustments, and sign off by the manufacturer's representative, indicating that the component, system or unit process meets the manufacturer's requirements.

PART 2 - MATERIALS

2.01 SUBMITTALS

A. Field Installation Reports - Submit reports by manufacturer's representative.

PART 3 - EXECUTION

3.01 EXAMINATION AND VERIFICATION OF CONDITION

A. The Contractor shall inspect systems and equipment prior to each start-up and verify their readiness for start-up. Conditions hazardous to equipment or personnel shall be corrected by the Contractor prior to start-up of equipment.

1. Start-up operations shall not proceed using temporary power or temporary
instrumentation and control wiring. All electrical and control connections shall be permanent and complete, and all such electrical components and equipment fully functional.

2. Use of repair parts during start-up operations shall not be permitted, except in such situations where the actual on-site verification of such repair parts' operability is specified.

3. The Contractor shall verify that all copies of the Maintenance and Operating Instructions have been received, and are acceptable, and the only outstanding item is the field verification of the Instructions.

3.02 PREPARATION

A. Prior to start-up of equipment or systems, all necessary test equipment shall be in place and operable.

B. Contractor shall ensure manufacturer's representative(s) shall be present for the initial start-up of systems or equipment.

C. The Contractor shall request permission to start-up equipment, including electrical gear, and notify the Project Manager of the start-up.

1. The Start-Up Request shall be submitted to the Project Manager a minimum of 72 hours before the scheduled start-up. Requests shall be made during normal working hours.

2. The Contractor shall obtain the approved Start-Up Request prior to the system or equipment start-up.

3. If training is to be conducted in conjunction with the start-up this should be indicated on the Start-Up Request.

D. Normal installation checks, such as for rotation, are not considered start-ups and do not normally require start-up notification.

1. All electrical apparatus, which is energized, shall be clearly marked.

3.03 CONDUCT OF START-UP AND COMMISSIONING

A. Start-up

1. Contractor shall ensure all initial start-ups of equipment or systems shall be performed under the technical direction of the manufacturer's representative.

2. Any lack of readiness of associated systems or failure of a system or equipment previously started prior to the date of final acceptance of the Project shall require additional initial start-up service of the manufacturer to be performed.

3. The Contractor shall repair, replace or modify any equipment or system, which fails to perform.

B. The Contractor shall commission all work.
C. The Contractor is responsible for the performance and operation of the systems and equipment during commissioning.

D. The Contractor shall make all adjustments and corrections necessary to achieve normal, stable operation of systems.

E. Any failures of equipment or systems operated under the direction of the Contractor shall be considered deficiencies and shall be corrected.

3.04 QUALITY CONTROL

A. Manufacturer’s Representative Reports.

1. Contractor shall ensure the manufacturer’s representative prepare a daily report on each site visit for each system or item of equipment inspected, adjusted, started-up, or worked on.

2. The report shall state the purpose of the visit, the representative’s observations and conclusions, and recommendations for further visits or action.

3. The reports shall be submitted to the Project Manager within three (3) days of the visit.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this Section includes submittal of Maintenance and Operating Instructions.

B. The Contractor shall prepare and furnish Maintenance and Operating Instructions for installation, maintenance and operation of all equipment.

1.02 DEFINITIONS

A. The Maintenance and Operating Instructions will be used by the Owner for both routine and major maintenance. Maintenance and Operating Instructions shall include complete and specific information for use by the Owner's operating and maintenance personnel. The Contractor is responsible for collecting, collating, and assembling the Maintenance and Operating Instructions.

B. Depot-level Instructions are detailed instructions that would be used by the Manufacturer's factory, repair depot, or authorized service center to repair or rebuild an item of equipment or a component, part, or subassembly of an item of equipment deemed by the Manufacturer as "not user serviceable". These instructions will be used for both ordinary and major maintenance, and enable the Project Manager to overhaul or repair equipment in the event parts become unavailable.

C. Original Equipment Manufacturer (O.E.M.) is the company that manufactured an item of equipment; or a component, part, or subassembly of an item of equipment.

D. Original/First Generation Copies are direct reproductions of the Manufacturer's master printing document(s).

PART 2 - MATERIALS

2.01 SUBMITTALS

A. Procedure

1. The Contractor shall prepare an initial submittal of three (3) original/first generation copies of Maintenance and Operating Instructions.

2. All Maintenance and Operating Instructions shall be specific for the equipment. Any portions of the submittal not pertinent to the equipment or component shall be crossed out with a bold line or marked with "does not apply", or clearly identify (and without question) the portions of the submittal that are pertinent. Note: Highlighting of submittals is not acceptable.

B. Maintenance and Operating Instructions shall be fully depot-level as described in this Section and shall be complete enough to fully delineate the internal functions of all purchased encapsulated components or similar "black box" devices to the satisfaction of the Project Manager.
1. Certain information, also categorized under this Section as Maintenance and Operating Instructions, is to be submitted with the product data to provide the Project Manager with information regarding the incorporation of the equipment into the work and with functional data to evaluate equipment operation. The requirements for this information are also identified in this Section and are to be incorporated as part of the Maintenance and Operating Instructions submittal.

2. The Maintenance and Operating Instructions shall contain, unless otherwise specified, the following information.

   a) Manufacturer's Data: Include general descriptive bulletins, brochures, or catalog sheets used to describe the equipment.

   b) Operating Instructions / Operating Sequence Descriptions: These shall be complete, detailed written descriptions of the operating sequence of all control systems and operations in all modes. The descriptions shall be specifically prepared for this work and shall be fully referenced to control diagrams and system components. The descriptions shall include start-up and shut-down operations under manual, automatic and emergency (alarm) conditions and any alternate operating modes. Descriptions of system reactions and sequencing including the operation of switches, lights, timers, relays, contacts, valves, motors, and equipment components shall be included. Interlock functions shall be fully described including system safety functions.

   c) Manufacturer's Instructions: This shall include instruction for storage, installation, routine preventive maintenance, and lubrication. This data shall include instructions that describe the proper procedure for moving, supporting, and anchoring of equipment, including tolerances for settings and adjustment. Also included shall be the storage requirements and procedures to protect products prior to installation; and, once installed, prior to start-up/periods of prolonged shut-down; and proper storage of repair parts.

   d) Parts List: Include assembly, exploded view illustrations, or sectional drawings with all parts identified. Part listings shall include descriptions, quantity (per assembly) required, and original equipment manufacturer's part numbers.

   e) Supplier Data: Provide addresses, telephone numbers, and names of contact persons for the equipment manufacturer and manufacturer's representative. Include both regional (local) and home offices.

   f) Warranties and Guarantees: Include terms and conditions of the warranty. Include the manufacturer's express warranty and any special express warranties in addition to the general warranty. Draft warranties shall be submitted with the shop drawing submittals. Final warranties will become effective on the date of substantial completion applicable to the named equipment. Copies of the approved draft warranties are to be included in the initial Maintenance and Operating Instructions submittal. Following substantial completion, copies of the executed final warranties shall be provided to the Project Manager for insertion into the final Maintenance and Operating Instructions.
PART 3 - EXECUTION

3.01 FIELD VERIFICATION

A. The Contractor shall verify the accuracy of Maintenance and Operating Instructions by visual and physical inspection of the installed equipment. The Contractor shall:

1. Perform field verification in the presence of the Project Manager.

2. Do not perform field verification until the Maintenance and Operating Instructions have received an acceptable disposition from the Project Manager.

3. Perform field verification after successful completion of Start-up, Testing, Adjusting, and Balancing.

4. Physically trace and document as required, all wiring and piping.

5. Visually inspect equipment and components and compare configurations and nameplate information to Maintenance and Operating Instructions.

6. Submit any changes, additions, or deletions to the Maintenance and Operating Instructions identified during field verification.

END OF SECTION
SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Reference General Structural Notes in the structural drawings for additional information.

1.02 SUMMARY
A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
   1. Footings.
   2. Slabs-on-grade.
   3. Suspended slabs.
B. Related Requirements:
   1. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.

1.03 DEFINITIONS
A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Reference General Structural Notes for mixing water to be withheld for later addition at Project site.
C. Steel Reinforcement Shop Drawings:
1. Steel Reinforcement shop drawings shall contain sufficient detail and information to allow complete fabrication, bending, and placement of steel reinforcement without reference to the contract drawings either on the fabrication shop floor or at the project site. The detailer shall generate all shop drawing fabrication and installation details from the structural drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted. When CAD or REVIT files are provided, it is the responsibility of the detailers to remove all information not directly relevant to the creation of the placing drawings as well as all references to the outside sources of the files.

   a. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical and welded connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Bar arrangement to identify size, shape, grade, and location of steel reinforcement.

   b. Provide details of fabrication, bending, and placement, prepared according to ACI SP-66 “ACI Detailing Manual.” Include special reinforcement required for openings through concrete structures.

   c. Shop drawings shall include plans for all slabs to show bar arrangement. Plans to include special reinforcement required for openings through concrete structures

   d. Shop drawing re-submittals shall clearly identify all revisions to previous submittals.

      1) Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.

      2) Engineer will not review information outside of revision clouds on resubmitted drawings.

2. Location of construction joints is subject to approval of the Engineer.

D. Samples: For waterstops.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Form materials and form-release agents.

4. Steel reinforcement and accessories.

5. Waterstops.

6. Curing compounds.
7. Slab treatments.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.08 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL
A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301 (ACI 301M).
   2. ACI 117 (ACI 117M).

2.02 FORM-FACING MATERIALS
A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT
A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.04 REINFORCEMENT ACCESSORIES
A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. Use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 CONCRETE MATERIALS
A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
B. Cementitious Materials:
   2. Fly Ash: ASTM C 618, Class F or C.
   3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33/C 33M.
   1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable and ASTM C1602/C1602M.

2.06 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 1-1/4 by 1/2 inch (31 by 12 mm).
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. CETCO, a Minerals Technologies company.
      b. Approved equal.

2.07 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.08 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.09 REPAIR MATERIALS

A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 4000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
   1. Reference the General Structural Notes for compressive strength, maximum W/C ratio, and air content.

B. Cementitious Materials: Refer to General Structural Notes.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture in concrete, as required, for placement and workability.

2.11 FABRICATING REINFORCEMENT
A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING
A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION
A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), and under the supervision of the formwork engineer, registered in the project state, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class C, 1/2 inch (13 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   1. Install keyways, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Chamfer exterior corners and edges of permanently exposed concrete.
H. Form openings, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

2. Install hatch and cable tray in accordance with manufacturer requirements.

3.03 REMOVING AND REUSING FORMS

A. Refer to General Structural Notes. Removal time shall not be less than the following:

1. Twelve hours minimum for slab-on-grade sides.

2. Four days minimum for elevated structural slabs.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORING AND RESHORING INSTALLATION

A. Shoring is the contractor's responsibility and shall conform to ACI 347R-14 and ACI 347.2-17. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

1. Formwork shall not be removed from horizontal members before concrete strength is at least 70 percent of design strength, as determined by field cured cylinders. In addition, shoring shall not be removed sooner than the following cumulative time periods with surrounding temperature greater than or equal to 50 degrees Fahrenheit:
a. Slab-on-Grade sides: 12 hours.

b. Elevated Structural Slabs: 28 days.

2. Do not remove shoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores to avoid damage to concrete.

3.05 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.

2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.07 WATERSTOP INSTALLATION

A. Self-Expanding Strip Waterstops: Install at locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.08 CONCRETE PLACEMENT

A. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

C. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.


3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

3.10 FINISHING SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to Base Slab.

C. Broom Finish: Apply a broom finish to Top Slab and Apron.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming
      with fiber-bristle broom perpendicular to main traffic route. Coordinate required
      final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades
   is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend
   with in-place construction. Provide other miscellaneous concrete filling indicated or
   required to complete the Work.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot
   temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI
   305.1M) for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of supported slabs,
   and other similar surfaces. If forms remain during curing period, moist cure after loosening
   forms. If removing forms before end of curing period, continue curing for remainder of
   curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed
   surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days
      with the following materials:
         a. Water.
         b. Continuous water-fog spray.
         c. Absorptive cover, water saturated, and kept continuously wet. Cover
            concrete surfaces and edges with 12-inch (300-mm) lap over adjacent
            absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-
      retaining cover for curing concrete, placed in widest practicable width, with sides
      and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or
      adhesive. Cure for not less than seven days. Immediately repair any holes or tears
      during curing period, using cover material and waterproof tape.
3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

   2. After concrete has cured at least 14 days, correct high areas by grinding.

   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

   4. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Steel reinforcement placement.

2. Verification of use of required design mixture.

3. Concrete placement, including conveying and depositing.

4. Curing procedures and maintenance of curing temperature.

5. Verification of concrete strength before removal of shores and forms from slabs.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

C. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

1. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

2. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
3. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

4. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

5. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

7. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION
SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY
   A. Section Includes:
      1. Structural stainless steel.
      2. Anchor Bolts

1.02 DEFINITIONS
   A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.03 ACTION SUBMITTALS
   A. Product Data:
      2. Perforated metal.
   B. Shop Drawings: Show fabrication of structural steel components.

