

# CITY OF BRIDGEPORT

DOUGLAS COUNTY

WASHINGTON



## CONTRACT PROVISIONS

For  
**WASTEWATER TREATMENT FACILITY  
OPERATIONS BUILDING RESTORATION – REBID**

Funding for this project is provided by the City of Bridgeport and by the  
Washington State Department of Ecology Clean Water State Revolving Fund  
Emergency Funding Program.

**G&O #20859  
OCTOBER 2021**



**Gray & Osborne, Inc.**  
CONSULTING ENGINEERS

# CITY OF BRIDGEPORT

DOUGLAS COUNTY

WASHINGTON



## CONTRACT PROVISIONS

For

### WASTEWATER TREATMENT FACILITY OPERATIONS BUILDING RESTORATION – REBID



10/12/21



10/12/2021

G&O #20859  
OCTOBER 2021



**Gray & Osborne, Inc.**  
CONSULTING ENGINEERS

**CALL FOR BIDS**  
**CITY OF BRIDGEPORT**  
**WASTEWATER TREATMENT FACILITY OPERATIONS**  
**BUILDING RESTORATION**

Sealed Proposals will be received by the undersigned at the City of Bridgeport, 1206 Columbia Avenue, Bridgeport, Washington 98813, up to 2:00 p.m.; local time on Tuesday, November 9, 2021 for furnishing the necessary labor, materials, equipment, tools, and guarantees thereof to construct the Wastewater Treatment Facility Operations Building Restoration project.

The Work shall be substantially complete within 145 working days after the commencement date stated in the Notice to Proceed. All bidding and construction is to be performed in compliance with the Contract Provisions and Contract Plans for this project and any addenda issued thereto that are on file at the office of the City Clerk, City Hall, Bridgeport, Washington.

The Proposals will be publicly opened and read aloud shortly after the time and date stated above. Proposals are to be submitted only on the form provided with the Bid Documents. All Proposals must be accompanied by a certified check, postal money order, cashiers check, or Proposal bond payable to the "City of Bridgeport" and in an amount of not less than five percent (5%) of the total Proposal amount.

Bid Documents for this project are available free-of-charge at the following website: <http://gobids.grayandosborne.com>. Bidders are encouraged to register in order to receive automatic email notification of future addenda and to be placed on the Bidders List. For assistance, please call (509) 453-4833. Contract questions shall be directed only to the office of the Project Engineer. Site visits shall be limited to 9:00 a.m. to 2:00 p.m., Monday through Friday, and shall be coordinated through Mr. Stuart Dezellem, of the City of Bridgeport, by calling 509-686-3613, at least 24 hours, in advance of the visit. No unauthorized visits or unscheduled visits will be allowed.

Financing of the Project has been provided by City of Bridgeport, Washington and Washington State Department of Ecology Clean Water State Revolving Fund Emergency Funding Program. Neither the State of Washington nor any of its departments or employees are, or shall be, a party to this Contract or any subcontract resulting from this solicitation for bids. Buy American Iron and Steel provisions apply.

The City of Bridgeport expressly reserves the right to reject any or all Proposals and to waive minor irregularities or informalities and to Award the Project to the lowest responsive, responsible bidder as it best serves the interests of the City of Bridgeport.

(Signed)

**JUDY BROWN**  
**CITY CLERK/TREASURER**

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# **PART 1**

## **BID DOCUMENTS**

## **BIDDER'S CHECKLIST**

### **1. REQUIRED FORMS**

The Bidder shall submit the following forms, which must be executed in full and submitted with the Proposal.

- a. Proposal (including Statement of Bidder's Qualifications) (Pages P-1 - P-6)
- b. Bid Deposit or Proposal Bond (PB-1)
- c. Ecology - DBE Subcontractor - Performance Form 6100-3, one copy for each DBE subcontractor
- d. Ecology - DBE Subcontractor - Utilization Form 6100-4
- e. Ecology - Bidders List, refer to page 6 of the SRF Specification Insert

### **2. SUPPLEMENTAL BIDDER CRITERIA**

The Apparent two lowest bidders shall submit to the Contracting Agency the completed Supplemental Bidder Criteria forms in the Appendix by noon of the second business day following the bid submittal deadline.

### **3. AGREEMENT FORMS**

The following forms (a., b., and c.) are to be executed and the Certificates of Insurance (d. and e.) are to be provided after the Contract is awarded and prior to Contract execution.

- a. Agreement (Pages A-1 - A-3)
- b. Performance Bond (Page B-1)
- c. Public Works Payment Bond (Page B-2)
- d. Certificate of Insurance
- e. Certificate of Builders Risk Insurance

### **4. SUBCONTRACTOR FORMS (Forms are located in Appendix E)**

The following forms (a., b., and c.) are to be executed by each subcontractor prior to work on-site.

- a. Ecology - DBE Subcontractor - Participation Form 6100-2
- b. Ecology - DBE Subcontractor - Performance Form 6100-3
- c. Ecology - DBE Subcontractor - Utilization Form 6100-4

# **WASTEWATER TREATMENT FACILITY OPERATIONS BUILDING RESTORATION**

## **PROPOSAL**

City of Bridgeport  
1206 Columbia Avenue  
Bridgeport, Washington 98813

The undersigned has examined the Work site(s), local conditions, the Contract, and all applicable laws and regulations covering the Work. The following unit and lump sum prices are tendered as an offer to perform the Work in accordance with all of the requirements set forth in the Contract and all applicable laws and regulations.

As required by the Contract, a postal money order, certified check, cashier's check or Proposal bond made payable to the Owner is attached hereto. If this Proposal is accepted and the undersigned fail(s) or refuse(s) to enter into a contract and furnish the required performance bond, labor and material payment bond, special guarantee bonds (if required), required insurance and all other required documentation, the undersigned will forfeit to the Owner an amount equal to five percent of the Proposal amount.

After the date and hour set for submitting the Proposals, no bidder may withdraw its Proposal, unless the Award of the contract is delayed for a period exceeding 60 consecutive calendar days.

The undersigned agrees that in the event it is Awarded the contract for the Work, it shall employ only Contractors and Subcontractors that are duly licensed by the State of Washington and remain so at all times they are in any way involved with the Work.

The undersigned agrees that the Owner reserves the right to reject any or all Proposals and to waive any minor irregularities and informalities in any Proposal.

**The undersigned agrees that the Owner will Award the Contract to the lowest responsible, responsive bidder whose Proposal is in the best interest of the Owner.**

**PROPOSAL - Continued**

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
1.	Wastewater Treatment Facilities Improvements	1 LS	\$ _____	\$ _____
2.	Mobilization and Demobilization	1 LS	\$ _____	\$ _____
3.	Minor Change	1 CALC	\$15,000.00	\$15,000.00
4.	Trench Excavation Safety Systems	1 LS	\$ _____	\$ _____
5.	Unsuitable Excavation	1 CY	\$ _____	\$ _____
Subtotal:.....			\$ _____	
Washington State Sales Tax (7.7%):.....			\$ _____	
TOTAL CONSTRUCTION COST: .....			\$ _____	

**Note: A bid must be received on all items.**

**PROPOSAL - Continued**

**STATEMENT OF BIDDER'S QUALIFICATIONS**

Name of Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone No. \_\_\_\_\_ Fax No. \_\_\_\_\_

Contact Person for this Project: \_\_\_\_\_

E-mail: \_\_\_\_\_

Number of years the Contractor has been engaged in the construction business under the present firm name, as indicated above:

\_\_\_\_\_

**WORK TO BE COMPLETED BY BIDDER**

List the Work and the dollar amount thereof that the Bidder will complete with its forces, if awarded the contract.

<b>Work to be Performed</b>	<b>Dollar Amount</b>

**PROPOSAL - Continued**

**PROPOSED SUBCONTRACTORS** (Per RCW 39.30.060)

For Proposals exceeding one million dollars, indicate who (either the Contractor submitting this bid or a subcontractor) will be completing the work for each of the five categories listed below. Information shall include their Washington State Department of Licensing Contractor's Registration No. This information shall be provided with the Proposal or within one hour after the published Proposal submittal time in accordance with RCW 39.30.060.

<b>Work to be Performed</b>	<b>Subcontractor or Prime (Name and Registration Number)</b>
Heating, Ventilation and Air Conditioning	
Plumbing	
Electrical	
Structural Steel Installation	
Rebar Installation	

**PROPOSAL - Continued**

**ADDENDA RECEIVED**

<b>Addendum No.</b>	<b>Date Received</b>	<b>Name of Recipient</b>

**NOTE: Bidder shall acknowledge receipt of all addenda. Bidder is responsible for verifying the actual number of addenda issued prior to submitting a Proposal.**

Subject to any extensions of the Contract Time granted under the Contract, the undersigned agrees to substantially complete the Work required under this Contract within 145 working days (the Substantial Completion Date) and to physically complete the Work required under this contract within 155 working days (the Physical Completion Date) from when Contract Time begins.

The undersigned has reviewed and fully understands the provisions in the Contract regarding liquidated damages and agrees that liquidated damages shall be \$1,500.00 per day for each and every working day beyond the Contract Time allowed for substantial completion until the Substantial Completion Date is achieved and \$700.00 for each and every working day required beyond the Contract Time for physical completion until the Physical Completion Date is achieved.

The undersigned is, and will remain in, full compliance with all Washington State administrative agency requirements including, but not limited to registration requirements of Washington State Department of Labor & Industries for contractors, including but not limited to requirements for bond, proof of insurance and annual registration fee. The undersigned's Washington State:

Dept. of Labor and Industries Workman's Compensation Account No. is \_\_\_\_\_;  
Dept. of Licensing Contractor's Registration No. is \_\_\_\_\_;  
Unified Business Identifier Number is \_\_\_\_\_;  
Excise Tax Registration Number is \_\_\_\_\_; and  
Employment Security Account Number is \_\_\_\_\_.

The undersigned has reviewed all insurance requirements contained in the Contract and has verified the availability of and the undersigned's eligibility for all required insurance. The undersigned verifies that the cost for all required insurance, has been included in this Proposal.

In relation to claims related in whole or in part to workplace injuries to employees, the undersigned waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. This waiver has been specially negotiated by the parties, which is acknowledged by the undersigned in signing this Proposal.

By signing the proposal, the undersigned declares, under penalty of perjury under the laws of the United States and the State of Washington, that the following statements are true and correct:

**PROPOSAL - Continued**

1. That the undersigned person(s) or entity(ies) has(have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this Proposal is submitted.
2. The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date (October 13, 2021), that the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

The undersigned agrees that the Owner is authorized to obtain information from all references included herein.

Sincerely,

_____ Sign Name	_____ Date
--------------------	---------------

By: _____ Print Name, Title	_____ Location Executed (City, State or County)
--------------------------------	--

\_\_\_\_\_  
Print Company Name

Amount of Proposal deposit: \$ \_\_\_\_\_ Check No. \_\_\_\_\_,

or Proposal bond in the amount of \$ \_\_\_\_\_

\_\_\_\_\_, issued through \_\_\_\_\_  
Name of Bank/Bonding Company

located at \_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
Telephone Number of Bank/Bonding Company

## PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we \_\_\_\_\_

\_\_\_\_\_

of \_\_\_\_\_ as principal, and the \_\_\_\_\_

\_\_\_\_\_

a corporation duly organized under the laws of the state of \_\_\_\_\_,  
\_\_\_\_\_ and authorized to do business in the State of  
Washington, as surety, are held and firmly bound unto the **CITY OF BRIDGEPORT** in the full  
and penal sum of five percent of the total amount of the bid proposal of said principal for the  
work hereinafter described, for the payment of which, well and truly to be made, we bind our  
heirs, executors, administrators and assigns, and successors and assigns, firmly by these presents.

The condition of this bond is such, that whereas the principal herein is herewith  
submitting his or its sealed proposal for the following construction project, to wit:

### **WASTEWATER TREATMENT FACILITY OPERATIONS BUILDING RESTORATION**

said bid and proposal, by reference thereto, being made a part hereof.

NOW, THEREFORE, If the said proposal bid by said principal be accepted, and the  
contract be awarded to said principal, and if said principal shall duly make and enter into and  
execute said Contract and shall furnish bond as required by the **CITY OF BRIDGEPORT**  
within a period of 10 days from and after said award, exclusive of the day of such award, then  
this obligation shall be null and void, otherwise it shall remain and be in full force and effect.

IN TESTIMONY WHEREOF, The principal and surety have caused these presents to be  
signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_

\_\_\_\_\_  
(Principal)

\_\_\_\_\_  
(Surety)

\_\_\_\_\_  
(Attorney-in-fact)

## **PART 2**

### **AGREEMENT AND BONDS**

## **AGREEMENT**

THIS AGREEMENT is entered into by and between the **CITY OF BRIDGEPORT** (hereinafter called the Owner) and \_\_\_\_\_ (hereinafter called the Contractor).

The Owner and the Contractor agree as follows:

### **ARTICLE 1. WORK.**

**[Include description of all schedules, alternate or additive items awarded]**

### **ARTICLE 2. CONTRACT TIME.**

The Contractor shall substantially complete the Work required by the Contract within 145 working days (the Substantial Completion Date) and physically complete the Work within 155 working days (the Physical Completion Date).

### **ARTICLE 3. LIQUIDATED DAMAGES.**

The Owner and the Contractor recognize that time is of the essence and that the Owner will suffer financial loss if the Work is not completed within the time, plus any extensions thereof, allowed in accordance with the Contract. They also recognize the inconvenience, expense, and difficulties involved in a legal proceeding to prove the actual loss suffered by the Owner if the Work is not completed within the time allowed in the Contract. Accordingly, the Owner and the Contractor agree that as liquidated damages for delay, and not as a penalty, the Contractor shall pay the Owner \$500.00 (US) per day for each working day beyond the Substantial Completion Date until the Contractor achieves substantial completion of the Work and \$1,000.00 (US) per day for each working day beyond the Physical Completion Date until the Contractor achieves physical completion of the Work.

### **ARTICLE 4. CONTRACT PRICE.**

The Owner shall pay the Contractor the amount(s) set forth in the Proposal (in United States dollars) for completion of the Work in accordance with the Contract.

**ARTICLE 5. CONTRACT.**

The Contract, which comprises the entire agreement between the Owner and the Contractor concerning the Work, consists of the following:

- This Agreement;
- The Contractor's Proposal including the bid, bid schedule(s), information required of bidder, Proposal bond, and all required certificates and affidavits;
- The Performance Bond and the Public Works Payment Bond;
- The Contract Provisions;
- The Plans (or drawings) consisting of \_\_\_\_\_ sheets, as listed in the index on sheet \_\_\_\_\_ of the Plans;
- Addenda numbers \_\_\_\_\_, inclusive; and
- Change Orders issued after the effective date of this Agreement.

There are no Contract Documents other than those listed in this Article 5. The Contract may be amended only in writing by Change Order as provided in the Contract.

**ARTICLE 6. MISCELLANEOUS.**

For purpose of indemnifying and defending any work place injury claims by employees of the Contractor and Subcontractors, the Contractor waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. This waiver has been specifically negotiated between the parties and is hereby acknowledged by the Contractor.  
\_\_\_\_\_(Contractor's initials)

The Contractor shall not assign any rights under or interests in the Contract, including but not limited to rights to payment, without the prior written consent of the Owner. Unless specifically stated in a written consent to an assignment, no assignment will release or discharge the Contractor-assignor from any duty or responsibility under the Contract.

The Contract is binding upon the Owner and the Contractor, and their respective partners, successors, assigns and legal representatives.

AGREEMENT – Continued

IN WITNESS WHEREOF, Owner and Contractor have caused this Agreement to be executed the day and year indicated below.

**CITY OF BRIDGEPORT**

**CONTRACTOR**

By \_\_\_\_\_

License No. \_\_\_\_\_

By \_\_\_\_\_

Date \_\_\_\_\_

Title \_\_\_\_\_

Attest \_\_\_\_\_

Name and Address for giving notices (print)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INFORMATION ONLY

**PUBLIC WORKS PERFORMANCE BOND**  
**to CITY OF BRIDGEPORT, WA**

Bond No. \_\_\_\_\_

The **CITY OF BRIDGEPORT**, Washington, (City) has awarded to \_\_\_\_\_ (Principal), a contract for the construction of the project designated as Wastewater Treatment Facility Operations Building Restoration in Bridgeport, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a bond for performance of all obligations under the Contract.

The Principal, and \_\_\_\_\_ (Surety), a corporation organized under the laws of the State of \_\_\_\_\_ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the City of Bridgeport, in the sum of \_\_\_\_\_ US Dollars (\$ \_\_\_\_\_ **amount to include sales tax**) Total Contract Amount, subject to the provisions herein.

This statutory performance bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform all of the Principal's obligations under the Contract and fulfill all the terms and conditions of all duly authorized modifications, additions, and changes to said Contract that may hereafter be made, at the time and in the manner therein specified, and if such performance obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety agrees to indemnify, defend, and protect the City of Bridgeport against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns (or any of the employees, subcontractors, or lower tier subcontractors of the Principal) to faithfully perform the Contract.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the officer executing on behalf of the surety.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

PRINCIPAL

SURETY

Principal Signature \_\_\_\_\_ Date \_\_\_\_\_

Surety Signature \_\_\_\_\_ Date \_\_\_\_\_

Printed Name \_\_\_\_\_

Printed Name \_\_\_\_\_

Title \_\_\_\_\_

Title \_\_\_\_\_

Local office/agent of Surety Company:

Name \_\_\_\_\_

Telephone \_\_\_\_\_

Address \_\_\_\_\_

**PUBLIC WORKS PAYMENT BOND**  
**to CITY OF BRIDGEPORT, WA**

Bond No. \_\_\_\_\_

The **CITY OF BRIDGEPORT**, Washington, (City) has awarded to \_\_\_\_\_ (Principal), a contract for the construction of the project designated as Wastewater Treatment Facility Operations Building Restoration in Bridgeport, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a payment bond in accord with Title 39.08 Revised Code of Washington (RCW) and (where applicable) 60.28 RCW.

The Principal, and \_\_\_\_\_ (Surety), a corporation organized under the laws of the State of \_\_\_\_\_ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the City of Bridgeport, in the sum of \_\_\_\_\_ US Dollars (\$ \_\_\_\_\_ **amount to include sales tax**) Total Contract Amount, subject to the provisions herein.

This statutory payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW Titles 60.28, 39.08, and 39.12 including all workers, laborers, mechanics, subcontractors, lower tier subcontractors, and material suppliers, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and all taxes incurred on said Contract under Title 50 and 51 RCW and all taxes imposed on the Principal under Title 82 RCW; and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety agrees to indemnify, defend, and protect the City of Bridgeport against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns, (or the subcontractors or lower tier subcontractors of the Principal) to pay all laborers, mechanics, subcontractors, lower tier subcontractors material persons, and all persons who shall supply such contractor or subcontractors with provisions and supplies for the carrying on of such work.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, except as provided herein, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the officer executing on behalf of the surety.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

**PRINCIPAL**

**SURETY**

Principal Signature \_\_\_\_\_

Date \_\_\_\_\_

Surety Signature \_\_\_\_\_

Date \_\_\_\_\_

Printed Name \_\_\_\_\_

Printed Name \_\_\_\_\_

Title \_\_\_\_\_

Title \_\_\_\_\_

Local office/agent of Surety Company:

Name \_\_\_\_\_

Telephone \_\_\_\_\_

Address \_\_\_\_\_

## **PART 3**

### **SUPPLEMENTARY GENERAL CONDITIONS & GENERAL CONDITIONS**

## **SUPPLEMENTARY GENERAL CONDITIONS**

The General Conditions shall be supplemented as follows:

### **Section 3.03.2 SAFETY MEASURES**

Supplement this section with the following:

“In response to COVID-19, the Contractor shall prepare a project specific COVID-19 Health and Safety Plan (CHSP).

The CHSP shall be prepared and submitted prior to beginning physical Work. The CHSP shall be based on the most current State and Federal requirements. If the State and Federal requirements are revised, the CHSP shall be updated as necessary to conform to the current requirements.

The Contractor shall update and resubmit the CHSP as the work progresses and new activities appear on the Look Ahead Schedule required under Section 3.04.15(1). If the conditions change on the project, or a particular activity, the Contractor shall update and resubmit the CHSP. Work on any activity shall cease if conditions prevent full compliance with the CHSP.

The CHSP shall address the health and safety of all people associated with the project including Owner representatives and workers in the field, Contractor personnel, consultants, project staff, subcontractors, suppliers and anyone on the project site, staging areas, or yards.

Costs for development and implementation of the CHSP shall be included in other items of work.”

# GENERAL CONDITIONS

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# **GENERAL CONDITIONS**

## **SECTION 1 - GENERAL INFORMATION APPLICABLE TO PROPOSAL AND CONTRACT**

### **1.01 DEFINITIONS AND TERMINOLOGY**

The following terms are abbreviated and defined as they are used in the Contract. When used in the Proposal form to denote items of Work and units of measurements, abbreviations mean the full expression of the abbreviated term.

### **1.02 ABBREVIATIONS AND TERMINOLOGY**

#### **1.02.1 REFERENCED STANDARDS AND CODES**

The following is a partial list of specifications and codes that may be referenced in sections of the Contract. The Contractor shall be responsible for conducting its Work and carrying out its operations and furnishing equipment in accordance with the latest edition or versions, in effect at the time of bid opening, of any applicable specified portions of the referenced standards and codes.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-friction Bearing Manufacturing Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Material
AWPA	American Wood Preservers' Association
AWS	American Welding Society

AWWA	American Water Works Association
CFR	Code of Federal Regulations
CLI	Chain Link Institute
CRAB	County Road Administration Board
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Associations
CSI	Construction Specifications Institute
DIPRA	Ductile Iron Pipe Research Association
EEl	Edison Electric Institute
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories
FHWA	Federal Highway Administration
FM	Factory Mutual
FSS	Federal Specifications and Standards, General Services Administration
HUD	United State Department of Housing and Urban Development
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illumination Engineering Society
IMSA	International Municipal Signal Association
IPC	International Plumbing Code
ISA	Instrumentation Society of America
JIC	Joint Industry Conference Electrical Standards for Industrial Equipment
LID	Local Improvement District
LPI	Lightning Protection Institute
MSHA	Mine Safety and Health Act
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
NCMA	National Concrete Manufacturer's Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NRMCA	National Ready Mix Concrete Association
OMWBE	Office of Minority and Women's Business Enterprises
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastic Pipe Institute
P/PCI	Precast/Prestressed Concrete Institute
RCW	Revised Code of Washington
SAE	Society of Automotive Engineers
SEPA	State Environmental Policy Act
SIES	Specifications and Illuminating Engineering Society
SSPC	Steel Structures Painting Council
UL	Underwriters' Laboratory
ULID	Utility Local Improvement District
UMTA	Urban Mass Transit Administration

WABO	Washington Association of Building Officials
WAC	Washington Administrative Code
WCLIB	West Coast Lumber Inspection Bureau
WISHA	Washington Industrial Safety and Health Administration
WRI	Wire Reinforcement Institute
WSDL&I	Washington State Department of Labor and Industries
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
WWPA	Western Wood Products Association

### **1.02.2 TERMINOLOGY**

The use of pronouns of any gender in these General Conditions shall include pronouns of all genders, as applicable.