1.04 INFORMATIONAL SUBMITTALS
   A. Welding certificates.
   B. Mill test reports for structural-stainless steel materials, including chemical and physical properties.

1.05 QUALITY ASSURANCE
   A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.6/D1.6M.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
   A. Comply with applicable provisions of the following specifications and documents:
1. ANSI/AISC 303.
2. ANSI/AISC 360.

2.02 STRUCTURAL STEEL MATERIALS

A. Angles Shapes: ASTM A276 AISI 316 (UNS S31600 S31603), Grade 30
B. Plate and Bar: ASTM A276, AISI 316 (UNS S31600 S31603), Grade 30
C. Perforated Metal: Standard stainless steel mesh as provided by equipment and stand manufacturer.
D. Welding Electrodes: Comply with AWS requirements.

2.03 ANCHOR BOLTS

A. Unheaded Anchor Bolts: ASTM F1554, Grade 36.

2.04 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.05 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.6/D1.6M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.06 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
   1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.6/D1.6M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E165/E165M.
b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

c. Ultrasonic Inspection: ASTM E164.

d. Radiographic Inspection: ASTM E94/E94M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete-bearing surfaces and locations of anchor bolts, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.03 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.

2. Verify weld materials and inspect welds.

3. Verify connection materials and inspect bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION
SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. The General and Supplementary Conditions are a part of the requirements for the work under this Division of the Specifications.

B. The general scope of this project is to replace two sewage pumps with new pumps, along with replacing the control panel. New conductors, conduit and circuit breaker are also to be furnished and installed. The alarm contactor panel is to be inspected as part of this scope to be considered for replacement.

C. The sump pit can be considered a Class 1 Division 1 Hazardous Location, as the presence of flammable gasses and corrosive vapors are expected to exist. The pump house itself is not considered a hazardous location because of seals on sump pit lid.

1.02 WORK INCLUDED

A. Provide labor and materials required to install, test and place into operation the electrical systems as called for in the Contract Documents, and in accordance with applicable codes and regulations.

B. Provide labor, materials, and accessories required to provide complete, operating electrical systems. Labor, materials or accessories not specifically called for in the Contract Documents, but required to provide complete, operating electrical systems shall be provided without additional cost to the Owner.

1.03 QUALITY ASSURANCE

A. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations and requirements of the utility companies serving the project and the Owner’s insurance underwriter.

B. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the most stringent apply.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Engineer prior to submitting bid.

D. All electrical equipment, materials, devices and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA, UL, and the State Fire Marshal.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, work-person like manner by competent work people. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. Equipment shall be certified for use in the State of the project and shall meet the State energy code.
1.04 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

1. ADA - Americans with Disabilities Act
2. ANSI - American National Standards Institute
3. ASA - Acoustical Society of America
4. ASTM - American Society for Testing and Materials
5. BIL - Basic Impulse Level
6. CBM - Certified Ballast Manufacturers
7. ECC - Engineer’s Control Center
8. EIA - Electronic Industries Alliance
9. ETL - Electrical Testing Laboratories, Inc.
10. FCC - Fire Control Center
11. FM - Factory Mutual
12. IEEE - Institute of Electrical and Electronic Engineers
13. IES - Illuminating Engineering Society
14. IPCEA - International Power Cable Engineers Association
15. LED - Light Emitting Diode
16. NEC - National Electric Code
17. NEMA - National Electrical Manufacturers Association
18. NETA - National Electrical Testing Association
19. NFPA - National Fire Protection Association
20. OEM - Original Equipment Manufacturer
21. OSHA - Occupational Safety and Health Administration
22. SCC - Security Control Center
23. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
24. TIA - Telecommunications Industry Association
25. UL - Underwriters Laboratories
B. Definitions:

1. Where it is stated in these specifications to submit to Engineer for review, refer to architectural General and Supplementary Conditions for proper procedures.

2. FURNISH means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.

3. INSTALL means to join, unit, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.

4. PROVIDE means to FURNISH and INSTALL.

5. AS DIRECTED means as directed by the Engineer, or the Engineer’s representative.

6. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.

7. SUBMIT means submit to Engineer for review.

1.05 GUARANTEE

A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. Guarantee work against faulty and improper material and workmanship for a period of one year from the date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, without additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

1.06 USE OF THE ENGINEER’S DRAWINGS

A. The Contractor shall obtain, at the Contractor’s expense, from the Engineer, a set of AutoCad or compatible format engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings and record drawings. The Contractor shall provide to the Engineer a written release of liability acceptable to the Engineer prior to receiving the electronic media.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.
B. Products and materials shall not contain asbestos, PCB, or any other material that is considered hazardous by the Environmental Protection Agency or any other authority having jurisdiction.

C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Engineer at no additional cost to the Owner.

D. Provide name/data plates on major components of equipment with manufacturer’s name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

E. Install materials and equipment with qualified trades people.

F. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

G. Fully lubricate equipment where required.

H. Follow manufacturer’s instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.

I. Where factory testing of equipment is required to ascertain performance, and attendance by the Owner’s representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.

J. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on the submittals.

K. Enclosures for electrical equipment installed in mechanical equipment rooms shall be NEMA type 1 gasketed. Enclosures for electrical equipment installed outdoors shall be NEMA type 3R.

L. Energy consuming equipment shall be certified for use in the State of the project and shall meet the State Energy Code and local energy ordinances.

M. Electrical products installed in this project shall be listed by a recognized testing laboratory or approved in writing by the local inspection authority as required by governing codes and ordinances.

N. Materials shall be new, of the best quality, and match or exceed current accepted industry standards. The materials shall be manufactured in accordance with NEMA, ANSI, U.L. or other applicable standards.

2.02 SUBSTITUTIONS

A. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.

B. Submit proposals to provide substitute materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project
schedule. Reimburse Owner for costs associated with the review of the proposed substitution whether substitution is accepted or rejected.

C. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work and related trades are not permitted.

D. The proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified and shown on the Drawings.

E. Proposals for substitutions shall include the following information:

1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.

2. Schematic drawings and details.

3. List of revisions to the Contract Documents that must be made if the substitution is accepted.

4. Estimate of costs the Owner may incur in implementing the substitution, such as test, evaluation, operating and support costs.

5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.

6. A statement indicating the reduction to the Contract price if the Owner accepts the substitution. Include required modifications to all related trades.

PART 3 - EXECUTION

3.01 FEES AND PERMITS

A. Pay all required fees and obtain all required permits related to the electrical installation.

B. Pay royalties or fees in connection with the use of patented devices and systems.

C. Provide controlled inspection where required by authorities having jurisdiction or by these specifications.

D. Contractor is responsible for paying for all utility shutdown and/or startup fees associated with electrical installation within the contract scope of work.

3.02 SUBMITTALS AND REVIEWS

A. Submit shop drawings, manufacturer’s product data sheets, samples, and test reports as specified.

B. Within two months after notice to proceed by the Owner or Owner’s Representative, or after execution of Owner/Contractor Agreement, submit a complete typed list of all
electrical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.

C. Within four months after notice to proceed by the Owner or Owner’s Representative, or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the Specification sections or Drawing number, and an item description. Prefix the submittal identification number by the Specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.

D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.

E. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments shall not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

F. Review and recommendations by the Engineer are not to be construed as change authorizations. If discrepancies between the materials or equipment submitted and the Contract Documents are discovered either prior to or after the data is processed, the Contract Documents will govern.

G. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted and accepted.

H. A minimum period of ten working days, exclusive of transmittal time, will be required in the Engineer’s office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.

I. Submit electronic copies of all items requiring shop drawings. Submit electronic copies of manufacturer’s product submittals. Electronic copies of submittals, with applicable markups, will be returned. Additional copies are the responsibility of the Contractor.

J. Submittals will be stamped as follows:

<table>
<thead>
<tr>
<th>Stamp</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>No Exceptions Noted</td>
<td>Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.</td>
</tr>
<tr>
<td>Exceptions Noted</td>
<td>Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.</td>
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<td>[ ] Resubmit for Record</td>
<td>Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.</td>
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<td>No Resubmission Required</td>
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<td>Revise and Resubmit</td>
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<td></td>
<td>Reviewed for Information Only</td>
</tr>
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<td></td>
<td>Unreviewed</td>
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</tbody>
</table>

K. Submit materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalog material. Maintenance and operating manuals are not acceptable substitutes for shop drawings.

L. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as materials or paint finishes.

M. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, piping and service connection data.

N. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

O. For each room or area of the building containing electrical equipment, submit the following:

1. Floor Plans: Plan and elevation layout drawings indicating the equipment in the exact location in which it is intended to be installed. These plans shall be of a scale not less than ¼ inch = 1’-0”. They shall be prepared in the following manner:

   a. Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).

   b. Illustrate all electrical equipment proposed to be contained therein. Include top and bottom elevations of all electrical equipment. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer’s required clearances.
c. Illustrate all other equipment therein such as conduits, detectors, luminaries, ducts, registers, pull boxes, wireways, structural elements, etc.

d. Indicate the operating weight of each piece of equipment.

e. Indicate the heat release from each piece of electrical equipment in terms of BTU per hour. This information shall be that which is supplied by the respective manufacturers.

f. Illustrate concrete pads, curbs, etc.

g. Indicate dimensions to confirm compliance with code-required clearances.

h. Indicate maximum normal allowable operating temperature for each piece of equipment (as per each respective manufacturer’s recommendation).

i. Equipment removal routes.

P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.

Q. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

S. Number all pages and drawings in product data brochures consecutively from beginning to end. Unless the following information is included, the submittal will be returned for resubmission. Resubmittals of product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

1. Indicate the following on the lower right-hand corner of each shop drawing and on the coversheet of each product data brochure electronic submission:

   a. The submittal identification number.

   b. Title of the sheet or brochure.

   c. Name and location of the project.
d. Names of the Engineer, Contractor, Subcontractor, manufacturer, supplier and vendor.

e. The date of submittal; and the date of each correction, version and revision.

T. The distribution equipment, short circuit and coordination study, and room layout submittals shall be submitted concurrently. Failure to submit concurrently may result in the immediate return of the submittal marked REVISE AND RESUBMIT.

3.03 COORDINATION OF WORK

A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.

B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.

C. The electrical drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.

D. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.

E. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations accepted by the Engineer before proceeding with the installation.

F. The Drawings show only the general run of raceways and approximate locations of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost to the Owner.

G. Verify with the Engineer the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings.

H. Circuit tags in the form of numbers are used where shown to indicate the circuit designation numbers in electrical panels. Show the actual circuit numbers on the as-built Record Drawings and on the associated typed panelboard directory card. Where circuiting is not indicated, provide required circuiting in accordance with the loading indicated on the Drawings and/or as directed.
I. The Drawings generally do not indicate the number of wires in conduit for the branch circuit wiring of fixtures and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated, the control intent, referenced wiring diagrams (if any), the specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.

J. Carefully check space requirements with other trades to insure that equipment can be installed in the spaces allotted.

K. Wherever work interconnects with work of other trades, coordinate with other trades to insure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (remote ballast, pull boxes, etc.) requiring access in order that the ceiling trade will know where to install access doors and panels.

L. Consult with other trades regarding equipment so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.

M. Furnish and set sleeves for passage of electrical risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each electrical riser passing through building surfaces.

N. Provide firestopping around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions and floors.

O. Provide detailed information on openings and holes required in precast members for electrical work.

P. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.

Q. Examine and compare the Contract Documents with the drawings and specifications of other trades, and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

R. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of Record Drawings.

S. Furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate work with the work of other trades. No work shall be installed before coordinating with other trades.

T. Coordinate with the local electric utility company and the local telephone company as to their requirements for service connections and provide all necessary metering provisions, grounding, materials, equipment, labor, testing, and appurtenances. Coordinate the electrical service installation with the Utility Company, contractor shall be responsible for all work related to the service that is not provided by the Utility. Coordinate with the
owner’s representative to arrange the existing building incoming service shutdown at least 4 weeks prior to commence,

U. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

V. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.

2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.

W. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Engineer.

X. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

Y. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.

2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.

Z. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Engineer.

3.04 CONTRACTOR’S COORDINATION DRAWINGS

A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Engineer) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as busway, conduit, piping, ductwork, etc., including conduit embedded
in concrete floors and walls. The Coordination Drawings shall be submitted complete to
the Engineer within three months after notice to proceed is given, and in compliance with
the construction schedule for the project. The sheet metal drawings, at a scale of not less
than 1/4 inch to 1 foot, shall serve as the base drawings to which all other Contractors
shall add their work. Each separate trade contractor shall draw their work on separate
layers with different color assignments to facilitate coordination. Each Coordination
Drawing shall be completed and signed off by the other Trade Contractors and the
Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler
work in the area covered by the specific drawing. The Contractor’s work shall be
installed according to the shop drawings and coordination drawings. If the Contractor
allows one trade to install their work before coordination with the work of other trades,
the Contractor shall make all necessary changes to correct the condition at no additional
cost to the Owner.