The terms “provide,” “furnish” and “install” are used interchangeably in the Contract and mean that the Contractor shall provide, furnish, and install the item(s) described unless specifically noted otherwise.

The terms “Plans” and “Drawings” are used interchangeably in the Contract and shall mean the Contract Plans, which show location, character, and dimensions of prescribed Work, including layouts, profiles, cross-sections, and other details.

### **1.02.3 ITEMS OF WORK AND UNITS OF MEASUREMENT**

AC	Asbestos Cement Pipe
Agg.	Aggregate
Al.	Aluminum
ATB	Asphalt Treated Base
BST	Bituminous Surface Treatment
CB	Catch Basin
Cfm	Cubic Feet per Minute
Cfs	Cubic Feet per Second
Cl.	Class
CMP	Corrugated Metal Pipe
Comb.	Combination
Conc.	Concrete
CPEP	Corrugated Polyethylene Pipe
Crib.	Cribbing
Culv.	Culvert
Cy or Cu. Yd.	Cubic Yard(s)
Dia.	Diameter
DI	Ductile Iron
DIM	Dimension
EA	Each
EL	Elevation
Est.	Estimate or Estimated

Excl.	Excluding
F	Fahrenheit
FIG	Figure
Ft.	Foot or Feet
GALV	Galvanized
Gph	Gallon(s) per Hour
Gpm	Gallon(s) per Minute
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
HR	Hour
Hund.	Hundred
In.	Inch or Inches
Incl.	Including
L	Liter
Lb.	Pound(s)
LF or Lin. Ft.	Linear Foot (Feet)
LS	Lump Sum
M	Thousand
MBM	Thousand Feet Board Measure
Pres.	Pressure
PSI	Pounds per Square Inch
PSF	Pounds per Square Foot
PVC	Polyvinyl Chloride
QTY	Quantity
Reg.	Regulator
Reinf.	Reinforced, Reinforcing
SF	Square Foot (Feet)
Sec.	Section
SL	Slope
St.	Street
Stl.	Steel
SST	Stainless Steel
Str.	Structural
Sy or Sq. Yd.	Square Yard(s)
Th.	Thick or Thickness
TN	Ton
Tr.	Treatment
TYP	Typical
VC	Vitrified Clay

### **1.03 DEFINITIONS**

#### **ACCEPTANCE**

The formal action by Owner or Owner's governing body as provided in RCW 39.08 and RCW 60.28, as existing or amended.

## **ADDENDUM**

A written or graphic document issued to all Bidders prior to bid opening and identified as an addendum, which clarifies, modifies or supplements the bid documents and becomes part of the Contract.

## **ADDITIVE**

A supplemental unit of work or group of bid items, identified separately in the Proposal, which may, at the discretion of the Owner, be awarded in addition to the base bid.

## **ALTERNATE**

One of two or more units of work or groups of bid items, identified separately in the Proposal, from which the Owner may make a choice between different methods or material of construction for performing the same work.

## **AWARD**

The formal decision of the Owner awarding the Contract to the lowest or most favorable responsible and responsive Bidder for the Work.

## **BID DOCUMENTS**

The component parts of the proposed Contract which may include, but not limited to, the Proposal form, the proposed Contract Provisions, the proposed Contract Plans, Addenda, and Subsurface Boring Logs (if any).

## **BIDDER**

A natural person or legal entity (e.g., partnership, corporation, limited liability company, firm, or joint venture) submitting a proposal or bid.

## **BUSINESS DAY**

A business day is any day from Monday through Friday, except holidays, as listed in Section 3.04.14.

## **CLERK**

The duly elected or appointed Clerk of the Commission, Council, or Board of Directors of the Owner or authorized designee.

## **COMMISSION, COUNCIL, OR BOARD OF DIRECTORS**

The duly elected or appointed Council, Commission, or Board of Directors of the Owner.

## **CONTRACT**

The written agreement between the Owner and the Contractor. It describes, among other things:

1. What work will be done, and by when;
2. Who will provide labor and materials; and
3. How Contractor will be paid.

The Contract includes: the agreement form, Bidder's completed Proposal form, all required certificates and affidavits, Performance Bond and Public Works Payment Bond, Contract Provisions, Contract Plans, and all Addenda and Change Orders executed pursuant to the provisions of the Contract.

## **CONTRACT BOND**

The approved form of security furnished by the Contractor and the Contractor's Surety as required by the Contract, that guarantees performance of all the Work required by the Contract and payment to anyone who provides supplies or labor for the performance of the Work.

## **CONTRACT DOCUMENTS**

See definition for "Contract."

## **CONTRACT PLANS (PLANS OR DRAWINGS)**

The Contract Plans (or drawings) are those plans, drawings or other illustrations and all addenda and revisions, whether issued before or after the award of the Contract to Contractor, which show location, character, and dimensions of the Work, including layouts, profiles, cross-sections and other details.

## **CONTRACT PROVISIONS**

A publication addressing the Work required for an individual project. At the time of the Call for Bids, the Contract Provisions may include, for a specific individual project, general conditions, supplemental general conditions, specifications, a listing of the applicable WSDOT Standard Plans, the prevailing minimum hourly wage rates, and an informational Proposal form with the listing of Bid items. The proposed Contract Provisions may also include, for a specific individual project, various required certifications or declarations. At the time of the Contract execution date, the Contract Provisions include the proposed Contract Provisions and include any Addenda, a copy of the agreement form, and a copy of the Proposal form with the Contract prices and extensions.

## **CONTRACT TIME**

The period of time established by the terms and conditions of the Contract within which the Work shall be complete.

## **CONTRACTOR**

The natural person(s) or legal entity (e.g., partnership, corporation, limited liability company, firm, joint venture) Contracting with the Owner to do the prescribed Work.

## **DATES**

**Substantial Completion Date** is the day that the Engineer determines the Owner has full and unrestricted use and benefit of the Work, from both an operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the physical completion of the total Work.

**Physical Completion Date** is the day that the Engineer determines that all of the Work required by the Contract is physically completed and the Owner has received from the Contractor all required record drawings, operation and maintenance manuals, manufacturers' affidavits, and software and programming.

**Contract Completion Date** is the day when all the Work and all the obligations of the Contractor under the Contract are fulfilled by the Contractor. All documentation and other items required by the Contract and required by law shall be furnished by the Contractor before establishment of this date.

**Final Acceptance Date** is the date on which the Owner accepts the Work as complete.

## **FIELD REPRESENTATIVE**

The Owner's representative who observes the Contractor's performance of the Work. Such observation shall not be relied upon by the Contractor or others as approval or acceptance of the Work, nor shall it in any manner relieve the Contractor from its obligations and responsibilities under the Contract.

## **NOTICE TO PROCEED**

The written notice from the Owner or Engineer to the Contractor authorizing and directing the Contractor to proceed with the Work and establishing the date on which the Contract Time begins.

## **OWNER**

The government entity or agency that awards the Contract to the Contractor and is responsible for the execution and administration of the Contract.

**PROJECT ENGINEER/ENGINEER**

The Owner's representative who administers the construction program for the Owner.

**PROPOSAL (or BID)**

A Bidder's offer, on a properly completed Proposal form, to perform the Work required by the Contract. The terms Proposal and Bid may be used interchangeably.

**SPECIFICATIONS**

Written provisions describing the Work and requirements thereof.

**STANDARD PLANS**

A manual of specific plans or drawings adopted by the Owner, which show frequently recurring components of work that, have been standardized for use.

**SUBCONTRACTOR**

A natural person, or entity (e.g., partnership, corporation, limited liability company, firm or joint venture) to which the Contractor sublets a portion of the Work.

**SUBGRADE**

The top surface of the roadbed on which subbase, base, surfacing, pavement, or layers of similar materials are placed.

**SUPPLEMENTARY GENERAL CONDITIONS**

That part of the Contract amends or supplements these General Conditions.

**TRAVELED WAY**

That part of the roadway made for vehicle travel, excluding shoulders and auxiliary lanes.

**WORK**

The provision of all labor, materials, tools, equipment, supervision and other things needed to complete the project in full accordance with the Contract Documents.

## **WORKING DRAWINGS**

Shop drawings, shop plans, erection plans, falsework plans, framework plans, cofferdam, cribbing and shoring plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data, including a schedule of submittal dates for working drawings where specified, that the Contractor shall submit to the Engineer for approval.

## **SECTION 2 - INSTRUCTIONS FOR PREPARATION OF PROPOSAL (OR BID)**

### **2.01 BID PROCEDURES AND CONDITIONS**

#### **2.01.1 QUALIFICATIONS OF BIDDERS**

Where applicable and required, Bidders shall provide all requested information relating to experience, financing, equipment, and organization relating to their ability to properly perform the Work. The Owner reserves the right to take whatever action it deems necessary to ascertain the responsibility of the Bidder and the ability of the Bidder to perform the Work satisfactorily.

#### **2.01.2 CONTRACT PROVISIONS AND CONTRACT PLANS**

Contract Provisions and Contract Plans are on file in the offices of the Owner and the Engineer, Gray & Osborne, Inc. After award of the Contract, up to five sets of Contracts will be issued without charge to the Contractor. Additional sets of Contracts may be purchased from the Owner by the Contractor.

#### **2.01.3 ESTIMATED QUANTITIES**

The quantities shown in the Proposal form are estimates and are stated only for bid comparison purposes. The Owner does not warrant, expressly or by implication, that the actual quantities will correspond with those estimates. Payment will be made on the basis of the actual quantities of each item of Work satisfactorily completed in accordance with the requirements of the Contract.

#### **2.01.4 EXAMINATION OF CONTRACT AND SITE**

##### **2.01.4(1) General**

Bidders shall satisfy themselves by personal examination of Contract Provisions, Contract Plans, and site of the proposed improvements, and by any other examination and investigation which they may desire to make as to the accuracy of the estimate of quantities, the nature of the Work and the difficulties to be encountered. Bidders shall review the entire Contract to ensure that the completeness of their Proposal includes all items of Work regardless of where shown in the Contract. Bidders are cautioned that alternate sources of information (copies of the Contract obtained from third parties) are not necessarily an accurate or complete representation of the Contract. Bidders shall use such information at their own risk.

Bidders shall be familiar and comply with all applicable federal, state, and local laws, ordinances, and regulations in any way applicable to the performance the Work. Bidders are responsible for familiarizing themselves with all current state and federal wage rates applicable to the Work and its duration before submitting a Proposal based on the Contract Provisions and Contract Plans. Any wage determination contained in the Contract is for the Bidder's general information only and is not warranted to be complete or accurate. The Owner will not consider any plea of misunderstanding or ignorance of such requirements. Bid prices shall reflect what the Bidder has determined to be the total cost of completing the Work, including but not limited to: construction methods, materials, labor, administrative costs, any and all applicable taxes, and equipment.

Except as the Contract may provide, the Bidder to which the Contract is awarded shall receive no payment for any costs that exceed those set forth in the Proposal.

#### **2.01.4(2) Interpretation of the Contract Provisions and Contract Plans**

If any Bidder desires interpretation or clarification of the Contract Provisions and Contract Plans, the Bidder shall make a written request to the Engineer for such clarification or interpretation prior to the submission of a Proposal. If the Engineer determines that the Contract Provisions and/or Contract Plans do not require interpretation or clarification, the Engineer will so notify the Bidder making the request. All interpretations and clarifications made by the Engineer will be by written addendum to all planholders of record, and a copy of the addendum will be filed in the office of the Owner. Neither the Owner nor the Engineer will be responsible for any interpretation, clarification or explanation of the Contract Provisions and Contract Plans that is not set forth in a written addendum to all planholders of record, and Bidders shall not under any circumstances rely on any other interpretation, clarification or explanation.

#### **2.01.4(3) Subsurface Information**

If the Owner has made a subsurface investigation of the site of the proposed Work, the boring log data and soil sample test data accumulated by the Owner will be made available for inspection by the Bidders. However, the Owner makes no representation or warranty, express or implied, that:

- a. The Bidders' interpretations from the boring logs may be correct;
- b. Moisture conditions and indicated water tables will not vary from those found at the time the borings were made;
- c. The ground at the location of the borings has not been physically disturbed or altered after the boring was made; and
- d. Conditions below the surface of the ground are consistent throughout the site with the information made available hereunder, or that conditions to be encountered on the site are uniform or consistent with geological conditions usually encountered in the area.

The Owner makes no representations, guarantees, or warranties as to the condition, materials, or proportions of the materials between the specific borings, regardless of any subsurface information the Owner may make available to the prospective Bidders. Bidders are solely responsible for making the necessary investigations to support and/or verify any conclusions or assumptions used in preparation of their Proposals.

Any subsurface investigations and analysis were carried out for design purposes only. Contractor may not rely upon or make any claim against Owner, Engineer, or any of their subconsultants, with respect to:

1. The completeness of such reports for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and

procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. Other conclusions, interpretations, opinions, representations, and information contained in such reports; or
3. Any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, conclusions, interpretations, opinions or information.

#### **2.01.4(4) Availability of Specified Items**

Prior to submitting a Proposal, all Bidders shall verify that all items necessary to complete the Work will be available in time to allow the Work to be completed within the Contract Time. In the event that one or more items may not be available to allow the Work to be completed within the Contract Time, the Bidder shall notify the Engineer in writing prior to submitting a Proposal. Responsibility for delays and related costs because of non-availability of items necessary to complete the Work shall be borne by the Contractor.

#### **2.01.5 PROPOSAL DEPOSIT**

A deposit of at least 5 percent of the total Proposal amount shall accompany each Proposal (Proposal Deposit). The Proposal Deposit may be in the form of a Proposal bond (surety bond), certified check, cashier’s check, or postal money order made payable to the Owner. All Proposal bonds shall be on the form included within the Contract Provisions and shall be signed by the Bidder and the surety. The surety shall: (1) be registered with the Washington State Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner. The Proposal bond shall not be conditioned in any way to modify the minimum 5 percent required. The Proposal Deposit will be held as a guaranty that the successful Bidder will, within 10 days from the date of notification of Award, enter into a Contract and furnish approved Performance and Public Works Payment Bonds, on forms attached, in amounts equal to 100 percent of the amount of the Contract, including state sales tax.

The failure to furnish a Proposal Deposit of a minimum of 5 percent with the Proposal shall make the Proposal non responsive and shall cause the Proposal to be rejected by the Owner.

#### **2.01.6 PROPOSAL**

- (1) Proposals shall be submitted on the Proposal form included in the Contract Provisions. All Proposals shall be completed, signed by an authorized person and dated. To be considered by the Owner as a responsive Proposal, the Bidder shall bid on all Additive or Alternate items set forth in the Proposal form, unless otherwise specified in the Contract Documents.
- (2) To be responsive, a Proposal shall state that it will remain valid for a period of 60 days following the date of Proposal opening. In the event that a conflict in this

duration appears elsewhere in the Contract Provisions, the longest duration shall apply.

- (3) All prices set forth on the Proposal form shall be legible and either be written in ink or typed. In the space provided on the Proposal form, Bidders shall identify all Addenda that have been received. The Proposal, Proposal Deposit, and all other certificates, forms or other documents required by the Contract Provisions to be executed and delivered with the Proposal shall be submitted in a sealed package, addressed to the Owner, and plainly marked "Proposal for \_\_\_\_\_ (insert name of project as shown on the Proposal) to be opened on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_," (insert the day, month and year shown in the published bid notice). The Owner will not consider any Proposal received after the time established for opening Proposals.
- (4) Where noted in the Proposal, the Bidder is to furnish information concerning its experience with work of a similar nature, equipment to be used on this project, and general background information. Information that is incomplete, evasive, or of a general nature only, may be considered as grounds for rejection of the Proposal.
- (5) RCW 39.30.060 requires Bidders on public works projects expected to cost one million dollars or more to provide the names of the structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing and electrical Subcontractors to whom the Bidder will directly subcontract those portions of the Work if awarded the Contract. The Bidder may not list more than one Subcontractor for each category of Work identified, unless Subcontractors vary with bid alternates, in which case the Bidder shall indicate which Subcontractor will be used for which alternate. Failure of the Bidder to list the names of such Subcontractors or to name itself to perform such Work, or listing two or more Subcontractors to perform the same Work, shall render the Bidder's Proposal unresponsive and void. Under RCW 39.30.060, the required names of such Subcontractors shall be provided with the Proposal or within one hour after the published Proposal submittal time. In addition to compliance with the requirements of RCW 39.30.060, the apparent successful Bidder may be required to submit to the Engineer as soon as possible after the Proposal opening, and not later than three calendar days thereafter, a written list of all proposed Subcontractors in addition to structural steel installation, rebar installation, heating, ventilation, and air conditioning, plumbing and electrical contractors, that will perform subcontracting Work on the project. If not previously provided, the following information shall be provided for each Subcontractor:
  - a. Name, address, email address, facsimile number, telephone number, contractor registration number and certification numbers;
  - b. The type of Work to be performed;

- c. A list of at least three recently completed projects for Work similar to that to be performed by the proposed Subcontractor, with the following information for each project:
    - i. Name of project,
    - ii. Name, address, and telephone number of the project owner; and
  - d. Any additional pertinent information establishing the experience or qualifications of the proposed Subcontractor.
- (6) After opening and reading Proposals, the Owner will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit, converted to the actual extension, will control. The total extensions, corrected where necessary, will be used by the Owner for comparison and award purposes and to establish the amount of the Contractor's Performance and Public Works Payment Bonds.

#### **2.01.7 WITHDRAWING OR REVISING PROPOSAL**

After submitting a physical Proposal to the Owner, the Bidder may withdraw, or revise it if:

1. The Bidder submits a written request signed by an authorized person and physically delivers it to the place designated for receipt of Proposals; and
2. The Owner receives the request before the time set for receipt of Proposals; and
3. The revised or supplemented Proposal (if any) is received by the Owner before the time set for receipt of Proposals.

If the Bidder's request to withdraw or revise its Proposal is received before the time set for receipt of Proposals, the Owner will return the unopened Proposal package to the Bidder. The Bidder must then submit the revised package in its entirety. If the Bidder does not submit a revised package, then its bid shall be considered withdrawn.

Late revised Proposals or late withdrawal requests will be date recorded by the Owner and returned unopened. Mailed, emailed, or faxed requests to withdraw or revise a Bid Proposal are not acceptable.

#### **2.01.8 DISQUALIFICATION OF BIDDERS**

1. A Proposal will be considered irregular and will be rejected if:
  - a. The Bidder is not prequalified when so required;

- b. The authorized proposal form furnished by the Owner is not used or is altered;
  - c. The completed proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
  - d. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
  - e. A price per unit cannot be determined from the Bid Proposal;
  - f. The Proposal form is not properly executed;
  - g. The Bidder fails to submit or properly complete a Subcontractor list, if applicable;
  - h. The Bidder fails to submit or properly complete a Disadvantaged, Minority or Women's Business Enterprise Certification, if applicable;
  - i. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
  - j. More than one proposal is submitted for the same project from a Bidder under the same or different names.
2. A Proposal may be considered irregular and may be rejected if:
- a. The Proposal does not include a unit price for every Bid item;
  - b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Owner;
  - c. Receipt of Addenda is not acknowledged;
  - d. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
  - e. If Proposal form entries are not made in ink.
3. A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1 through 8 in this Section:

The Owner will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1. Evidence that the Bidder meets Supplemental Criteria 2 through 8 shall be provided by the Bidder as stated later in this Section.

a. **Criteria 1 – Federal Debarment**

- 1. Criterion: The Bidder shall not currently be debarred or suspended by the Federal government.
- 2. Documentation: The Bidder shall not be listed as having an “active exclusion” on the U.S. government’s “System for Award Management” database ([www.sam.gov](http://www.sam.gov)).

b. **Criteria 2 – Delinquent State Taxes**

1. Criterion: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.
2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder does not owe delinquent taxes to the Department of Revenue. If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Owner by the deadline listed below.

c. **Criteria 3 – Claims Against Retainage and Bonds**

1. Criterion: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the 3 years prior to the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its Subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date. If the Bidder has had claims against retainage and bonds in the three years prior to the bid submittal date, they shall submit a list of the public works projects completed in the 3 years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information:
  - Name of project
  - The owner and contact information for the owner;
  - A list of claims filed against the retainage and/or payment bond for any of the projects listed;
  - A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

d. **Criteria 4 – Public Bidding Crime**

1. Criterion: The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
2. Documentation: The Bidder, if and when required as detailed

below, shall sign a statement (on a form to be provided by the Owner) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

e. **Criteria 5 – Termination for Cause / Termination for Default**

1. **Criterion:** The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

f. **Criteria 6 – Lawsuits**

1. **Criterion:** The Bidder shall not have lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date, along with a written explanation of the circumstances surrounding each such lawsuit. The Owner shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet of terms of construction related contracts.

g. **Criteria 7 – Contract Time (Liquidated Damages)**

1. **Criterion:** The Bidder shall not have had liquated damages assessed on any projects it has completed 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet Contract Time, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.