C. The Contractors’ Coordination Drawings shall indicate structural loads at support points
for all piping 10 inch and larger, racked piping, racked conduit, busway, and suspended
electrical equipment. Submit to Structural Engineer for review and approval. The
elevation, location, support points, static, dynamic and expansion forces and loads
imposed on the structure at support and anchor points shall be indicated. All beam
penetrations and slab penetrations shall be indicated and sized and shall be coordinated.
Work routed underground or embedded in concrete shall be indicated by dimension to
column and building lines and shall be coordinated. Coordination Drawings shall
document all required structural penetrations for initial construction. Penetrations shall be
dimensioned for walls, floors and roofs. These structural coordination requirements
require review and approval by the Structural Engineer prior to completion and submittal
of the drawings.

D. This requirement for Coordination Drawings shall not be construed as authorization for
the Contractor or trade contractors to make any unauthorized changes to the Contract
Documents. Contract document space allocations shall be maintained such as ceiling
height, designated clearance for future construction and flexibility, chase walls,
equipment room size, unless prior written authorization is received from the Engineer to
change them.

E. Prior to final acceptance of the Work the Contractor shall submit the Coordination
Drawings as part of the Record Drawings submittal.

3.05 EXAMINATION OF SITE

A. Prior to the submitting of bids, visit the project site and become familiar with all
conditions affecting the proposed installation and make provisions as to the cost thereof.

B. The Contract Documents do not make representations regarding the character or extent of
the sub-soils, water levels, existing structural, mechanical and electrical installations,
above or below ground, or other sub-surface conditions which may be encountered
during the work. Evaluate existing conditions, which may affect methods or cost of
performing the work, based on examination of the site or other information. Failure to
examine the Drawings or other information does not relieve the Contractor of
responsibility for the satisfactory completion of the work.

3.06 CUTTING AND PATCHING
A. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc., using skilled tradespeople of the trades required at no additional cost to the Owner.

B. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Engineer is obtained. If permission is granted, perform this work in a manner acceptable to the Engineer.

C. Where conduit or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

3.07 MOUNTING HEIGHTS

A. Mounting heights shall conform to ADA requirements.

B. Verify exact locations and mounting heights with the Engineer before installation.

C. Electrical and telecommunications outlets shall be mounted not lower than 15 inches above finished floor to bottom of outlet and not higher than 48 inches above finished floor to top of device.

D. Electrical switches shall be mounted not lower than 36 inches above finished floor to center of switch and not higher than 48 inches above finished floor to center of switch.

E. Fire alarm manual pull stations shall be mounted 48 inches above finished floor to center of manual pull station.

F. Outlets for public and other wall mounted type telephones shall be installed so that the particular telephone installed conforms to ADA mounting height requirements.

G. Visual Alarms: Mount not less than 80 inches to the bottom or 96 inches to the top of the device.

H. Wall Mounted Exit Signs: 2 inches above top of door to bottom of sign.

I. Low Level Exit Signs: 6 inches to bottom of sign.

J. Stairwell and utility corridor wall mounted lighting fixtures shall be mounted 8 feet 6 inches above finished floor or 1 foot below ceiling or structure above, whichever is lower.

3.08 CONTINUANCE OF EXISTING SERVICES

A. Existing electrical services not specifically indicated to be removed or altered shall remain as they presently exist.
B. Where existing services interfere with new construction, alter or reroute such existing equipment to facilitate new construction after obtaining written permission from the Engineer. Notification in writing giving two weeks advance notice of planned alteration is required.

C. Preserve continuity of service of existing facilities (related to damage or alteration due to new construction). Unauthorized alteration to existing equipment shall be corrected without additional cost to the Owner.

3.09 DEMOLITION

A. Remove, relocate, and reroute existing electrical equipment to facilitate new construction or remodeling work.

B. Examine the site before submitting a bid to observe existing conditions.

C. Schedule demolition in advance. Schedule work to avoid disruption of normal operations.

D. Reconnect circuits serving equipment required to remain in service to other panelboards, motor control centers, or other appropriate distribution equipment. Provide additional panelboards, motor control centers, or other appropriate distribution equipment where there is insufficient available capacity in remaining existing equipment for reconnection.

E. Remove existing conduit and wire back to panelboard, motor control center, or other distribution source.

F. Where a circuit is interrupted by removal of a device or fixture from that circuit, provide additional conduit and wire to restore service to the remaining devices and fixtures on that circuit.

G. Electrical equipment to be removed that is in good working order shall be carefully removed and offered to the Owner. Items rejected by the Owner shall be removed from the project site and properly disposed of.

3.10 CLEANING UP

A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.

B. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.

C. All electrical equipment shall be thoroughly vacuumed and wiped clean prior to energization and at the completion of the project. Equipment shall be opened for observation by the Engineer as required.

3.11 WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make
penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.

B. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

3.12 SUPPORTS

A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.

B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and mechanical equipment rooms.

C. Provide supporting frames or racks for equipment, which is installed in a freestanding position.

D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.

F. Electrical equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Provide independent support of electrical equipment. Do not attach to supports provided for ductwork, piping or work of other trades.

G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electrical equipment and supports shall not come in contact with work of other trades.

3.13 FASTENINGS

A. Fasten equipment to building structure in accordance with the best industry practice.

B. Where weight applied to the attachment points is 100 pounds or less, conform to the following as a minimum:

1. Wood: Wood screws.
2. Concrete and solid masonry: Bolts and expansion shields.
3. Hollow construction: Toggle bolts.
4. Solid metal: Machine screws in tapped holes or with welded studs.
5. Steel decking or sub-floor: Fastenings as specified below for applied weights in excess of 100 pounds.

C. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:

1. At concrete slabs provide 24-inch x 24-inch x ½-inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.

2. At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with their decking or sub-floor such hangers shall be provided.

D. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:

1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.

E. For items, which are shown, as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

F. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

3.14 IDENTIFICATION

A. Identify electrical equipment with permanently attached black phenolic nameplates with ½ inch high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates for equipment connected to the emergency power system shall be red with white lettering. Nameplates shall be attached with cadmium plated screws; peel and stick tape or glue on type nameplates are not allowed.

B. Cable tags shall be flameproof secured with flameproof non-metallic cord.

C. Provide an engraved nameplate for each switch controlling loads, which are not local to the switch.

D. Wherever raceways for future use are terminated outside of the building, stake the location with a 2-foot-long, 1-inch x 1-inch clear heart redwood stake.

E. See individual sections for additional identification requirements.

3.15 PROHIBITED LABELS AND IDENTIFICATIONS
A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.

B. Required UL labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

3.16 EQUIPMENT PADS AND ANCHOR BOLTS

A. Provide concrete pads under all floor mounted electrical equipment. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28 day, 2500psi concrete reinforced with 6-inch x 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a ¾ inch radius. Shop drawings stamped NO EXCEPTIONS NOTED shall be used for dimensional guidance in sizing pads.

B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.

C. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6 inches square, 18-gauge galvanized metal backplates, which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not allowed.

3.17 DELIVERY, DRAYAGE AND HAULING

A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of drayage or storage.

B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer’s supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.18 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.
B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.

C. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

D. Lighting fixture troffers with parabolic reflectors shall be installed with factory mounted plastic protective bags around parabolic reflector assembly. Remove protective bag just prior to occupancy.

3.19 TESTING OF ELECTRICAL SYSTEMS

A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract closeout. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.

B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Owner’s Representative has been given. Update this schedule periodically as the project progresses.

3.20 OPERATING INSTRUCTIONS

A. Provide the services of factory trained specialists to provide an operating instructions seminar for equipment and systems. The seminar shall be conducted over a five day (consecutive) period. Instruction time is defined as straight time working hours and does not include nights, weekends, or travel time to and from the project.

B. Submit seminar agenda, schedule and list of representatives to the Owner for approval thirty days prior to suggested date of seminar. Do not commence seminar until the Owner has issued a written acceptance of the starting time and attendees. Confirm attendance of seminar by written notification to participants.

C. Instruct Owner’s operating personnel in proper starting sequences, operation, shutdown, general maintenance and preventative maintenance procedures, including normal and emergency procedures.

D. Submit final copies of Record Drawings and Operating and Maintenance Manuals to Owner at seminar.
E. Submit a written record of minutes and attendees of the seminar to the Owner.

3.21 OPERATING AND MAINTENANCE MANUALS

A. Provide Operating and Maintenance Manuals for equipment and materials furnished under this Division.

B. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.

C. Provide the following information where applicable:

1. Identifying name and mark number.
2. Locations (where several similar items are used, provide a list).
3. Complete nameplate data.
4. Certified Record Drawings and Final Reviewed submittals.
5. Parts list.
6. Performance curves and data.
7. Wiring diagrams.
8. Manufacturer’s recommended operating and maintenance instructions with all non-applicable information deleted.
9. List of spare parts recommended for normal service requirements.
10. Assembly and disassembly instructions with exploded view drawings where necessary.
11. Test reports.
12. Trouble shooting diagnostic instructions where applicable.

D. Submit electronic copies of operating and maintenance data books for review at least ten (10) weeks before the completion date. Assemble data in a completely indexed volume or volumes electronically as indicated for each item.

3.22 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the Project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of blueline prints or AutoCAD files of the Contractor’s Coordination Drawings. The prints shall be marked or the AutoCAD files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit, raceways and boxes, and all changes and deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the
Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD electronic format media upon Project completion.

B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two dimensions to permanent structures.

C. The Contractor and Subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an AutoCAD image similar to the following:

```
RECORD DRAWING
(3/8 inch high letters)
To be used for recording Field Deviations and Dimensional Data Only
(5/16 inch high letters)
```

D. Upon completion of the work, the Contractor and subcontractors shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD image similar to the following:

```
RECORD DRAWING
CERTIFIED CORRECT
(3/8 inch high letters)
(Printed Name of General Contractor)
(5/16 inch high letters)
Date:
(Printed Name of Subcontractor)
(5/16 inch high letters)
Date:
```

E. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified Record Drawings to the Engineer for review and shall make changes, corrections or additions as the Engineer may require to the Record Drawings. After the Engineer's review and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD format. The Engineer does not assume any responsibility for the accuracy or completeness of the Record Drawings.
3.23 FINAL PUNCHLIST

A. Prior to the Final Punchlist, certify that systems and equipment are complete, operational, and are in compliance with the Contract Documents.

B. During the Final Punchlist, provide personnel with access keys, hand held radios, and necessary expertise to operate each system and piece of equipment to demonstrate operational compliance with the Contract Documents.

C. Any deficiencies noted on the Final Punchlist shall be expeditiously corrected and certified in writing.

3.24 EARLY OCCUPANCY

A. Complete those systems which are necessary to allow partial early occupancy of the building.

B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

END OF SECTION
SECTION 260501 – MINOR ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Electrical demolition.

1.02 RELATED REQUIREMENTS

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify field measurements and circuiting arrangements are as shown on Drawings.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition drawings are based on casual field observation and existing record documents.
   D. Report discrepancies to Resident Engineer before disturbing existing installation.
   E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   B. Coordinate communications interruptions and shutdowns with Resident Engineer.
      1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
      2. Make temporary connections to maintain service in areas adjacent to work area.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
   D. Existing Electrical power distribution: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.
B. Remove all abandoned communication cabling, power and lighting wiring to source of supply.
C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes and below raised floor. Cut conduit flush with walls and floors, and patch surfaces.
D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
E. Disconnect and remove abandoned panelboards and distribution equipment.
F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
H. Disconnect, remove and store for later use all devices indicated on Drawings to be reused.
I. Repair adjacent construction and finishes damaged during demolition and extension work.
J. Maintain access to existing electrical installations and communications installations that remain active. Modify installation or provide access panel as appropriate.
K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.
B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION
PART 1 - GENERAL

1.01 WORK INCLUDED

A. Conductor sizes are sized for copper and shall be considered minimum for ampcalities and voltage drop requirements.

B. Conduits for special systems shall be as recommended by the equipment manufacturer except as noted.

C. Deliver conductors to the job site in cartons, protective covers, or on reels.

D. The existing power distribution feeders are desired to be re-used where they can remain substantially undisturbed.

1.02 SUBMITTALS

A. Product data.

B. Test reports.

PART 2 - PRODUCTS

2.01 CONDUCTORS - 600V

A. Type:
   1. Copper: No. 12 AWG minimum size unless noted otherwise, No. 8 and larger, Class B concentric or compressed stranded.

B. Insulation:
   1. Thermal setting, polyvinyl chloride: THW, THHN, THWN unless noted or specified otherwise.
   2. Cross linked polyethylene: XHHW-2

C. Thru wiring in luminaires shall be rated for 90-degree C minimum.

D. Manufacturers: Alcan, General, Essex, Rome, Southwire, or equal.

E. Color coding of conductors by system voltage is required:
   1. For 120/208 Volt power systems, utilize: Black, Red and blue for phase conductors. Utilize white for neutral conductors. Utilize green for ground conductors.

F. Where a distinct color code system is currently in place, continue with that system.
2.02 POWER LIMITED WIRING
A. Copper, stranded or solid as recommended by the system manufacturer.
B. Insulation shall be appropriate for the system and location used.
C. Provide pre-manufactured, UL listed and labeled cable supports.