2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had liquidated damages assessed on any projects it has completed within the 5 years prior to the bid submittal date, or shall submit a list of projects with assessed liquidated damages along with Owner contact information, and number of days assessed liquidated damages.

h. **Criteria 8 – Capacity and Experience**

1. Criterion: The Bidder shall have sufficient current capacity and the project superintendent assigned to the project shall have experience to meet the requirements of this project. The Bidder and the project superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.
2. Documentation: The Bidder shall, if and when required as detailed below, on a form to be provided by the Owner, provide the Bidder's gross dollar amount of work currently under contract, the Bidder's gross dollar amount of contracts currently not completed, five major pieces of equipment anticipated to be on the project and whether the equipment is leased or owned, the superintendent assigned to this project and their number of years of experience, and two project references of similar size and scope during the 5-year period immediately preceding the bid submittal deadline for this project. The Owner may check owner references for the previous projects and may evaluate the owner's assessment of the Bidder performance.

As evidence that the Bidder meets Supplemental Responsibility Criteria 2 through 8 stated above, the apparent two lowest Bidders must submit to the Owner by 12:00 P.M. (noon) of the second business day following the bid submittal deadline, a written statement verifying that the Bidder meets Supplemental Criteria 2 through 8 together with supporting documentation (sufficient in the sole judgment of the Owner) demonstrating compliance with Supplemental Responsibility Criteria 2 through 8. The Owner reserves the right to request further documentation as needed from the low bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Owner also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and Supplemental Criteria, and to use that information in their evaluation. The Owner may consider mitigating factors in determining whether the Bidder complies with the requirements of the Supplemental Criteria.

The basis for evaluation of Bidder compliance with these mandatory and Supplemental Criteria shall include any documents or facts obtained by Owner (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Owner from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Owner which is believed to be relevant to the matter.

If the Owner determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Owner shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 2 business days of the Owner's determination by presenting its appeal and any additional information to the Owner. The Owner will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Owner will not execute a contract with any other Bidder until at least 2 business days after the Bidder determined to be not responsible has received the Owner's final determination.

Request to Change Supplemental Bidder Responsibility Criteria Prior To Bid: Bidders with concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility Criteria may make or submit requests to the Owner to modify the criteria. Such requests shall be in writing, describe the nature of the concerns, and propose specific modifications to the criteria. Bidders shall submit such requests to the Owner no later than 5 business days prior to the bid submittal deadline and address the request to the Project Engineer or such other person designated by the Owner in the Bid Documents.

### **2.01.9 PROPOSAL ERRORS**

If a Bidder discovers an error in the Bidder's Proposal after the Proposals have been opened and tabulated and desires to withdraw the erroneous Proposal, the Bidder shall submit a notarized affidavit signed by the Bidder, accompanied by original certified worksheets used in the preparation of the Proposal, requesting relief from the Award. The affidavit shall describe the specific error(s) and certify that the worksheets are the originals used in the preparation of the Proposal.

The affidavit and the certified worksheets shall be received by the Engineer before 5:00 p.m. local time on the next business day following the day of the Proposal opening or the claim of error will not be considered. The Engineer will review the certified worksheets to determine the validity of the claimed error, and make its recommendation to the Owner. If the Owner and Engineer concur that the claim of error is allowable under applicable law, the Bidder will be relieved of responsibility for the Proposal, and the Proposal Deposit will be returned to the Bidder. Thereafter, at the discretion of the Owner, all Proposals may be rejected or an Award made to the next lowest responsive, responsible Bidder.

## **2.02 AWARD AND EXECUTION OF CONTRACT**

### **2.02.1 AWARD OF CONTRACT**

A Contract will not be awarded until the Owner is satisfied that the successful Bidder is responsible, reasonably familiar with the Work to be performed and has the necessary capital, tools, personnel and equipment to satisfactorily perform the Work.

The Owner reserves the right to waive informalities in the bidding, accept a Proposal of the lowest responsive, responsible Bidder, reject any or all Proposals, republish the call for Proposals, or revise or cancel the project.

After the date and hour set for the opening of the Proposals, no Bidder may withdraw its Proposal unless the Award of the Contract is delayed for a period exceeding 60 calendar days following Proposal opening. In the event that a conflicting duration appears elsewhere in the Invitation for Proposals or Contract Provisions or advertisement, the longer period shall govern.

### **2.02.2 EXECUTION OF CONTRACT**

Within 10 calendar days after notification by the Owner of the Award, the successful Bidder shall return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certificates, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions. If the Contract is signed by an officer, agent, or other authorized representative of the Contractor, the officer, agent, or other representative shall furnish satisfactory evidence of authority to sign as the legal representative of the Contractor, if required by the Owner. An authorized partner of a joint venture may sign the Contract, subject to the approval of the Owner, which may, at its discretion, require each and every member of the joint venture to sign the Contract.

Should the successful Bidder fail to return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certifications, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions within 10 calendar days after notification by the Owner of the Award, the Owner reserves the right to and may elect to withdraw the award to the successful Bidder and award the Contract to the next responsible, responsive Bidder.

Until the Owner executes the Contract, no Proposal shall bind the Owner, and the Contractor shall not commence any Work. The Contractor shall bear all risks for any Work begun before the Contract is executed by the Owner.

### **2.02.3 FAILURE TO EXECUTE CONTRACT**

If the Contractor fails to submit the insurance certificates, bonds, and all other certificates, forms, information and documents as required by the Contract Provisions, with the executed Contract within the time required by the Contract Provisions, the Owner may then award the Contract to the next lowest responsive, responsible Bidder or reject any or all Proposals.

### **2.02.4 RETURN OF PROPOSAL DEPOSIT**

When Proposals have been examined and corrected as necessary, Proposal Deposits accompanying Proposals ineligible for further consideration will be returned. All other Proposal Deposits will be held until the Contract is awarded and fully executed, after which the Proposal Deposits, except those subject to forfeiture, will be returned.

### **2.02.5 NOTICE TO PROCEED**

A written Notice to Proceed will be issued to the Contractor by the Owner or Engineer after the Contract has been executed by the Contractor and the Owner, and the Performance and Public Works Payment Bonds and required insurance and other certificates and documents are approved by the Owner and, when applicable, by State or Federal agencies responsible for funding any portion of the project. The Contractor shall not commence Work until the Notice to Proceed has been issued.

## **SECTION 3 - GENERAL REQUIREMENTS OF THE CONTRACT**

### **3.01 SCOPE OF THE WORK**

#### **3.01.1 INTENT OF THE CONTRACT**

The intent of the Contract is to describe a functionally complete project to be constructed in accordance with the Contract. The Contractor shall provide all labor, supervision, materials, tools, equipment, transportation, supplies, and other things required expressly by, or reasonably implied from, the Contract, to complete all Work. Omissions from the Contract of details of Work which are necessary to carry out the intent of the Contract, or which are customarily performed, shall not relieve the Contractor from performing the complete Work called for by the Contract; such Work shall be performed as if fully set forth and described in the Contract. The unit or other bid prices shall be full payment for everything required to complete the Work, including but not limited to labor, supervision, materials, equipment, jobsite and home office overhead and profit.

#### **3.01.2 COORDINATION OF CONTRACT**

The Contract Plans and the Contract Provisions for the Work shall be considered as a whole, and anything shown or called for in one and omitted in any other is as binding as if called for or shown on both. Figure dimensions shall, in all cases, be used in preference to scale dimensions. Any inconsistency in the Contract Documents shall be resolved by the following order of precedence (e.g., 1 presiding over 2 through 4, 2 presiding over 3 through 4, etc.):

1. Addenda;
2. The Agreement and Proposal Form;
3. Specifications;
  - 3a. Supplementary General Conditions (including conditions supplied by federal or state agencies on projects funded, in whole or part, by such agencies. In the event of a conflict in various forms of General Conditions, those conditions affording the greatest benefit or protection to the Owner shall govern.);
  - 3b. General Conditions;
  - 3c. Technical Specifications;
4. Contract Plans.

#### **3.01.3 ASSIGNMENT OF CONTRACT**

The Contractor shall not assign the Contract or any part of the Contract or of the funds to be received under the Contract unless such assignment is approved by the Owner and the Contractor's Performance and Public Works Payment Bonds surety prior to the execution or effectiveness of the assignment.

## **3.02 CONTROL OF WORK**

### **3.02.1 AUTHORITY AND ROLE OF THE ENGINEER**

- (1) The Engineer is the authorized representative of the Owner, and is employed to act as advisor and consultant to the Owner in engineering matters relating to the Contract. Among other things, the Engineer may determine the quantity of material installed or Work completed, evaluate whether materials and equipment comply with the Specifications, and assist the Owner with answering questions relating to the meaning and intent of the Contract. The Owner, with the advice of the Engineer, will make the final determination relating to quality, acceptability and conformity of labor and materials to the requirements of the Contract.
- (2) The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Engineer does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Engineer may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Engineer, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Engineer's performance of project representation and observation services shall not make the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Engineer responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.
- (3) The Engineer shall have no liability whatsoever to, or contractual relationship with, the Contractor in any way relating to the Contract. The Owner and the Contractor shall look solely to each other for the enforcement with respect to any rights, obligations, claims or liabilities arising under or in any way relating to the Contract. Neither the authority given to the Engineer herein, nor any action or service provided by the Engineer or its subconsultants with regard to the Work, shall create any duty owed by the Engineer or its subconsultants to the Contractor or a cause of action against the Engineer or its subconsultants by Contractor.
- (4) Nothing in the Contract shall, in any way, be construed to place responsibility on the Field Representative, Engineer or the Owner for the method, manner, direction or superintendency of the performance of the Work by the Contractor. Such responsibility rests solely with the Contractor.

- (5) Neither the Engineer nor any of its assistants or agents shall have any power to waive any obligation of the Contract. The Engineer's failure to reject Work that is defective or otherwise does not comply with the requirements of the Contract shall not constitute approval or acceptance of the Work or relieve the Contractor of its obligations under the Contract, notwithstanding that such Work has been estimated for payment or that payments have been made for that Work. Neither shall such failure to reject Work, nor any acceptance by the Engineer or by the Owner of any part or of the whole of the Work bar a claim by the Owner at any subsequent time for recovery of damages for the cost of removal and replacement of any portions of the Work that do not comply with the Contract.
- (6) No order, measurement, determination or certificate by the Engineer or Owner for payment of money or payment for or acceptance of the whole or of any part of the Work by the Engineer or the Owner or extension of time or possession taken by the Owner shall constitute a waiver of any portion of the Contract, nor shall any waiver of any breach of the Contract constitute a waiver of any other or subsequent breach thereof.

### **3.02.2 AUTHORITY OF FIELD REPRESENTATIVE**

- (1) Field Representatives are assigned to the project site to keep the Engineer and Owner generally informed as to the progress of the Work and the manner in which it is being done; to keep records; and to act as liaison between the Contractor, Owner and Engineer. When observed, the Field Representative shall call the attention of the Contractor to any deviations from the Contract. However, failure of the Field Representative to call the attention of the Contractor to faulty Work or deviations from the Contract shall not constitute either a waiver of any requirement in the Contract or acceptance of said Work.
- (2) Since one of the Field Representative's primary responsibilities is to observe that the Work progresses expediently and in a workmanlike manner, the Field Representative may offer suggestions to the Contractor, which the Contractor, at its sole discretion, may or may not choose to follow. Such suggestions are not to be considered as anything but suggestions offered to cooperate with and assist the Contractor and shall not constitute an assumption of responsibility, financial or otherwise, by the Field Representative, the Engineer or the Owner.
- (3) The presence or absence of the Field Representative on the job site will be at the sole discretion of the Owner, and the presence or absence of the Field Representative at any time will not relieve the Contractor of its responsibility to properly perform the Work as required by the Contract.
- (4) The Field Representative will have the authority, but not the obligation, to reject defective materials and equipment if observed; however, the failure of the Field Representative to reject defective materials and equipment or any other Work involving deviations from the Contract will not constitute acceptance of such Work. The Field Representative is not authorized to approve or accept any portion of the

Work or to issue instructions contrary to the Contract; all such approvals, acceptances or instructions shall be in writing and signed by the Engineer or the Owner.

- (5) The Field Representative does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Field Representative does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Field Representative may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Field Representative, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Field Representative's performance of observation services shall not make the Field Representative responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Field Representative responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.

### **3.02.3 CONSTRUCTION OBSERVATION AND INSPECTIONS**

- (1) All Work required by the Contract, including all materials and equipment to be furnished and the manufacture and preparation thereof shall, at all times, be subject to observation by the Owner's designated representatives, who may, at any time in the performance of their duties, enter upon the Work or the shops and factories where any part of the Work, materials or equipment are being prepared, fabricated or manufactured.
- (2) Observation of Work by the Owner, the Engineer, or the Field Representative shall not relieve the Contractor of its obligation to furnish satisfactory materials and workmanship. Work or materials found unsatisfactory at any time during the life of the Contract, and the applicable warranty periods, guarantees or limitation periods shall be promptly corrected or replaced immediately by the Contractor at its own expense.
- (3) Upon request by the Owner or Engineer, the Contractor shall furnish all tools, labor, equipment and materials necessary to examine any Work that may be completed or in progress, even to the extent of uncovering or taking down portions of completed or covered Work. Work shall be left exposed until examined by the Owner or Engineer, at no additional cost to the Owner. If the Owner or the Engineer determines that the uncovered Work does not comply with the requirements of the Contract, the cost of such examination and the cost of reconstruction and/or repair shall be borne by the Contractor.

- (4) The Contractor shall promptly comply with all directions of the Engineer with reference to correcting any Work or replacing any materials or equipment found to be not in accordance with the Contract. In the event of a dispute, the Contractor may appeal to the Engineer's decision to the Owner in accordance with the Contract, and the Owner's decision shall be final.

#### **3.02.4 EMERGENCY CONTACT LIST**

The Contractor shall submit an emergency contact list to the Engineer no later than five calendar days after the date the Contract is executed. The list shall include, at a minimum, the Contractor's project manager or equivalent, project superintendent, traffic control supervisor, and erosion and sediment control lead. The list shall identify a representative with delegated authority to act as the emergency contact on behalf of the Contractor and include one or more alternates. The emergency contact shall be available upon the Engineer's request at other than normal working hours. The emergency contact list shall include 24-hour telephone numbers for all individuals identified as emergency contacts or alternates.

#### **3.02.5 ORAL AGREEMENTS**

No oral agreement or conversation with any officer, agent, or employee of the Owner, either before or after execution of the Contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the Contract. Such oral agreement or conversation shall be considered as unofficial information and in no way binding upon the Owner, unless subsequently put in writing and signed by the Owner.

#### **3.02.6 ELECTRONIC FILES**

All Work performed shall be in conformity with the signed Contract Plans and Contract Provisions. If the Contractor requests electronic files, the Engineer may provide the files. The use of the electronic files shall be at the Contractor's sole risk. The Engineer does not warrant the completeness or accuracy of the electronic files and the Engineer assumes no liability for any errors or omissions in the digital data. The Contractor shall be responsible for reviewing and checking the electronic files to ensure that they are suitable for the Contractor's purpose.

### **3.03 LEGAL RELATIONS AND RESPONSIBILITIES**

#### **3.03.1 APPLICABLE LAWS AND REGULATIONS**

##### **3.03.1(1) General**

The Contractor shall comply with all laws, ordinances, rules and regulations of any authority having jurisdiction in any way relating to the project, including, but not limited to, regulations governing site maintenance, clean-up, air pollution control, noise control, water quality control, surface water control and runoff, tree and vegetation protection, cultural resources and oil and hazardous substance control.

### **3.03.1(2) Utilities and Similar Facilities**

The Contractor shall protect all private and public utilities from damage. Utilities include, among others: telephone lines; cable television and high-speed internet lines; gas; electric power lines; sanitary sewer; septic sewer systems; storm sewer, waterlines, and irrigation lines; street lighting and traffic signal and signing systems; and railroad tracks and related equipment.

In accordance with Chapter 19.122 of the Revised Code of Washington, the Contractor shall call the One-Number Locator Service for the field location of underground utilities. If no locator service is available for the area where the project is located, the Contractor shall provide written notice to all owners of utilities known to, or suspected of, having underground facilities within or near all areas of that will be excavated.

The Contractor shall be responsible for all costs required to protect public and private utilities from damage.

### **3.03.1(3) Site Maintenance**

The Contractor shall keep the Work site, staging areas, and Contractor's facilities clean and free from rubbish and debris. Materials and equipment shall be removed from the Work site when they are no longer necessary. Upon completion of the Work and before final acceptance, the Work site shall be cleared of equipment, unused materials, and rubbish and the Work site shall be left in clean and neat condition.

### **3.03.1(4) State Taxes**

The Washington State Department of Revenue has issued special rules on the State sales tax. Section 3.03.1(4) a through Section 3.03.1(4) c are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Owner will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 3.03.1(4) b describes this exception.

The Owner will pay the retained percentage only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.051). The Owner may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to the Contract or not. Any amount so deducted will be paid into the proper State fund.

#### **a. State Sales Tax — Rule 171**

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political

subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the Work.

b. State Sales Tax — Rule 170

WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Owner, retail sales tax on the full Contract price. The Owner will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

**EXCEPTION:** The Owner will not add in sales tax for a payment the Contractor or a Subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

c. Services

The Contractor shall not collect retail sales tax from the Owner on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

**3.03.1(5) Equal Employment Responsibilities**

The Contractor shall, at its sole cost and expense, comply with all applicable laws, policies and regulations pertaining to nondiscrimination and equal employment opportunities. The absence of specific provisions or other requirements mandated by state, municipal or federal laws, policies or regulations from these General Conditions shall not excuse the Contractor from compliance with such laws, regulations or policies.

### **3.03.1(6) Archaeological and Historical Objects**

Archaeological or historical objects, such as ruins, human skeletal remains, sites, buildings, artifacts, fossils, or other objects of antiquity that may have significance from a historical or scientific standpoint, which may be encountered by the Contractor, shall not be further disturbed. The Contractor shall immediately notify the Engineer of any such finds.

The Engineer will determine if the material is to be salvaged. The Contractor may be required to stop work in the vicinity of the discovery until such determination is made. The Engineer may require the Contractor to suspend Work in the vicinity of the discovery until salvage is accomplished.

If the Engineer finds that the suspension of Work in the vicinity of the discovery increases or decreases the cost or time required for performance of any part of the Work under the Contract, the Engineer will make an adjustment in payment or the time required for the performance of the Work in accordance with Section 3.04.6.

### **3.03.2 SAFETY MEASURES**

All Work under the Contract shall be performed in a safe manner. The Contractor and all Subcontractors shall comply with all applicable rules, regulations, and safety standards of the Washington State Department of Labor and Industries and all other federal, state, local and other governmental entities having jurisdiction over the project. The Contractor shall be solely and completely responsible for the conditions of the job site, including the safety of all persons and property during the performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

The Engineer's review of the Contractor's work plan, safety plan, construction sequences, schedule or performance does not and is not intended to include review or approval of the adequacy of the Contractor's safety measures in, on, or near the job site. The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract. The Engineer has neither the authority nor the responsibility to enforce construction safety laws, rules, regulations, or procedures, or to order the stoppage of Work for claimed violations thereof.

The Contractor shall exercise all required and appropriate precautions to protect all persons and property from injury and damage.

### **3.03.3 HAZARDOUS MATERIAL**

Biological hazards and associated physical hazards may be present at the Work site. The Contractor shall take precautions and perform any necessary Work to provide and maintain a safe and healthful Work site in accordance with all applicable laws. The cost for all Work necessary to provide and maintain a safe Work site shall be included in the Contractor's Proposal, unless the Contract includes provisions to the contrary.

### **3.03.4 PAYMENT OF WAGES AND RELATED REQUIREMENTS**

#### **3.03.4(1) Minimum Prevailing Wage Requirements**

- a. The Contract is subject to the minimum prevailing wage and hour requirements of RCW 39.12 and RCW 49.28 (as amended or supplemented). On projects having federal funding, federal wage laws and rules may also apply. The Contract may list minimum hourly rates for wages for trades or occupations in the locality within the state where such labor is performed as determined by the Industrial Statistician for the Department of Labor and Industries or under the federal Davis-Bacon Act. These rates are for general reference purposes only and may not be current or complete. The Contractor, any Subcontractor, or other person doing any Work under the Contract shall not pay any worker less than the applicable current minimum hourly wage rates required by applicable law. Higher wages and benefits may be paid.
- b. The Contractor, any Subcontractor, and all individuals or firms required by RCW 39.12, WAC 296-127, or the Federal Davis-Bacon and Related Acts (DBRA) to pay minimum prevailing wages, shall not pay any worker less than the minimum hourly wage rates and fringe benefits required by RCW 39.12 or the DBRA. Higher wages and benefits may be paid.
- c. In accordance with WAC 296-127, the applicable prevailing wage rates that are in effect on the date when Proposals are due shall remain in effect for the duration of the Contract. By incorporating prevailing wage rates into the Contract, the Owner does not warrant or imply that the Contractor will find labor available at those rates. The Contractor shall calculate in its Proposal any amounts above the minimums that it will actually have to pay. Further, rates for wages and/or fringe benefits may change while the Contract is in force. If they do, the Contractor shall bear the cost of paying rates above those in effect at time of bid.
- d. If employing labor in a class not listed in the Contract Provisions on State funded projects, the Contractor shall request the Industrial Statistician, Department of Labor and Industries to determine the correct wage and benefits rate.
- e. If employing labor in a class not listed in the Contract Provisions on a federally funded project, the Contractor shall request the U.S. Secretary of Labor to determine the correct wage and benefits rate.
- f. The Contractor shall ensure that any firm (Supplier, Manufacturer, or Fabricator) that falls under the provisions of RCW 39.12 because of the definition "Contractor" in WAC 296-127-010, complies with all the requirements of RCW 39.12.
- g. The Contractor shall be responsible for compliance with the requirements of the DBRA and RCW 39.12 by all firms (Subcontractors, lower tier Subcontractors, Suppliers, Manufacturers, or Fabricators) engaged in any part of the Work necessary to complete the Contract. Therefore, should a violation of this

Subsection occur by any firm that is providing Work or materials for completion of the Contract whether directly or indirectly responsible to the Contractor, the Owner will take action against the Contractor, as provided by the provisions of the Contract, to achieve compliance, including, but not limited to, withholding payment on the Contract until compliance is achieved.