2.03 CONNECTORS - 600V AND BELOW
A. Branch Circuit Conductor Splices: Live spring type, Scotchlok, Ideal Wire Nut, Buchanan B-Cap, or 3M Series 560 self-stripping type.
B. Cable Splices: Compression tool applied sleeves, Kearney, Burndy, or equal with 600V heat shrink insulation. For cable splices in sub-terrain/underground vaults or any wet locations shall be provided with 600V 3M Series DBR-6 or approved.
C. Terminator Lugs for Stranded Wire:
   1. No. 10 Wire and Smaller: Spade flared, tool applied.
   2. No. 8 Wire and Larger: Compression tool applied, Burndy, Anderson, or equal. Set screw type terminator lugs supplied as an integral part of switches and circuit breakers will be acceptable for terminating only copper conductors.

PART 3 - EXECUTION
3.01 CONDUCTORS
A. Pulling compounds may be used for pulling all power system conductors. Clean residue from the conductors and raceway entrances after the pull is made.
B. Pulleys or blocks shall be used for alignment of the conductors when pulling. Pulling shall be in accordance with manufacturer’s specifications regarding pulling tensions, bending radii of the cable, and compounds. A dynamometer shall be utilized on all high voltage cable pulls to ensure that the maximum allowed cable tension is not exceeded. The Architect and Engineer shall be notified prior to all cable pulls. Record the maximum strain of each pull.
C. Conductors entering terminal or junction boxes mounted on hermetically sealed refrigeration compressor motors shall be copper.
D. Make up and insulate wiring promptly after installation of conductors. Wire shall not be pulled in until all bushings are installed and raceways terminations are completed. Wire shall not be pulled into conduit embedded in concrete until after the concrete is poured and forms are stripped.
E. Wire devices external to isolating panels with copper stranded conductors having a cross-linked polyethylene insulation or equivalent with a dielectric constant of 3.5 or less.
F. Minimum insulation wall thickness shall be 1/32” for #10 and #12 AWG and 5/64” for #8 AWG and larger conductors. Wiring shall be color coded in accordance with NEC and appropriate NFPA standards.
3.02 CONNECTORS

A. Control and special systems wires shall be terminated with a tool applied spade flared lug when terminating at a screw connection.

B. All tool applied compression connectors shall be applied per manufacturer’s recommendations and physically checked for tightness.

3.03 COLOR CODING

A. Secondary service, feeders, and branch circuit conductors shall be color coded. Phase color code to be consistent at all feeder terminations, A-B-C left-to-right, A-B-C top-to-bottom, or A-B-C front-to-back.

B. Use solid color compound or solid color coating for No. 12 and No. 10 branch circuit conductors and neutral sizes.

C. Phase conductors No. 8 and larger color code using one of the following:
   1. Solid color compound or solid color coating.
   2. Stripes, bands, or hash marks of color specified above.
   3. Colored as specified using 3/4-inch wide tape. Apply tape in half overlapping turns for a minimum of three inches for terminal points and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

D. Switchlegs, travelers, etc., to be consistent with the phases to which connected or a color distinctive from that listed.

E. Color coding of the flexible wiring system conductors and connectors shall be the manufacturer’s standard.

F. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

3.04 TESTS

A. Perform insulation resistance tests on all new phase and neutral conductors of feeders and circuits over 100 Amperes ampacity, 480 Volt and below, with a 1000 Volt, direct current, megohmmeter. The written test report listing the results of the test to be submitted to Architect. Equipment which may be damaged by this test shall be disconnected prior to the test.

B. Scheduling of electrical testing must be coordinated with Owner well in advance. The impact of the required testing is expected to affect employees and clients of Owner’s facilities and services.

END OF SECTION
SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Expand the existing building reference ground electrode system.
B. Expand the existing building reference ground access conductor system.
C. Provide a complete ground system as specified herein and shown on the Drawings.
D. Include bonding of conduit systems.
E. Maintain electrical continuity of the existing ground array system as specified herein and shown on the Drawings. Included in this section are the minimum composition requirements and installation methods for the following:
   1. Busbars
   2. Bonding accessories

1.02 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufactures listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the following standards and the Authority Having Jurisdiction (AHJ).
   1. ANSI/TIA/EIA – 568 Commercial Building Telecommunications Cabling Standard
   2. TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces
   3. ANSI/TIA/EIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   4. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
   5. NFPA 70 – National Electric Code
7. PRODUCTS

1.03 GROUNDING CONDUCTORS
A. Green, 600 Volt, polyvinyl Chloride, THWN insulated copper for interior systems.
B. Bare copper for underground or exterior systems.

1.04 CONNECTORS
A. Cast, Compression, set screw or bolted type for building internal conductor termination.
B. Form poured, exothermic welds (Cadweld) for use: exterior to the building, where exposed to the elements or below grade or underground.
C. Grounding lugs where provided as standard manufacturer’s items on equipment.

1.05 GROUND RODS
A. Copper clad steel, 5/8”x10’-0” long ground rods. Where ground wells are indicated, provide a 12-inch deep, 8-inch diameter precast concrete well with flush lid for accessibility and inspection of welded connections.
B. Utilize RCP Vaults No. 12R12A with 12R12-t cover.

PART 2 - EXECUTION
2.01 INSTALLATION
A. Grounding Conductors: Default sized in accord with Article 250, Tables 250-122 and 250-66 of the National Electrical Code. Where larger size conductors are indicated on the drawings, utilize the size indicated on the drawings.
B. Grounding Conductor Connectors: Made up tight and located for future servicing and to insure low impedance.
C. Ground the electrical system, the cold-water service, structural steel, and transformers to the building ground grid.
D. All Plug-in Receptacles: Bonded to the boxes, raceways, and grounding conductor.
E. Provide equipment grounding conductor in all PVC conduit runs.
F. Provide ground bonding to above ground portion of metal gas piping per NEC 250-104(b).
G. All separately derived systems shall be solidly grounded to the reference ground electrode system via the building reference ground access conductor system.
H. Bond the new electrode to the panel ground bus.
I. Provide splice copper wire ground pathway that is visually traceable from the motor frame to the ground bus in the panel and from the ground bus in the panel there is to be a bonding connection between the neutral bus and the ground bus.

2.02 EQUIPMENT

A. Provide separate green insulated equipment ground conductor in all non-metallic and flexible electrical raceways. Effectively ground all luminaires, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, buses, etc., for this purpose.

B. Provide grounding bushings on all feeder conduit entrances to panels and equipment enclosures and bond bushings to enclosures with minimum No. 10 AWG conductor. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG.

END OF SECTION
SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33, Raceway and Boxes for Electrical Systems

1.03 REFERENCE STANDARDS


D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
1.05 SUBMITTALS
A. See Division 01 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.06 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with applicable building code.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS
A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 150%. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:


e. Or Approved Equal

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

1. Manufacturers:


   e. Or Approved Equal

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.


2. Channel Material:

   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.

   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

3. Manufacturers:


   d. Substitutions: See Section 01 60 00 - Product Requirements.

   e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Busway Supports: 1/2 inch diameter.
      c. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
      d. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
      e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
      f. Outlet Boxes: 1/4 inch diameter.
      g. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
   1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
   3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
   4. Manufacturers:
      d. Or Approved Equal

G. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   b. Channel Material: Use galvanized steel.
   c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
   d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
   d. Or Approved Equal

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as shown on the drawings.
   B. Verify that mounting surfaces are ready to receive support and attachment components.
   C. Verify that conditions are satisfactory for installation prior to starting work.
3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: Also comply with Section 26 05 33, Raceway and Boxes for Electrical Systems.

J. Box Support and Attachment: Also comply with Section 26 05 33, Raceway and Boxes for Electrical Systems.

K. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

L. Secure fasteners according to manufacturer's recommended torque settings.

M. Remove temporary supports.

N. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.
3.03  FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION
SECTION 260533 – RACEWAY, BOXES AND CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide raceways and conduits of specified types for all electrical systems wiring, except where clearly shown or specified otherwise. All fittings, boxes, hangers and appurtenances shall be included.

B. Size raceways and conduits as specified. Where no size is indicated, conduit may be the minimum code permitted size for the quantity of conductors installed, based upon NEC tables for conductors with type THW/TW insulation.

PART 2 - PRODUCTS

2.01 METALLIC CONDUITS

A. Galvanized Rigid Conduit (GRC): Smooth surfaced heavy wall mild steel tube of uniform thickness and temper, reamed and threaded at each end and protected inside and out with galvanizing, sherardizing, or equivalent process. GRC shall comply with NEC Article 346.

B. Intermediate Metallic Conduit (IMC): Smooth surface, intermediate wall mild steel tube of uniform thickness and temper, reamed and threaded at each end, and protected inside and out with galvanizing, sherardizing, or equivalent process. IMC shall comply with NEC Article 345.

C. Electrical Metallic Tubing (EMT): Smooth surface, thin wall mild steel tube of uniform thickness and temper, galvanized or sherardized on the outside, and enameled on the interior. EMT shall comply with NEC Article 348.

D. Flexible Conduits (Flex):

1. Flexible Metallic Conduit: Interlocking single strip steel construction, galvanized inside and out after fabrication. Flex shall comply with NEC Article 350.

2. Liquid Tight: Similar to flexible metallic conduit, except encased in a liquid tight polyvinylchloride or equivalent outer jacket over the flexible steel core, and shall comply with NEC Article 351.

2.02 NON-METALLIC CONDUITS

A. Underground Ducts:

1. PVC, Encased Burial: Type EB for concrete encasement, shall meet or exceed the current requirements of EB-20/ASTM F512, NEMA TC-6 and U.L. 651. Rate for use with 90°C wire.

2. PVC, Direct Burial: Type DB suitable for direct burial, shall meet or exceed the
current requirements of DB-20/ASTM F512 and NEMA TC-6. Rate for use with 90°C wire.

B. Rigid Non-Metallic Conduit: Type II PVC Schedule 40, suitable for use with 90°C rated wire. Conduit shall conform to UL Standard 651 and carry appropriate UL listing for above and below ground use.

2.03 WIREWAYS

A. Troughs: Steel, painted, square in cross section, preformed knock-outs on standard spacing, screw cover.

B. Fittings: Tees, elbows, couplings as required for configuration shown on the Drawings.

2.04 FITTINGS

A. GRC and IMC:

1. Threaded Locknuts: Sealing type where used with NEMA 2, 3, 3R, 4 and 12 enclosures.

2. Threaded Bushings: 1 1/4 inch and larger, insulated, grounding type as required under Section 26 05 26, Grounding and Bonding for Electrical Systems.

3. Threaded Couplings: Standard threaded of the same material and as furnished with conduit supplied. Erickson type couplings may be used where required to complete conduit runs larger than 1 inch.

B. EMT:

1. Connectors: Steel compression ring or steel set screw type for conduit termination, with insulated throat, suitable for conditions used.

2. Steel EMT fittings are required to have at least 5% recycled steel content.

3. Use lay-in grounding type bushings where terminating grounding conductors.

4. Couplings: Steel compression ring or steel set screw type, concrete tight.

C. Threadless: GRC and IMC couplings and box connectors may be steel threadless, compression ring or set screw type for use with conduits 1 inch and smaller where installed in poured concrete locations or where limited working space makes threaded fittings impractical.

D. Weatherproof Connectors: Threaded.

E. Expansion Couplings: Equal to O.Z. type EX with jumper.

F. Seal-Offs: With filler fiber, compound, removable cover.
2.05 METALLIC BOXES

A. Flush and Concealed Outlet Boxes: For interior installation, provide:
   1. Electroplate Zinc galvanized stamped steel
   2. All interior installation backboxes are 4-inch square minimum, with 1-1/2-inch minimum depth
   3. Depth of backbox is required to be adjusted as required to meet current National Electrical code fill requirements
   4. Provide backboxes with screw ears for device ring mounting, knock-out plugs, mounting holes, and fixture studs if required
   5. Provide backboxes with green bolt, threaded ground conductor termination capability
   6. Terminate copper raceway bonding conductor at backbox threaded ground termination via green threaded bolt
   7. Terminate copper raceway bonding conductor on circuit ground conductor via conductor splice
   8. Isolated circuit ground conductors are not bonded to the backbox threaded ground termination
   9. RACO or equal

B. Surface Outlet Boxes: Galvanized stamped steel same as above for use on ceilings; cast steel or aluminum with threaded hubs or bosses for use on walls.

C. Large Boxes: Boxes exceeding 4-11/16 inches square when required shall be welded steel construction with screw cover and painted, steel gauge as required by physical size, Hoffman, Circle AW or equal.

D. Systems: Boxes for systems devices shall be as recommended by the systems manufacturer, suitable for the equipment installed. Equip with grounding lugs, brackets, device rings, etc., as required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount backboxes staggered in wall framing spaces to reduce acoustic coupling from one space to another. Back to back backbox installation is not allowed.

B. Conceal all conduits in finished spaces. Concealed conduits shall run in a direct line with long sweep bends and offsets. GRC and IMC embedded in concrete below grade or in damp locations shall be made watertight by painting the entire male thread with Rustoleum metal primer or equal before assembly.
C. Route exposed conduit parallel or at right angles to structural building lines and neatly offset into boxes. Conduits attached directly to building surfaces shall closely follow the surfaces. Conduit fittings shall be used to “saddle” under beams. Drilling or notching of existing beams, trusses on structural members shall be coordinated with Architect prior to commencing.