### **3.03.4(2) Posting Notice Requirements**

Notice of intent to pay prevailing wages and prevailing wage rates for the project shall be posted for the benefit of workers. The Contractor shall post the following, together with anything else necessary to comply with all applicable laws and regulations:

- a. One copy of the approved “Statement of Intent to Pay Prevailing Wages” for the Contractor, each Subcontractor, and any other firm (Supplier, Manufacturer, of Fabricator) that falls under the provisions of RCW 39.12 because of the definition of “Contractor” in WAC 296-127-010;
- b. One copy of the prevailing wage rates for the project;
- c. The address and telephone number of the Industrial Statistician for the Department of Labor and Industries, along with a statement that complaints and questions about wage rates may be directed there; and
- d. FHWA 1495/1495A “Wage Rate Information” poster if the project is funded with federal aid.

Notice shall be posted at a location readily visible to workers at the job site, or where no field office is established, at a local office. The Contractor shall supply a copy of the Notice to any employee upon request.

### **3.03.4(3) Apprentices**

If employing apprentices, the Contractor shall submit to the Owner written evidence showing:

- a. That each apprentice is enrolled in a program approved by the Washington State Apprenticeship and Training Council;
- b. The progression schedule for each apprentice; and
- c. The established apprentice-journeyman ratios and wage rates in the project locality upon which the Contractor shall base such ratios and rates under the Contract. Any worker for whom an apprenticeship agreement has not been registered and approved by the Washington State Apprenticeship and Training Council shall be paid the prevailing hourly rate for journeymen provided in RCW 39.12.021.

### **3.03.4(4) Required Documents**

#### **1. General**

All “Statements of Intent to Pay Prevailing Wages”, “Affidavits of Wages Paid” and Certified Payrolls, including a signed Statement of Compliance for Federal-aid projects, shall be submitted on the State L&I online Prevailing Wage Intent & Affidavit (PWIA) system. Statements of Intent to Pay Prevailing Wages”, and “Affidavits of Wages Paid” shall also be submitted to the Engineer. When requested by the Engineer, Certified Payrolls shall also be submitted to the Engineer.

#### **2. Intents and Affidavits**

On forms provided by the Industrial Statistician of State L&I, the Contractor shall submit to the Engineer the following for themselves and for each firm covered under RCW 39.12 that will or has provided Work and materials for the Contract:

- a. The approved “Statement of Intent to Pay Prevailing Wages” State L&I’s form number F700-029-000. The Contracting Agency will make no payment under this Contract until this statement has been approved by State L&I and reviewed by the Engineer.
- b. The approved “Affidavit of Prevailing Wages Paid”, State L&I’s form number F700-007-000. The Contracting Agency will not grant Completion until all approved Affidavit of Wages paid for the Contractor and all Subcontractors have been received by the Engineer. The Contracting Agency will not release to the Contractor any funds retained under RCW 60.28.011 until “Affidavit of Prevailing Wages Paid” forms have been approved by State L&I and all of the approved forms have been submitted to the Engineer for every firm that worked on the Contract.

The Contractor is responsible for requesting these forms from State L&I and for paying any fees required by State L&I.

#### **3. Certified Payrolls**

Certified payrolls are required to be submitted by the Contractor for themselves, all Subcontractors and all lower tier Subcontractors. The payrolls shall be submitted weekly on all Federal-aid projects and no less than monthly on State funded projects.

#### **4. Penalties for Noncompliance**

The Contractor is advised, if these payrolls are not supplied within the prescribed deadlines, any or all payments may be withheld until compliance is achieved. In addition, failure to provide these payrolls may result in other sanctions as provided by State laws (RCW 39.12.050) and/or Federal regulations (29 CFR 5.12).

### **3.03.5 BONDS, INSURANCE AND INDEMNITY OBLIGATIONS**

#### **3.03.5(1) Contract Bonds**

The successful Bidder shall provide an executed Performance Bond and Public Works Payment Bond for the full Contract amount (including sales tax). The Contract Bonds shall:

1. Be on Owner-furnished forms;
2. Be signed by an approved Surety (or Sureties) that:
  - a. Is registered with the Washington State Insurance Commissioner; and
  - b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner.
3. Be conditioned upon the faithful performance of the Contract by the Contractor within the prescribed time; and
4. Be conditioned upon the payment of taxes, increases, and penalties incurred on the project under Titles 50, 51 and 82 RCW; and
5. Guarantee that the Surety shall indemnify, defend, and protect the Owner against any claim of direct or indirect loss resulting from the failure:
  - a. Of the Contractor (or any of the employees, Subcontractors, or lower tier Subcontractors of the Contractor) to faithfully perform the Contract; or
  - b. Of the Contractor (or the Subcontractors or lower tier Subcontractors of the Contractor) to pay all laborers, mechanics, Subcontractors, lower tier Subcontractors, materialperson, or any other person who provides supplies or provisions for carrying out the Work.
6. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and
7. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).

The Owner may require Sureties or Surety companies on the Contract Bonds to appear and qualify themselves. Whenever the Owner deems the Surety or Sureties to be inadequate, it may, upon

written demand, require the Contractor to furnish additional Surety to cover any remaining Work. Until the added Surety is furnished, payments on the Contract will stop.

### **3.03.5(1.1) Two-Year Guarantee Period**

The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within 2 years after Final Acceptance of the Work. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Owner's written notice of a defect, and shall complete such Work within the time stated in the Owner's notice. In case of an emergency, where damage may result from delay or where loss of services may result, such corrections may be made by the Owner's own forces or another contractor, in which case the cost of corrections shall be paid by the Contractor. In the event the Contractor does not accomplish corrections within the time specified, the Work will be otherwise accomplished and the cost of same shall be paid by the Contractor.

When corrections of defects are made, the Contractor shall then be responsible for correcting all defects in workmanship and materials in the corrected work for 2 years after acceptance of the corrections by Owner.

This guarantee is supplemental to and does not limit or affect the requirements that the Contractor's Work comply with the requirements of the Contract or any other legal rights or remedies of the Owner.

### **3.03.5(2) Worker's Benefits**

- a. The Contractor shall make all payments required for unemployment compensation under RCW Title 50 and for industrial insurance and medical aid required under RCW Title 51. If any payment required by Title 50 or Title 51 is not made when due, the Contractor shall indemnify the Owner with respect to all costs and damages, including attorneys' fees and expenses, associated with such nonpayment. The Owner may retain payments due under Title 50 or Title 51 from any money due to the Contractor and make payment to the appropriate fund.
- b. The Contractor shall include in the various items in its bid Proposal all costs for payment of unemployment compensation and for providing the required insurance coverage(s). The Contractor will not be entitled to any additional payment for: (1) failure to include such costs in the Proposal, or (2) post-Award determinations made by the U.S. Department of Labor, the Washington State Department of Labor and Industries, or any other agency or entity regarding insurance coverage requirements.

### **3.03.5(4) Public Liability & Property Damage Insurance**

#### **3.03.5(4.1) General Requirements**

- A. The Contractor shall procure and maintain insurance described in all subsections in this Section, from insurers with a current A.M. Best rating not less than A – VII

and licensed to do business in the state of Washington. The Owner reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.

- B. The Contractor shall keep this insurance in force during the term of the Contract and for 30 days after the Physical Completion Date, unless otherwise indicated.
- C. All insurance coverage required by this section shall be written and provided by “occurrence-based” policy forms rather than by “claims made” forms.
- D. The insurance policies shall contain a “cross liability” provision.
- E. The Contractor’s and all Subcontractors’ insurance coverage shall be primary and non-contributory insurance as respects the Owner’s insurance, self-insurance, or insurance pool coverage. Any insurance, self-insurance or self-insured pool coverage maintained by the Owner shall be excess of the Contractor’s insurance and shall not contribute with it.
- F. The Contractor shall provide the Owner and all Additional Insured with written notice of any policy cancellation and the date of effective cancellation within 2 business days of receipt.
- G. The Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the Owner.
- H. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of Contract, upon which the Owner may, after giving 5 business days notice to the Contractor to correct the breach, immediately terminate the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Owner on demand, or at the sole discretion of the Owner, offset against funds due the Contractor from the Owner.
- I. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the Contract and no additional payment will be made.

#### **3.03.5(4.2) Additional Insured**

All insurance policies, with the exception of Workers Compensation, shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:

- The Owner and its officers, elected/appointed officials, employees, agents, and volunteers;
- Gray & Osborne, Inc.;

The above-listed entities shall be additional insured(s) for the full available limits of liability

maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by the Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 3.03.5(4.4) describes limits lower than those maintained by the Contractor.

### **3.03.5(4.3) Subcontractors**

Contractor shall ensure that each Subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 3.03.5(4.5)A and 3.03.5(4.5)B. Upon request of the Owner, the Contractor shall provide evidence of such insurance.

### **3.03.5(4.4) Verification of Coverage**

The Contractor shall deliver to the Owner a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the Work. The certificate and endorsements shall conform to the following requirements:

1. An ACORD certificate or a form determined by the Owner to be equivalent. The certificate or an endorsement form shall indicate the Contractor's insurance is primary and non-contributory.
2. The Contractor shall obtain endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 or the equivalent of each, naming the Owner and all other entities listed in 3.03.5(4.2) as Additional Insured(s) and showing the policy number. If the Contractor is unsuccessful in securing these endorsements after exerting commercially reasonable efforts, the Contractor shall obtain other endorsements providing equivalent protection to the Additional Insured. Commercially reasonable efforts shall be evidenced by a signed statement by the Contractor's insurance broker indicating that endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 are not available and the endorsements submitted provide equivalent protection to the Additional Insured.
3. Any other amendatory endorsements to show the coverage required herein.
4. A notification of coverage enhancements on the Certification of Insurance shall not satisfy these requirements; actual endorsement must be submitted.

Upon request, the Contractor shall forward to the Owner a full and certified copy of the insurance policy(s). If Builders Risk Insurance is required on this project, a full and certified copy of that policy is required when the Contractor delivers the signed Contract for the Work.

### **3.03.5(4.5) Coverages and Limits**

The insurance shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve the Contractor from liability in excess of such limits. All deductibles and self-insured retentions shall be disclosed and

are subject to approval by the Owner. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

#### **3.03.5(4.5)A Commercial General Liability**

Commercial General Liability insurance shall be written on coverage forms at least as broad as ISO occurrence form CG 00 01, including but not limited to liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract. There shall be no exclusion for liability arising from explosion, collapse or underground property damage.

The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

Contractor shall maintain Commercial General Liability Insurance arising out of the Contractor's completed operations for at least 3 years following Substantial Completion of the Work.

Such policy must provide the following minimum limits:

\$1,000,000	Each Occurrence
\$2,000,000	General Aggregate
\$2,000,000	Products & Completed Operations Aggregate
\$1,000,000	Personal & Advertising Injury, each offence
\$1,000,000	Stop Gap/Employers' Liability

#### **3.03.5(4.5)B Automobile Liability**

Automobile Liability for owned, non-owned, hired, and leased vehicles, with an MCS 90 endorsement and a CA 9948 endorsement attached if "pollutants" are to be transported. Such policy(ies) shall provide the following minimum limit:

\$1,000,000	combined single limit each accident
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#### **3.03.5(4.5)C Workers' Compensation**

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

#### **3.03.5(4.5)D Excess or Umbrella Liability**

The Contractor shall provide Excess or Umbrella Liability coverage at limits of \$2 million per occurrence and annual aggregate. This excess or umbrella liability coverage shall apply, at a minimum, to both the Commercial General and Auto insurance policy coverage and employers liability.

This requirement may be satisfied instead through the Contractor's primary Commercial General and Automobile Liability coverage, or any combination thereof.