D. GRC and IMC terminations at boxes, cabinets, and general wiring enclosures shall be rigidly secured with double locknuts and bushings or approved fittings. Conduit shall be screwed in and shall engage at least five threads in hub where conduit boxes with threaded hubs or bosses are used. Insulating bushings shall be used for conduits 1-1/4 inches or larger.

E. Keep conduit and raceways closed with suitable plugs or caps during construction to prevent entrance of dirt, moisture, concrete, or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance.

F. Pack spaces around conduits with polyethylene backing rods and seal with polyurethane caulking to prevent entrance of moisture where conduits are installed in sleeves or block-outs penetrating moisture barriers.

3.02 CONDUIT

A. Minimum raceway size for power circuits is 3/4-inch, industry standard measure.

B. Minimum raceway size for low energy control circuits is 1/2-inch, industry standard measure.

C. Control circuits are to be routed via dedicated raceways, separate from power conductors. Control circuits with the same disconnecting means as the power circuit, and NEC compliant insulation matching the power circuit insulation rating may be routed in a common raceway with the power conductors.

D. Raceways crossing structure expansion joints or structure seismic joints shall have adequate range (axial as well as transverse) of intrinsic motion compensation to meet the structure design motion limits.

E. Provide NEC sized, bonded internal grounding continuity conductors within raceways crossing structure expansion joints or structure seismic joints as required to assure raceway ground continuity during and after the structure design motion limits.

F. Structure design motion limits include shortening as well as lengthening of the instantaneous raceway length as compared to the circuit length. Conductors or cables installed in raceways crossing structure expansion joints or structure seismic joints shall have adequate coiled circuit length and coil storage space to meet the structure design motion limits. The conductors are expected to slide within the raceway system as required to maintain circuit continuity and insulation integrity during the structure design motion limits.

G. Conduits for branch circuit use are required to have not more than 40% fill at the completion of the project.

H. GRC may be used in all areas for wiring systems. GRC shall be installed for wiring
underground in cast concrete construction, in damp locations, and in hazardous areas for serving fire pump controllers and where subject to mechanical injury with threaded fittings made up tight. IMC may be used in locations not in contact with earth or fill.

I. EMT may be used in all other dry protected locations. Provide green equipment bonding conductor where used for power circuit feeders 2-inch and larger. EMT, whether exposed or concealed, shall be securely supported and fastened at intervals of nominally every 8 feet and within 24 inches of each outlet, ell, fitting, panel, etc.

J. Flex shall be used for connections to vibration producing equipment and where installation flexibility is required with a minimum 12 inches slack connection. Limit flex length to 36 inches for exposed equipment connections and 72 inches in concealed ceiling and wall cavities. PVC jacketed flex shall be used in wet locations, areas subject to wash-down, and exterior locations.

K. PVC Type II Schedule 40 may be used underground and in and under interior slabs, poured concrete walls, and where scheduled or noted on the Drawings. Make connections with waterproof solvent cement. Provide GRC at 60 degree and larger bends and where penetrating slabs.

L. MC Cable may be used as permitted per NEC, state and local codes. MC Cable not permitted for feeders, service entrance feeders and homeruns.

3.03 RACEWAYS

A. Surface metal wireways may be installed at locations to serve motor starters or other control devices where required by a multitude of wiring interconnections or physical layout.

3.04 FITTINGS

A. Metallic raceways and conduits shall be assembled continuous and secured to boxes, panels, etc., with appropriate fittings to maintain electrical continuity. All conduit joints shall be cut square and reamed smooth with all fittings drawn up tight.

B. Crimp-on, tap-on, indenter type, malleable iron or cast set screw fittings shall not be used.

3.05 BOXES

A. Boxes and outlets shall be mounted at nominal center line heights shown on the drawings. Adjust heights in concrete masonry unit (CMU) walls to prevent devices or finish plates from spanning masonry joints.

B. Boxes are to be located and accessible for service, inspection or circuiting adjustment at the time of final project completion. Access clearance is required to meet current NEC, NESC, OHSA and NFPA 70E requirements.

C. Permanently label all boxes per specification requirements. At a minimum, the panel of energization and circuit breaker number shall be visible.

D. Circuiting exiting panel or switchboard enclosures shall have metal conduit protection.
E. Outlet boxes shall be of code required size to accommodate all wires, fittings, and devices. Provide multi-gang boxes as required to accept devices installed with no more than one device per gang. Equip all metallic boxes with grounding provisions.

F. Flush wall switch and receptacle outlets used with conduit systems shall be 4 inches square, 1-1/2 inches or deeper, with one or two-gang plaster ring mounted vertically. Where three or more devices are at one location, use one-piece multiple gang tile box or gang box with suitable device ring.

G. Wall bracket and ceiling surface mounted luminaire outlets shall be 4-inch octagon 1-1/2 inches deep with 3/8-inch fixture stud where required. Wall bracket outlets to have single gang opening where required to accommodate fixture canopy. Provide larger boxes or extension rings where quantity of wires installed requires more cubic capacity.

H. Junction boxes installed in accessible ceiling or wall cavities or exposed in utility areas shall be a minimum of 4 inches square, 1-1/2 inches deep with appropriately marked blank cover.

I. Boxes for the special systems shall be suitable for the equipment installed. Coordinate size and type with the system supplier.

J. Provide pull boxes where shown for installation of cable supports or where required to limit the number of bends in any conduit to not more than three 90-degree bends. Use galvanized boxes of code required size with removable covers installed so that covers will be accessible after work is completed.

K. Recessed boxes shall be flush with finished surfaces or not more than 1/8-inch back. Set boxes level and plumb. Long screws with spacers or shims for mounting devices will not be acceptable. No combustible material shall be exposed to wiring at outlets.

L. Covers for flush mounted boxes in finished spaces shall extend a minimum of 1/4-inch beyond the box edge to provide a finished appearance. Finish edge of cover to match cover face.

M. Boxes installed attached to a stud in sheet rock walls shall be equipped with opposite side box supports equal to Caddy #760. Install drywall screw prior to finish taping. Methods used to attach boxes to studs shall not cause projections on the face of the stud to prevent full length contact of sheet rock to the stud face.

3.06 PULL WIRES

A. Install nylon pull lines in all empty conduits larger than 1 inch where routing includes 25 feet or more in length or includes 180 degrees or more in bends.

B. Where conduits requiring pull lines are stubbed out and capped, coil a minimum of 36 inches of pull line and tape at termination of conduit for easy future access. Label pull lines as to conduit starting or terminations point and intended future use.

END OF SECTION
SECTION 262000 – LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install the materials for the complete secondary service and distribution system as specified herein and shown on the Drawings. Secondary distribution system shall be fully rated. Series rating shall not be acceptable.

B. Provide a transformer pad and ground grid for use by the serving utility. Coordinate pad size, openings, type of construction, conduit arrangement and grounding requirements with the utility prior to construction.

1.02 UTILITY METERING

A. Provide utility metering facilities where indicated on the Drawings, complying with the established serving utility requirements. Provide quantity and style of meter sockets and accessories required by the utility.

B. Include all metering charges or connection costs charged by the serving utility in the original proposal. Refer to Coordination of Work section of these Specifications.

1.03 SUBMITTALS

A. Shop drawings.

B. Product data.

C. Ground Fault Protection System Test Report.

D. Coordination study.

E. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cutler Hammer, General Electric, Square D.

2.02 MAIN DISTRIBUTION PANEL

A. Panel: Sectionalized, floor standing, metal enclosed units containing molded or insulated case circuit breakers. Panel shall be listed by Underwriters’ Laboratories and shall bear a UL label as suitable for use as service equipment; NEMA 3R Enclosure.

B. Circuit Breakers: Main breakers and sub distribution feeder breakers shall be AC power type, dead front, with solid state trip devices. Interrupting rating shall be a minimum of 65,000 rms symmetrical amperes. Breakers shall be rated for standard continuous duty. Field adjustable trip functions shall consist of:
1. Long time ampere rating.
2. Long time delay.
3. Instantaneous pickup.
4. Short time pickup.
5. Short time delay.
7. Ground fault delay.

C. Equip breakers with the following additional auxiliary devices:
   1. Shunt trip.
   2. Undervoltage trip.
   3. Normally (open) (closed) alarm switch.
   4. Electric operator.
   5. Ground fault test button.
   6. Ground fault trip indicator.
   7. Trip indication with auxiliary contacts.
   8. Overcurrent indication with auxiliary contacts.

D. Equip breakers with zone selective interlocking on the (short time) (ground fault) (short time and ground fault) trip for maximum coordination.

E. Bus work: Copper or aluminum, sized as shown on the Drawings, 100% neutral with a maximum hot-spot temperature rise of 65 degrees C. above an ambient of 40 degrees C. under continuous full load current and rated to withstand (42,000 A) (65,000 A) (100,000 A) fault current. Include bussing provisions for future devices in all spaces called for. Provide a copper ground bus in bottom of enclosure, full length of assembly.

F. Digital Metering: Provide potential and current transformers, ammeter, voltmeter, power factor meter, required selector switches and associated accessories for monitoring the properties of the incoming secondary power as provided by the utility. Ammeter and voltmeter selector switches shall have provisions for reading individual phase amperes, individual phase to neutral volts, phase to phase volts and include a meter “off” position. Metering equipment shall be switchboard grade with nominal 2% accuracy.

G. Finish: Primed and finished with not less than two coats of light gray enamel.

2.03 SUB-DISTRIBUTION PANELS

A. Panels: Similar in manufacture as the main distribution equipment, free standing, front
operated circuit breaker type, fully enclosed with bussing provisions for future extension. Assemblies rated over 1000 amperes shall be of free-standing construction. Overcurrent protection ratings shall be as noted on the Drawings. All devices shall be capable of interrupting the fault current available.

B. Bus Work: Copper or aluminum, sized as shown on the Drawings, 100% neutral with a maximum hot-spot temperature rise of 65 degrees C above an ambient of 40 degrees C under continuous full load current and rated to withstand 65,000 A fault currents. Include bussing provisions for mounting future devices in all spaces called for. Where panel configuration provides additional spaces within a section, these spaces shall be bussed to receive future devices. Make provisions for future extension of bussing. Provide a copper ground bus in bottom of enclosure.

C. Circuit Breakers: Molded case, bolt-in thermal magnetic type. Breakers shall have short circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system. Minimum short circuit rating for any circuit breaker shall be 10,000 A.I.C. for 120V and 208V breakers, 14,000 A.I.C. for 277V and 480V breakers.

D. Digital Sub-Metering: Provide metering provisions in separate sections of the distribution equipment to measure line amps and energy consumption of various selected loads indicated on the Drawings. Metering shall include the necessary potential and current transformers, ammeter with phase selector switch, watthour meter with demand register and associated accessories for recording the department usage on a regular basis. Metering equipment shall be switchboard grade with nominal 2% accuracy with provisions for flush mounting in the appropriate distribution panel section. Kilowatt hour meters shall be two stator polyphase complete with 15-minute interval sweep type demand register.

E. Finish: Primed and finished with not less than two coats of light gray enamel.

204 BRANCH PANELBOARDS

A. Branch Circuit Panels: Bolt-in circuit breaker type with aluminum or copper bussing. Panels shall be fitted with flush lift latches and locks keyed alike, same as existing. Deliver all panel keys to the Owner at completion of the project.

B. Main Circuit Breakers: Equip panels indicated with main circuit breakers sized as scheduled and mounted behind door at top of panel. Back feeding of branch circuit breakers is not acceptable.

C. Branch Circuit Breakers: Molded case, thermal magnetic type. Breakers shall have short Circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system. Breakers mounted in branch panelboards shall be of the bolt-in type. Circuit breakers used for switching duty shall be UL listed for that purpose and marked “SWD”. Minimum short circuit rating for any circuit breaker: 10,000 A.I.C. for 120V and 208V breakers, 14,000 A.I.C. for 277V and 480V breakers.

D. Wiring Gutters: A minimum of 4 inches wide except where feeder conductors enter where a minimum of 6 inches clear shall be provided. Feeder conductors to enter directly in line with lug terminals wherever practicable. Provide separate feeder studs for each
feeder conductor compression lug.

E. Cabinets: Flush doors with concealed hinges and mounting clamps equal to Square D Mono Flat, or ITE Decor trim. Surface panels shall have metal face trims with no sharp edges or corners. Finish surface panel tubs to match face trim. Equip with a sheet metal skirt to floor, finished to match panel to prevent dirt accumulation where conduits penetrate floor. Access panel on skirt may be screw type for access to interior.

F. Ground Bus: Provide a grounding bus with termination capacity for the grounding conductor sized for the branch circuit equipment grounding conductors in isolated ground 208Y/120V panels identified by suffix IG. Grounding bus shall be (insulated from) (bonded to) the panel cabinet.

2.05 DRY TYPE TRANSFORMERS

A. Enclosed and ventilated, air cooled type, Class H insulation, designed for 115 degrees C temperature rise above 40 degrees C ambient temperature at full load continuous operation. Equip with two 2-1/2% FCAN taps and four 2-1/2% FCBN taps. Maximum sound level shall be N.E.M.A. standard with vibration isolators between the core and coil assembly and case.

B. Case to be totally enclosed with louver to prevent entry of foreign objects into the interior, manufactured in accordance with all NEMA & U.L. approval standards.

C. Provide an isolation shield between the primary and secondary windings in transformers where noted or shown on the Drawings to attenuate line electrical disturbances. Insulate shield from the transformer windings and core and ground to transformer enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the secondary distribution system assemblies and equipment as shown on the Drawings, parallel and square with the building lines.

B. Neatly lace and secure the conductors of the feeder circuits individually at maximum 2-foot intervals. The cable lugs shall not support the weight of the cables.

C. Mount a spare fuse cabinet adjacent to each fusible distribution panel. Equip cabinet with one complete set of spare fuses of each size and type installed in the panel with appropriate fuse pullers.

3.02 BRANCH PANELBOARDS

A. Install panelboards plumb and level, located as shown on the Drawings up 6'-0” to top unless noted otherwise.

B. Equip selected breakers with mechanical locking devices such that they may be locked in the “on” position. Selected breakers shall include those serving alarm systems, fire suppression systems, communications systems and other critical loads directed.

C. Install a spare 3/4-inch conduit from flush panels for each three single pole breakers or
spaces provided. Terminate conduits above accessible ceiling or as directed.

D. Utilize circuit breakers in existing panels which are to remain. Where faulty or inadequate breakers are found in these panels, replace with suitable breakers from panels removed during demolition.

E. Equip all circuit breakers associated with multi-wire branch circuit breakers with handle ties per NEC 210-4. Provide grouping of multi-wire branch circuits per NEC 210-4(D).

3.03 TRANSFORMERS

A. Install the indoor low voltage transformer with flexible conduit connections to housing. Make all cable and ground wire connections.

B. In general, transformers will be floor mounted. When necessary to wall or trapeze mount, securely anchor to structure using a safety factory of 4.

3.04 CONCRETE PADS

A. Provide nominally 3 1/2-inch deep concrete housekeeping pads under all free-standing pieces of switchgear and floor mounted transformers. Pads shall extend nominally 2 inches beyond the edges of the equipment.

3.05 COORDINATION AND ARC FLASH STUDY

A. Provide arc flash study per NEC, IEEE 1584, and NFPA 70E.

B. Coordination study shall be prepared for the electrical overcurrent devices to assure proper equipment and personnel protection.

C. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source. The study shall reflect the operation of each device during normal and abnormal current conditions.

D. The coordination study shall be prepared by qualified engineers of the switchgear manufacturer, Electro-Test, Electrical Systems Analysis, Inc. or approved. The contractor is responsible for providing all pertinent information required by the preparers to complete the study.

E. The complete study shall include a system one-line diagram and protective coordination curves.

F. Coordination curves shall be prepared to determine the required settings of protective devices to assure selective coordination. The curves shall graphically illustrate on log-log paper that adequate time separation exists between each protection device shall be plotted in such a manner that all upstream devices will be clearly depicted on one sheet. The following specified information shall also be shown on the coordination curves:

1. Device identification.

2. Voltage and current ratio for curves.

3. 3-phase and 1-phase ANSI damage points for each transformer.
4. No-damage, melting, and clearing curves for fuses.
5. Cable damage curve.
6. Transformer in rush points.

G. A table shall be developed to summarize the settings selected for the protective devices. Included in the table shall be the following:
1. Device identification.
2. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
3. Fuse rating and type.
4. Ground fault pickup and time delay.
SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED
   A. Provide wiring devices and plates or blank plates only for all outlet boxes.

1.02 SUBMITTALS
   A. Product data.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
   A. Wiring Devices and Plates: Hubbell, Leviton, Pass & Seymour.

2.02 MATERIALS
   A. Wiring devices shall be specification grade, with special devices as specified and required. Furnish a matching cap for all special purpose devices that do not have the common 120-volt NEMA 5-20R configuration.
   B. All lighting switches and duplex receptacles installed shall have similar appearance characteristics unless noted otherwise.

2.03 WALL SWITCHES
   B. Switch with pilot, lighted clear toggle, Hubbell HBL-1221-PL.

2.04 RECEPTACLES
   A. Normal Power Duplex: 3-wire, 2-pole grounding, steel backstrap, NEMA 5-20R, back and side wired. Verify finish color with architect.
   C. Special Purpose Receptacles: As noted on Drawings with NEMA configurations.

2.05 PLATES
   A. Flush Finish Plates: Verify finish color with architect.
B. Surface Covers: Galvanized or cadmium plated steel, 1/2" raised industrial type with 
openings appropriate for device installed.

C. Weatherproof: Standard duplex GFI receptacle. Hubbell WP26MH cover mounted horizontally with hinges up. Special purpose receptacles. Hubbell WP723D.

D. Identification: Identify receptacle plates with press on labels indicating serving panel and branch circuit number.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Devices and finish plates to be installed plumb with building lines. Wall mounted receptacles shall be installed vertically at centerline height shown on the Drawings. 
Unless otherwise noted on the drawings or shown/specifed in the architectural drawings, 
details, and elevations the centerline of all receptacles shall be 18 inches above finished 
floor and the centerline of all light switches shall be 48 inches above finished floor per ADA. For all above counter devices, verify exact mounting heights with architectural 
drawings, details, and elevations.

B. Finish plates and devices are not to be installed until final painting is complete. 
Scratched or splattered finish plates and devices will not be accepted.

C. Provide weatherproof device covers on devices at all exterior locations and damp or wet label areas.

3.02 CORD CAPS

A. All special plugs provided with the receptacles shall be given to the Owner in their cartons with a letter stating the date and the Owner’s representative that received the materials.

3.03 COORDINATION

A. Refer to Architectural elevations, sections and details for exact locations.

B. Coordinate with equipment installer the locations and methods of connection to devices mounted in cabinets, counters, work benches, service pedestals and similar equipment.

3.04 TESTING

A. Receptacles shall be tested for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

B. Test all GFI receptacles and replace defective units.

END OF SECTION
SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Protecting existing trees and vegetation to remain.
2. Removing existing trees and other vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above-grade and below-grade site improvements.
6. Disconnecting, capping or sealing site utilities.

1.02 SUBMITTALS

A. Product Data for each type of product indicated.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site and disposed of properly.

1.04 PROJECT CONDITIONS

A. Traffic: minimize interference with adjoining roads, streets, walks and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree and vegetation-protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

1.05 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter, sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving".

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Combination of ryegrass and fine fescue grass seed or hydroseed mix. Contractor to submit proposed mix suitable for the site location for review prior to construction.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures. Requirements for temporary erosion-and-sedimentation-control are specified in Section 31 25 00 “Erosion and Sedimentation Controls”.
3.03 TREE AND VEGETATION PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements below.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

D. Restore native surface with hydroseeding. Use a combination of ryegrass and fine fescues or equivalent for hydroseeding. Contractor to submit grass seed mix for approval prior to construction.

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Completely remove stumps and remove roots, obstructions, and debris to a depth
of 18 inches below exposed subgrade.

4. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove paving, and curbs, at existing full-depth joints unless indicated otherwise. Neatly saw-cut length of existing pavement to remain with vertical faces prior to removing existing pavement.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Preparing subgrades
2. Excavating and backfilling for structures.
3. Base course for concrete pavers and pavements.
4. Base course for asphalt paving.
5. Excavating and backfilling for utility trenches.

1.02 SUBMITTALS

A. Product Data.
B. Aggregate Sieve Analysis.

1.03 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course, or subgrade, and concrete, or hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or cement concrete.

I. Subgrade: Surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

K. Unified Soil Classification System:
   1. GW: Well-graded gravels; gravel/sand mixtures with little or no fines.
   2. GP: Poorly-graded gravels; gravel/sand mixtures with little or no fines.
   3. GM: Silty gravels; poorly-graded gravel/sand/silt mixtures.
   4. GC: Clayey gravels; poorly-graded gravel/sand/clay mixtures.
   5. SW: Well-graded sands’ gravelly sands with little or no fines.
   6. SP: Poorly-graded sands; gravelly sands with little or no fines.
   7. SM: Silty sands; poorly, graded- sand/gravel/silt mixtures.
   8. SC: Clayey sands; poorly-graded sand/gravel/clay mixtures.
   9. ML: Inorganic silts; sandy, gravelly, or clayey silts.
  10. CL: Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays.
  11. OL: Organic, low-plasticity clays and silts.
  12. MH: Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
  13. CH: Fat clays; high-plasticity, inorganic clays.
  14. OH: Organic, medium to high-plasticity clays and silts
  15. PT: Peat, humus, hydric soils with high organic content.

1.04 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

C. Site Information: Research public utility records and verify existing utility locations prior to ordering any material. Notify the Engineer immediately if any discrepancies are found in the project survey.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Native Backfill Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve or use Oregon Standard Specifications for Construction 3/4-inch-0” BASE AGGREGATE.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 3-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 5 percent passing a No. 200 sieve or use Oregon Standard Specifications for Construction 3/4-inch—0-inch BASE AGGREGATE.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Backfill and Fill:

1. Satisfactory native soil materials
2. Initial trench backfill: Use OREGON STANDARD SPECIFICATIONS FOR CONSTRUCTION (3/4-inch – 0-inch) base aggregate.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction or as follows:

1. Red: electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Tracer Wire: 12 AWG minimum solid copper insulated High Molecular Weight Polyethylene (HMW PE) tracer wire or approved equal. The tracer wire insulation shall be green for sewer pipe and blue for waterlines and be a minimum of 45 mil. thick. Joints or splices shall be waterproof. The wire shall be rated for 30 Volt.

C. Separation Fabric: Woven geotextile, specifically manufactured as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 180 lbf; ASTM D 4632.
2. Tear Strength: 68 lbf ; ASTM D 4533.
3. Puncture Strength: 371 lbf; ASTM D 4833.
4. Apparent opening size: No. 30; ASTM D 4751.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations. Provide protective insulating materials as necessary.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section “Site Clearing.”

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section“ Erosion and Sediment Control” during earth moving operations.
D. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

F. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

G. Protect all areas designated to receive pervious pavers or pervious pavement from excessive compaction.

3.02 EXPLOSIVES

1. Explosives: Do not use explosives.

3.03 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions without prior approval by the Engineer.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.04 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

3.05 EXCAVATION FOR PAVEMENTS

A. Excavate surfaces under pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: Refer to plans for clearance widths.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade and bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, or per Oregon Standard Drawing RD300. Hand excavate for bell of pipes.

2. Excavate utility structures to provide 6 inches clearance (enlarge as needed) to allow for compaction of backfill material.

3.07 SUBGRADE INSPECTION

A. Proof-roll subgrade with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Soft pockets and areas of excess yielding that have been identified shall be scarified and moistened or aerated, or removed and replaced with suitable soil materials to the depth required. Re-compact and retest until specified compaction is obtained.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILLS AND FILLS

A. Backfill: Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including.

2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.
3.11 UTILITY TRENCH BEDDING

A. Place bedding on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

3.12 UTILITY TRENCH BACKFILL

A. Trenches under Footings: Backfill trenches excavated under footings with satisfactory soil or approved backfill to within 18 inches from the bottom of footings elevation; fill remaining trench excavation with concrete up to the elevation of bottom of footings. Concrete is specified in "Cast-in-Place Concrete."

B. Place and compact initial trench backfill material, backfill sizes per Oregon Standard Drawing RD300 and Oregon Standard Specifications for Construction Section 00405.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

C. Place and compact final backfill of satisfactory native soil to final subgrade elevation.

D. Install warning tape per Oregon Standard Drawing RD300.

E. Install tracer wire in a continuous fashion above the utility in such a manner as to be able to properly trace utility lines without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire. Bring tracer wire to the surface at every box, vault, drainage structure, or manhole.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under footings and foundations, use engineered fill.
4. Under and around utility structures, use engineered fill.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Unpaved Areas: Plus or minus 1 inch.
   2. Pavements: Plus or minus 1/2 inch.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:
   1. Shape subbase course to required crown elevations and cross-slope grades.
   2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
3.18 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing Agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved, but in no case fewer than three tests.

2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

D. With the approval of the Engineer, proof-roll testing of subgrade and/or aggregate base may be substituted for other compaction testing.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Weather permitting and as approved, stormwater infiltration facility plants shall be installed as soon as possible after placing and grading the growing media in order to minimize erosion and further compaction.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION
SEASON 312500 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SUMMARY:

A. This section includes the following:
   1. Prevention of erosion due to construction activities.
   2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

1.02 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), under requirements for the 2012 General Permit for Discharges from Construction Activities.

B. Also comply with all more stringent requirements of State of Oregon Erosion and Sedimentation Control Manual.

C. Follow an Erosion and Sedimentation Control Plan.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

G. Inspections:
   1. Inspections must be conducted by a person who:
      a) Is knowledgeable in the principle and practice of erosion and sediment controls, and
      b) Possesses the skills to assess conditions at the construction site that could impact stormwater quality, and
      c) Is knowledgeable in the correct installation of the erosion and sediment controls, and
      d) Is able to assess the effectiveness of sediment and erosion control
measures selected to control the quality of stormwater discharges from the construction activity.

2. Visual monitoring requirement: all areas of the site disturbed by construction activity must be inspected to ensure that BMPs are in working order. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking as well as areas used for storage of materials that are exposed to precipitation for evidence of spillage or other potential to contaminate stormwater runoff. In addition, inspect all discharge points identified in the ESCP for evidence of or the potential for the discharge of pollutants, and to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to surface waters. Where discharge points are inaccessible, nearby downstream locations must be inspected to the extent that such inspections are practicable.

3. All ESCP controls and practices must be inspected according to the following schedule:

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Minimum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Active Period.</td>
<td>Daily when stormwater runoff, including runoff from snowmelt, is occurring. At least once every two weeks, regardless of whether stormwater runoff is occurring.</td>
</tr>
<tr>
<td>2. Prior to the site becoming inactive or in anticipation of site inaccessibility.</td>
<td>Once to ensure that erosion and sediment control measures are in working order. Any necessary maintenance and repair must be made prior to leaving the site.</td>
</tr>
<tr>
<td>3. Inactive periods greater than 14 consecutive calendar days.</td>
<td>Once every 2 weeks.</td>
</tr>
<tr>
<td>4. Periods during which the site is inaccessible due to inclement weather.</td>
<td>If practical, inspections must occur daily at a relevant and accessible discharge point or downstream location.</td>
</tr>
</tbody>
</table>

4. Recordkeeping Requirements: Document all visual inspections in an onsite logbook. If there are no findings, simply record the inspection date, and inspector’s name. In addition, record any findings, including:

a) At the designated discharge location(s):

i. Where to make observations:
   a. At the discharge location if the discharge is to a conveyance system leading to surface waters;
   b. From the discharge point to 50 feet downstream if the discharge is to surface waters; and
   c. At any location where more than 1/2 of the width of the receiving surface water is affected.

ii. How to make observations:
a. For turbidity and color, describe any apparent color and the clarity of the discharge, and any apparent difference in comparison with surface waters.

b. Describe any sheen or floating material, or record that it is absent. If present, it could indicate concern about a possible spill or leakage from vehicles or materials storage.

b) If a site is inaccessible due to inclement weather, record the inspections noted at a relevant discharge point or downstream location, if practical.

c) Locations of BMPs that need to be maintained, inspections of all BMPs, including erosion and sediment controls, chemical and waste controls, locations where vehicles enter and exit the site, status of areas that employ temporary or final stabilization control, soil stockpile area, and non-stormwater pollution (e.g. paints, oils, fuels, adhesives) controls.

d) Locations of BMPs that failed to operate as designed or proved inadequate for a particular location;

e) Locations where additional BMPs are needed that did not exist at the time of inspection; and

f) Corrective action required and implementation dates.

g) All inspection records and monitoring results must be kept on site and maintained by the permit registrant. The records shall list the construction site name as it appears on the registrant’s permit and the file or site number. These records must be made available to DEQ, Agent, or local municipality upon request. These records must be delivered or made available to DEQ within 3 working days of request. These inspection records and monitoring results must be maintained for at least 3 years after project completion. In addition, a copy of the ESCP and revisions must be retained on site and made available on request to the DEQ, Agent, or the local municipality. During inactive periods of greater than 7 consecutive calendar days, the ESCP must be retained by the permit registrant but does not need to be at the construction site.

H. Erosion On-Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.

2. Prevent development of ruts due to equipment and vehicular traffic.

3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off-Site: Prevent erosion of soil and deposition of sediment on other properties due to construction activities for this project.

1. Prevent windblown soil from leaving the project site.
2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

2. If sediment basins are used as temporary preventive measures pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off-Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.03 SUBMITTALS

A. Product Data: For materials indicated in ESCP and additional materials included in ESCP revisions.

B. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bio-filtration Bags: Bark or woodchip filled bag of flexible netting.

1. Fill material shall be clean, 100 percent recycled wood or compost product.

2. Bags shall be made of nylon mesh.

B. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; with the following properties:

1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance
with ASTM D 4751.

2. Permittivity: 0.05 sec⁻¹, minimum, when tested in accordance with ASTM D 4491.

3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.

4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.

5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.

6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.

7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

C. Silt Fence Posts: One of the following, minimum 4 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Softwood, 4 by 4 inches in cross-section.
   3. Hardwood, 2 by 2 inches in cross-section.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION
   A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES
   A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

   B. Construction Entrances: Traffic-bearing aggregate surface.
      1. Width: As required; twenty (20) feet, minimum.
      2. Length: fifty (50) feet, minimum.
      3. Provide at each construction entrance from public right-of-way.
      4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

   C. Linear Sediment Barriers: Made of silt fences, wattles, or compost socks.
1. Provide linear sediment barriers:
   a) Along downhill perimeter edge of disturbed areas, including soil stockpiles.

2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a) Slope of Less Than 2 Percent: 100 feet.
   b) Slope Between 2 and 5 Percent: 75 feet.
   c) Slope Between 5 and 10 Percent: 50 feet.
   d) Slope Between 10 and 20 Percent: 25 feet.
   e) Slope Over 20 Percent: 15 feet.

D. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil or sand bags on outer edges.
   2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves; or, 6 inches of straw or hay;
      a) as approved by Owner’s Representative.

E. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Temporary Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D 4873.
   2. Use nominal 36 inch high barriers with minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   3. Install with top of fabric at nominal height and embedment as specified.
   4. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
   5. Fasten fabric to wood posts using one of the following:
a) Integral pockets.

b) Four 3/4 inch diameter, 1 inch long, 14 gage nails.

c) Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.


7. Wherever runoff will flow around end of barrier, provide temporary splash pad or other outlet protection.

C. Bio-Filter Bag:

1. Install bags in continuous rows with ends butting tightly, with one bag at each end of row turned uphill.

2. Anchor bags with at least two stakes per bag, into the ground.

3.05 MAINTENANCE

A. Inspect preventive measures routinely (daily), within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:

1. Promptly replace fabric that deteriorates unless need for fence has passed.

2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Bio-Filtration Bags:

1. Promptly replace bags that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bags.

3. Repair bag rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owners Representative.
B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION
SECTION 321216 – ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY
A. Section Includes:
   1. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.
   3. Related Requirements:
      a) Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, aggregate subbase and base courses, and aggregate pavement shoulders.

1.02 SUBMITTALS
A. Product Data: For each type of product. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the work.
   2. Job-mix Designs: For each job mix proposed for the Work.
B. Material Certificates: For each paving material.

1.03 QUALITY ASSURANCE
A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Section 00744 of the 2018 Oregon Standard Specifications for Construction for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.04 PROJECT CONDITIONS
A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expect before time required for adequate cure, or if the following conditions are not met:
   1. Tack Coat: Minimum surface temperature of 60 deg F.
   2. Asphalt Base and Surface Course:

      | Dense Graded Mixes         | Surface Temperature |
      |---------------------------|--------------------|
      | Less than 2 inches        | 60 degrees F       |
      | 2 inches – 2 1/2 inches    | 50 degrees F       |
      | Greater than 2 1/2 inches  | 40 degrees F       |
3. If placing asphalt between March 15 and September 30, temperature may be lowered 5 degrees F.

4. Do not use field burners or other devices to heat the pavement to the specified minimum temperature.

PART 2 - PRODUCTS

2.01 AGGREGATES
   A. Conform to the requirements of 00744 of the 2018 Oregon Standard Specifications for Construction.

2.02 ASPHALT MATERIALS
   A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22
   B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt.

2.03 AUXILIARY MATERIALS
   A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
   B. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

2.04 MIXES
   A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 30 percent by weight.
      1. Surface Course Limit: Recycled content no more than 30 percent by weight.
   B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by Oregon Parks and Recreation and complying with the following requirements:
      1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
      3. AC Base Course: Level 2, 1/2 inch dense, HMAC.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify
soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply tack coat uniformly to vertical asphalt surfaces. Apply at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

D. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at a minimum temperature of 250 deg F.
2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AISMS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.06 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. AC Base Course: Plus or minus 1/2 inch.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. AC Base Course: 1/4 inch.
2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
3. Difference between adjacent panels: 1/8 inch.

3.08 CORRECTION OF DEFECTS

A. Correct all defects in materials and work at no additional cost to the owner, as follows:

1. Fouled Surfaces: Immediately repair, clean, and re-tack fouled surfaces that would prevent full bond between successive lifts of mixture.

2. Boils, Slicks, and Oversized Material: Immediately remove and replace boils, slicks, and oversized materials with fresh mixture.

3. Segregation: Take immediate corrective measures when segregation or non-uniform surface texture is occurring in the finished mat. If segregation continues to occur, stop production until a plan for providing uniform surface texture is approved by the Port.

4. Roller Damage to the Surface: Immediately correct surface damage from rollers with additional fresh mixture or by other means approved by the owner.

5. Longitudinal Joints: Take immediate corrective measures when open longitudinal joints are being constructed or when the elevation of the two sides of a longitudinal joint does not match. If problems with the longitudinal joint continue to occur, stop production until a plan for providing tight, equal elevation longitudinal joints is approved by the owner.

6. Corrective Measures: Take immediate corrective measures when the specified compaction density is not being achieved.

7. Other Defects: Remove and replace any HMAC that:
a) Is loose, broken or mixed with dirt.

b) Visually shows too much or too little asphalt.

c) Is defective in any way.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

A. Except for material indicated to be recycled, remove excavated materials from Project Site and legally dispose of them in an EPA-approved landfill.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Piping joining materials.
   2. Sleeves.
   4. Piping system common requirements.

1.02 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - PRODUCTS

2.01 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
      a) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.02 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
C. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
E. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.03 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.
B. Drawings, schematics and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
C. Install piping to permit valve servicing.
D. Install piping at indicated slopes.
E. Install piping free of sags and bends.
F. Install fittings for changes in direction and branch connections.
G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Sleeves are not required for core-drilled holes.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities. Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.


H. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool according to fitting manufacturer's written instructions.

I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number
PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.

2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

M. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Install dielectric fittings at connections of dissimilar metal pipes.

3.04 GROUTING

A. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout.

C. Avoid air entrapment during placement of grout.

D. Place grout, completely filling voids and provide smooth surface.

E. Place grout around anchors.

F. Cure placed grout.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: gravity-flow, nonpressure and force-main, pressure sanitary sewerage outside the building, with the following components:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.
4. Sewage Air Release Valve
5. Ductile Iron Valves
6. Manhole Rehabilitation
7. Pump Station Equipment
8. Manhole
9. Valve Vault
10. Concrete

1.02 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water
B. Force-main, pressure-piping rating: at least equal to system operating pressure but not less than 150 psig.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Cleanouts
2. Pipe material.
3. Pipe Valves
4. Mechanical plugs.
5. Manhole Rehabilitation Products
6. Pump Station Equipment

B. Shop Drawings: For manholes, include plans, elevations, sections, details, and frames and
covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Field quality-control reports.

1.04 PROJECT CONDITIONS

A. Site information: Research public utility records and verify existing utility locations prior to ordering any materials. Notify the Engineer immediately if any discrepancies are found in the project survey.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” Article for applications of pipe, fitting, and joining materials.

2.03 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Piping:

1. Pipe: AWWA C151.
2. Standard Fittings: AWWA C110, ductile or gray iron.
5. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.
6. Lining: Ceramic epoxy coating for ductile iron force mains. Protecto 401 or approved equivalent

2.04 PVC PIPE AND FITTINGS

A. PVC Sewer Piping, NPS 15 and Smaller:

1. Pipe, NPS 15 and Smaller: ASTM D 3034, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.

B. PVC Sewer Piping, NPS 18 (DN 450) and Larger:

C. PVC Pressure Piping:
   1. Pipe: AWWA C900, [Class 100] [Class 150] [and] [Class 200] PVC pipe with bell-and-spigot ends for gasketed joints ASTM E 1785 Schedule 80 pipe with plain ends for solvent-cement joints.
   2. Fittings: Ductile iron, compact fittings complying with AWWA C153 for push-on joints and using AWWA C111, rubber gaskets. ASTM D 2467, Schedule 80 socket-type fittings. Provide transition fittings as required.

D. Ductile Iron Pressure Piping:
   1. Pipe
   2. Fittings

E. PVC Service Pipe and Fittings: ASTM E 1785 Schedule [40] [80] pipe, with plain ends for solvent-cement joints with [ASTM D 2466, Schedule 40] [ASTM D 2467, Schedule 80] socket-type fittings.

2.05 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.06 PRESSURE-TYPE PIPE COUPLINGS
A. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psi minimum pressure rating and ends of same sizes as piping to be joined.

C. Center-Sleeve Material: Manufacturer's standard

D. Gasket Material: Natural or synthetic rubber.

E. Metal Component Finish: Corrosion-resistant coating or material.

2.07 CLEANOUTS

A. Cleanouts: At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with counter sunk slot, and cast-iron frame and cover.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fittings and riser to cleanout.

2.08 SEWAGE AIR RELEASE & VACCUM BREAK VALVE

A. Double orifice (small & large orifice) with bias mechanism for large volume air intake and controlled air discharge. Maximum operating pressure of 145 psi.

B. Fusion bonded epoxy powder coated ductile iron body with high density polyethylene (solid) float and EPDM O-ring and nozzle seat.

C. Vent-O-Mat Series RGX II or approved equal.

2.09 DUCTILE IRON VALVES

A. AWWA, Gate Valve:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a) American AVK Co.; Valves & Fittings Div.
      b) American Flow Control Div.
      c) McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
      d) McWane, Inc.; Kennedy Valve Div.
      e) McWane, Inc.; M & H Valve Company Div.
      f) McWane, Inc.; Tyler Pipe Div.; Utilities Div.
      g) Mueller Co.
      h) NIBCO Inc.
      i) U.S. Pipe and Foundry Company.
3. **Nonrising-Stem, Resilient Wedge Gate Valve:**
   a) **Description:** ductile iron body bonnet and wedge. The wedge shall be encapsulated in rubber.
      1) **Standard:** AWWA C509
      2) **Minimum Pressure Rating:** 200 psig
      3) **End Connections:** Flanged
      4) **Interior coating:** Complying with AWWA C550

B. **Swing Check Valve:**
   1. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. **Basis-of-Design Product:** Subject to compliance with requirements, provide ductile iron flanged swing check valve Val matic Swing-Flex Check Valve or an approved equivalent.
   3. **Standard:** AWWA C508
   4. **Position Indicator and Manual Backflow Assembly**

2.10 **MANHOLE REHABILITATION**

A. **External Joint Sealer:**
   1. External joint seal shall meet or exceed the requirements of ASTM C-877 type II.
   2. External joint seals shall consist of a collar 12-inch wide with an outer layer of polyethylene, with a minimum tensile strength of 4,000 psi and a minimum tear resistance of 1,500 psi, and an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric. Two 5/8-inch steel straps shall be located within the collar 3/4-inch from each edge. The straps shall be confined in tubes that isolate them from the mastic and allow them to slip freely with mechanically tightened and locked around the manhole joint. The collar shall be furnished with a minimum of 6-inch overlap and a closing flap to cover any remaining exposed strap.

B. **Manhole Lid Sealer:**
   1. Gasket and plugs shall be molded, cut, or extruded from a high quality rubber compound such as Nitrile, EPDM, Neoprene or a blend thereof. When extrusion is the method of manufacturer, the material shall be cured in a round forming mold to maintain a flat and circular finished form. The molded products shall have a minimum tensile strength of 1,500 psi. Products cut from sheet material shall have a minimum tensile strength of 800 psi and extruded products shall have a minimum of 1,200-psi and all shall have a hardness (durometer) of 60+/-.5.
C. External Chimney Seal:

1. Install external mechanically locking seal consisting of the following components:
   
a) Flexible rubber sleeve and extension shall be extruded or molded high-grade rubber compound confirming to the applicable material requirements of ASTM C-923 with a minimum 1500 psi tensile strength, maximum 18% compression set and a hardness (durometer) of 45 +/- 5. The rubber sleeve shall be corrugated, with a minimum thickness of 3/16 inches. The top section of the sleeve shall be designed to extend both over and under the manhole frame’s base flange, thereby allowing it to be mechanically locked to the frame. The bottom section of the sleeve shall contain an integrally formed compression band recess and a series of sealing fins to facilitate a watertight seal. Any splice used to fabricate the sleeve or extension shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180-degree bend with no visible separation.

b) Compression bands shall be integrally formed from 16-gauge stainless steel confirming to the applicable material requirements of ASTM C-923, Type 304, with no welded attachments and shall have a minimum width of 1-inch. The top compression band shall have a shape and width sufficient to, when tightened, will mechanically lock the sleeve to the manhole frame’s base flange. The lower compression band shall be a flat strip to allow placement into the lower band recess of the seal and or extension. The tightening mechanism on both bands shall have the capacity to develop the pressure necessary to make a watertight seal and shall have a minimum adjustment ranges of 2 diameter inches. Screws, bolts, and nuts used on the bands shall be stainless steel conforming to ASTM F-593 and 594, Type 304.

c) The seal shall be designed to prevent leakage of water through the manhole chimney section throughout a 50-year design life. In addition, the seal shall be capable of repeated vertical movement of the frame of not less than 2-inches and/or repeated horizontal movement of not less than 1/2-inch after installation and throughout its design life.

2.11 PUMP STATION EQUIPMENT

A. Guide Rail Systems and Discharge Pipe Assemblies: 2-inch, schedule 40, stainless steel guide rail with stainless steel lifting cable or chain compatible for the specified pumps

B. Pump Removal Crane
   1. Tern Portable Davit Crane Model #5PT20G-M2, 2000 lb capacity, or approved equivalent
   2. #ED300-DW11 Drill Drive, 120V/1Ph
   3. 5BW20G Standard Wall Mount Base, Galvanized
   4. 1/4" x 36’ 304SS Wire Rope Assy. having 316SS Hook with Safety Latch

C. Pump Station Wetwell Components.

1. Xylem Flygt Concerto 6020 N80 submersible pumps. 230V 5.5 HP, FM approved, or approved equivalent.
2. TOP 150 Wetwell Insert, or approved equivalent
3. Pedestrian Rated Aluminum Safe Hatch
4. Cable Tray for Wetwell
5. NEMA 4x Stainless Steel Pump Disconnect Panel and Stand
6. NEMA 12 Painted Steel 230V Duplex Concertor XPC Control Panel with Touch Screen and XTU Cellular Autodialer
7. Floats
   a) Requirements specified in Division 26 – Electrical shall apply
8. Pump Liquid Level Control Pressure Transducer
9. 1/8" Stainless Steel Lifting Cable
10. Pump Power Cable. Each cable to have a stainless steel basket cable grip attached to hook on upper guide bar bracket.

2.12 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints rubber gasketed joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation if site conditions warrant and/or as shown in plans.
   4. Base Section: 6-inch minimum thickness for floor slab and 5 inch (125-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
   5. Riser Sections: 5-inch minimum thickness, of length to provide depth indicated.
   6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
   7. Gaskets: ASTM C 443, rubber or preformed plastic.
   8. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   9. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   10. Steps: Individual FRP steps; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
11. Adjusting Rings: Interlocking rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

12. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 23-inch ID by 3- to 7-inch riser, with 3 1/4 -inch- minimum-width flange and 24 3/4-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

2. Material: ASTM A 48, Class 30 gray iron designed for heavy duty service unless otherwise indicated.

2.13 VALVE VAULT

A. Precast Utility Vault:

1. Utility Vault by Old Castle, or approved equivalent.

2. Description: Precast, reinforced concrete, of depth indicated, with provision for sealant joints.

3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls.

4. Joint Sealant: ASTM C990, butyl resin sealant, or per manufacturer’s recommendation.

B. Hatch:

1. Locking galvanized steel doors per manufacturer’s recommendation.

2.14 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.


B. Portland Cement Design Mix: 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a) Invert Slope: Uniform slope through manhole to match invert elevations per plans, minimum 2 percent.

2. Benches: Concrete, sloped to drain into channel.
   a) Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.


2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
   a) Unshielded flexible couplings for same or minor difference OD pipes.
   b) Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   c) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping’s OD and larger piping’s ID permits installation.

B. Gravity-flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range.
1. NPS 4 to NPS 15: PVC sewer pipe and fittings gaskets, and gasketed joints.

C. Force-main Pressure Piping: use the following pipe materials for each size range:

   NPS 1 to NPS 3 (DN 25 to DN 75): PVC Schedule [480] [80], service pipe; PVC Schedule [480] [80], service-pipe fittings; and solvent-cemented joints.

   1. NPS 3 to NPS 4: Ductile-iron, grooved pressure pipe; ductile-iron standard or compact fittings; gaskets; and gasketed joints. Use “c” clamp to connect pipe.

3.03 PIPING INSTALLATION

A. Install tracer wire directly over piping and at outside edges of underground structures. See Section 31 20 00 “Earth Moving” for tracer wire material requirements.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, sewer piping according to the following:

   1. Install piping pitched down in direction of flow, at minimum slope of 2 percent or match existing conditions, unless otherwise indicated.

   2. Install piping with 3-foot of minimum cover.

   3. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

   4. Core drill existing manhole and contractor to ensure adequate clearance between existing laterals. Fill annular space with non-shrink grout.

F. Install force-main, pressure piping according to the following:

   1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

   2. Install piping with 24 inch minimum cover.

   3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.

   4. Install ductile-iron special fittings according to AWWA C600.
5. Contractor to provide all required restrained fittings to connect into existing 3 inch pressure line.

G. Fill existing comminutor tank and lift station wetwell with control density fill when new pump station is active.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

I. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

J. Install air-vacuum valves per manufacturer’s recommendations.

3.04 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Section 33 05 00 “Common Work Results for Utilities.” Where specific joint construction is not indicated, follow piping manufacturer’s written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

2. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

C. Join force-main, pressure piping according to the following:

1. Join ductile iron pressure piping with the PVC pressure piping piping according to ASTM D 2855.

2. Join dissimilar pipe materials with pressure-type couplings.

D. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

   a) Unshielded flexible couplings for pipes of same or slightly different OD.

   b) Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

   c) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface for manholes that occur in pavements. Set tops 3 inches minimum above finished surface elsewhere unless otherwise indicated.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use pipe fittings in sewer pipes at branches for cleanouts, and use PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, per the Detail. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drain. Use transition fitting to join dissimilar piping materials.

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by core drilling into existing unit. Make connection into existing pipe using an “Inserta-Tee” fitting per the manufacturer’s recommendations or approved equal. Make connection to existing manhole using
round rubber gasket installed on the pipe per the manufacturer’s instructions. Cut end of connection pipe passing through the manhole wall to conform to the shape of and be flush with the inside wall unless otherwise indicated. The opening around the gasket shall be grouted to a watertight seal. Existing manhole inverts, flow lines, channels, etc. shall be chipped out and re-grouted to accommodate the new pipe.

a) Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

b) Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Make connections to existing piping and underground structures so finished Work complies with requirements specified for new Work.

3.09 PUMP STATION INSTALLATION

A. Pump Guide Rail: Install and anchor pump guide rail per manufacturer’s recommendations.

B. Valve Vault: Install per manufacturer’s recommendations and as shown on plans.

C. Wetwell: Install per manufacturer’s recommendations and as shown on plans.

3.10 MANHOLE REHABILITATION

A. Clean existing manholes and install per manufacturer’s recommendations.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a) Alignment: Less than full diameter of inside of pipe is visible between structures.

b) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c) Damage: Crushed, broken, cracked, or otherwise damaged piping.

d) Infiltration: Water leakage into piping.

e) Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
      a) Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
      b) Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile pipe, during 24-hour period.
      c) Close openings in system and fill with water.
      d) Purge air and refill with water.
      e) Disconnect water supply.
      f) Test and inspect joints for leaks.
      g) Option: Test concrete gravity sewer piping according to ASTM C 924.
   6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a) Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING
   A. Clean dirt and superfluous material from interior of piping.

3.13 AS-BUILTS
A. Contractor shall utilize a surveyor licensed in the State of Oregon to document post construction of the sewer line. Provide the following information in AutoCAD Release 10 format:

1. Rim Elevation
2. Pipe Invert(s)
3. Pipe Size(s)

B. Perform a television inspection of the newly installed sanitary gravity lines.

1. Notify the Engineer and Owner’s Representative a minimum of 72-hours before cleaning or video inspection. Allow access to the Engineer or Owner’s Representative at all times to observe the video monitor and all other operations.
2. Clean the pipe of obstructions that will impede video inspection. Install a screen to catch debris at the downstream end of the pipe run. Avoid causing damage to pipe while completing the cleaning operations.
3. Inspect the mainline pipes using a digital color video camera equipped with an illumination devise that provides clear and sharp images with all pipe sizes and material types. The camera and lighting shall be capable of operating in 100% humidity conditions and with ability to pan and tilt 275° and rotate 360°. Service line laterals can utilize a push camera with imaging capabilities and illumination requirements similar to that required for the mainline pipe.
4. Perform continuous video inspection while pipe remains clean. Video inspect pipe one segment at a time. Do not move the camera at a speed greater than 30 feet per minute. Move the camera through the line in either direction, stopping, panning, or tilting as necessary to permit documentation of the pipe’s condition including the location of all lateral connections.
5. Provide a verbal narrative description on each video inspection recording. Include the following minimum information in the narrative: the beginning and the end of the video, access point identification, the total footage of the pipe inspected, the company name, the operator’s name and the date, time and weather conditions. Make note of all joints, lateral connections, and other conditions within the pipe.
6. Begin all video inspection with the footage meter set to zero and begin video inspection from the middle of the access point. Provide accurate on-screen distance measurements in the video recording. Ensure that the footage information on the recorded video corresponds to the footage references in the written inspection report.
7. Record the video inspection using an approved file format.
8. Record video continuously, without editing or starts and stops, in color from the beginning to the end of each pipe segment. Ensure that the pipe image is free of visual distortions and appears level and centered in the pipe being inspected. Ensure that the audio portion of the composite video recording is sufficiently free from electrical interference and background noise to provide complete clarity of
the narrative description.

9. Furnish one copy of all post-construction written inspection reports and video recordings within three days after completing the inspections or as specified.

Each delivered video recording will be reviewed and any pipe deficiencies noted. Correct all pipe deficiencies that are revealed in the recording and written report within 48 hours after receiving notification. Re-perform the video inspection, submit the new video and update the written report at no additional cost to the Client.

END OF SECTION 333100