### **3.03.5(4.5)E Builders Risk Insurance**

The Contractor shall purchase and maintain Builders Risk insurance covering interests of the Owner, the Contractor, Subcontractors, and lower tier Subcontractors in the Work. Builders Risk shall be required for all structures on the project. A structure is any equipment, facility, building, bridge, retaining wall, or tank extending 4 feet or more above adjacent grade; or any facility less than 4 feet above adjacent grade, and containing more than \$50,000 worth of electrical or mechanical equipment. Poles, light standards, or antenna less than 50 feet in height and less than 2 feet in diameter shall not be considered structures. Builders Risk insurance, when required, shall be on an all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood, earthquake, theft, vandalism, malicious mischief and collapse. The Builders Risk insurance, when required, shall include coverage for temporary buildings, debris removal, and damage to materials in transit or stored off-site. Such insurance shall cover “soft costs” including but not limited to design costs, licensing fees, and architect’s and engineer’s fees. Builders Risk insurance shall be written in the amount of the completed value of the applicable portions of the project, with no coinsurance provisions.

The Builders Risk insurance covering the Work shall have a deductible of \$5,000 for each occurrence, which will be the responsibility of the Contractor. Higher deductibles for flood, earthquake and all other perils may be accepted by the Owner upon written request by the Contractor and written acceptance by the Owner. Any increased deductibles accepted by the Owner will remain the responsibility of the Contractor.

The Builders Risk insurance shall be maintained until the Physical Completion Date.

The Contractor and the Owner waive all rights against each other and any of their Subcontractors, lower tier Subcontractors, agents and employees, each of the other, for damages caused by fire or other perils to the extent covered by Builders Risk insurance or other property insurance applicable to the Work. The policies shall provide such waivers by endorsement or otherwise.

Liability for facilities not covered by Builders Risk shall remain the responsibility of the Contractor.

### **3.03.5(4.5)F LHWCA Insurance**

If the Contract involves work on or adjacent to Navigable Waters of the United States, the Contractor shall procure and maintain insurance coverage in compliance with the statutory requirements of the U.S. Longshore and Harbor Workers' Compensation Act (LHWCA).

Such policy must provide the following minimum limits:

\$1,000,000	Bodily Injury by Accident – each accident
\$1,000,000	Bodily Injury by Disease – each employee
\$1,000,000	Bodily Injury by Disease – policy limits

### **3.03.5(4.5)G Protection and Indemnity Insurance Including Jones Act**

If the Contract involves marine activities, or work from a boat, vessel, or floating platform, the Contractor shall procure and maintain Protection and Indemnity (P&I) coverage including collision liability, injury to crew (Merchant Marine Act of 1920 - Jones Act) and passengers, removal of wreck and liability for seepage, pollution, containment and cleanup using form SP-23 or SP 38 or a form as least as broad.

All entities listed under Section 3.03.5(4.2) of the General Conditions shall be named as additional insureds on the Contractor's Protection and Indemnity insurance policy.

Such policy must provide the following minimum limits:

\$1,000,000	Bodily Injury by Accident – each accident or occurrence
\$1,000,000	Bodily Injury by Disease – each employee
\$1,000,000	Bodily Injury by Disease – policy limits

### **3.03.5(4.5)H Hull and Machinery**

If the Contract involves use of a boat, vessel, or floating platform, the Contractor shall procure and maintain coverage at Market Value of vessel on American Institute Hull Clauses, 6/2/77 form.

### **3.03.5(4.5)I Marine Pollution**

If this Contract is near or on water, the Contractor shall procure and maintain Pollution Liability (OPA, CERCLA) insurance to satisfy U.S. Coast Guard requirements as respects the Federal Oil Pollution Act of 1990 and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended.

Such policy must provide the following minimum limits, or statutory limits of liability as applicable, whichever is higher:

\$1,000,000	per Occurrence
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### **3.03.5(4.5)J Pollution Liability**

If this Contract includes work with lead based paint, materials containing asbestos or transportation of hazardous materials, the Contractor shall provide a Contractors Pollution Liability policy, providing coverage for claims involving bodily injury, property damage (including loss of use of tangible property that has not been physically injured), cleanup costs, remediation, disposal or other handling of pollutants, including costs and expenses incurred in the investigation, defense, or settlement of claims, arising out of any one or more of the following:

1. Contractor's operations related to this project.
2. Remediation, abatement, repair, maintenance or other work with lead-based paint or materials containing asbestos.
3. Transportation of hazardous materials away from any site related to this project.

All entities listed under 3.03.5(4.2) of these general conditions shall be named by endorsement as additional insureds on the Contractors Pollution Liability insurance policy.

Such Pollution Liability policy shall provide the following minimum limits:

\$1,000,000 each loss and annual aggregate

### **3.03.5(4.5)K Professional Liability**

If the Contract requires engineering design services, the Contractor and/or its Subcontractor(s) and/or its design consultant providing construction management, value engineering, or any other design-related non-construction professional services shall provide evidence of Professional Liability insurance covering professional errors and omissions.

Such policy shall provide the following minimum limits:

\$1,000,000 per claim and annual aggregate

If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability insurance shall include coverage for Environmental Professional Liability.

If insurance is on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract.

### **3.03.5(5) Indemnity and Hold Harmless**

- a. To the fullest extent permitted by law and subject to the limitations of RCW 4.24.115, the Contractor shall defend, indemnify and hold harmless the Owner and the Engineer and their appointed and elected officials, agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees and expenses arising out of or resulting from the negligent performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. Provided, however, that when any such claim, damage, loss or expense arises from the concurrent negligence of (1) the Owner, or anyone for whose acts it may be liable, and (2) the Contractor, or anyone for whose acts it may be liable, it is expressly agreed that the Contractor's obligations of defense and indemnity under this section shall be effective only to the extent of the Contractor's negligence and those for whose negligence the Contractor is responsible. This obligation of indemnity shall not extend to claims, losses or expenses arising from the sole negligence of the Owner, its appointed or elected officials, agents or employees.

- b. In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this section shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts, it being the expressed intent of the parties that Contractor herein specifically waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. **THIS WAIVER HAS BEEN SPECIALLY NEGOTIATED BY THE PARTIES, WHO HAVE ACKNOWLEDGED SAME BY AFFIXING THEIR SIGNATURES TO THE PROPOSAL FORM.**

### **3.03.5(6) Patent Royalties & Process Fees**

The Contractor shall be responsible for all costs arising from the use of patented devices, materials, or processes used in or incorporated in the Work. The Contractor agrees to indemnify, defend, and save harmless the Owner from all claims and damages, in any way relating to the use of patented devices, materials, or processes used in or incorporated in the Work.

### **3.03.6 METHOD OF SERVING NOTICE**

All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, shall be in paper format, hand delivered or sent via mail delivery service to the Owner. Electronic formats such as emails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

## **3.04 PROSECUTION AND PROGRESS OF THE WORK**

### **3.04.1 QUALITY OF WORK**

#### **3.04.1(1) Workmanship**

- a. The Contractor represents that it is fully experienced and possesses all the necessary capital, facilities and expertise to perform all of the Work, and hereby guarantees that all of the Work performed by it under the Contract will be of the highest quality and done in a workmanlike fashion in strict accordance with the requirements of the Contract.
- b. The Contractor shall at all times employ skilled workers and use skilled Subcontractors in the performance of the Work. When required in writing by the Owner or the Engineer, the Contractor or its Subcontractors shall remove from the Work site any person or Subcontractor who is, in the opinion of the Owner or the Engineer, not competent, not qualified, disorderly, or otherwise unsatisfactory and shall not again employ such discharged person or Subcontractor on the Work,

except with the prior written consent of the Owner. Discharge of any person or Subcontractor shall not be the basis of any claim for compensation or damages against the Owner or the Engineer.

- c. All Work performed under the Contract shall be of first quality workmanship throughout, with the Work complete and in full working order upon completion.
- d. Except when otherwise expressly specified in the Contract, the Contractor shall design, survey, layout and be responsible for all methods, materials and equipment used in performing the Work.
- e. If, at any time, the Contractor's workforce (including Subcontractors), in the opinion of the Owner and/or the Engineer, shall be inadequate for maintaining the necessary progress required to complete the Work within the Contract Time, the Contractor shall at its sole cost, if so required by the Owner and/or the Engineer, increase the workforce or equipment to such an extent as to give reasonable assurance of compliance with the Work schedule. The failure of the Owner and/or the Engineer to make such demand shall not relieve the Contractor of its obligation to perform the Work in accordance with the requirements of the Contract. The Contractor alone shall be responsible for the safety, efficiency and adequacy of its activities, construction methods and the rate of progress required by the Contract.

#### **3.04.1(2) Contractor's Supervisory and Site Personnel**

- a. The Contractor shall assign sufficient supervisory personnel to ensure the faithful prosecution of the Work and shall have adequate supervisory personnel present at the Work site who are either employees of the Contractor or duly authorized representatives designated in writing to the Owner and/or the Engineer. The Contractor shall at all times maintain at the Work site a complete copy of the Contract Provisions, Contract Plans, and record drawings of the Work that has been completed.
- b. The Contractor shall at all times have at least one duly authorized supervisory representative at the Work site who shall be fully authorized to make binding decisions on behalf of the Contractor with respect to the Work. If the Contractor's duly authorized supervisory representative at the Work site will be absent from the Work site for more than four hours, he/she shall designate an assistant who possesses the same authority and so inform the Owner and the Field Representative, if applicable.

#### **3.04.2 MATERIALS AND EQUIPMENT**

- (1) Materials and equipment furnished and installed shall be manufactured, fabricated or constructed to meet all applicable safety requirements. All material and equipment supplied by the Contractor and incorporated in the Work shall be of new manufacture, free from defects and in strict compliance with the requirements of

the Contract. When required by the Owner, a certificate from the manufacturer or other responsible supplier shall be supplied attesting to this fact.

- (2) All tools and equipment used for construction operations shall be of the size and type suitable for the Work and shall be kept in safe and good working condition at all times.
- (3) The Contractor shall, whenever required during the progress of the Work and after completion of the Work, furnish proof acceptable to the Owner that all items of equipment and all materials installed equal or exceed all requirements specified in the Contract.
- (4) The Contractor shall use all means possible to protect materials and equipment from damage or degradation of any kind before, during and after installation.
- (5) The Contractor shall replace any materials or equipment damaged during the performance of the Work to the approval of the Owner and the Engineer. The cost of replacing damaged materials and equipment shall be borne by the Contractor.

### **3.04.3 SPECIFICATION OF PARTICULAR MATERIALS AND EQUIPMENT**

- (1) Within the Contract, certain items are specified by brand, style, trade name, or manufacturer in order to set forth a standard of quality, and/or preference by the Owner. Unless specifically noted otherwise, it is not the intent of the Contract to exclude other processes or materials of a type and quality equal to those designated.
- (2) The term “or equal” as used in the Contract does not mean that the Contractor’s substitution of material or equipment will necessarily be approved as equal by the Engineer. If the Contractor desires to substitute material or equipment on the basis that it is equal to that specified, the Contractor shall submit a written request to the Engineer to substitute the material or equipment. The Contractor shall not use or incorporate such material or equipment into the Work until the Contractor has received written approval from the Engineer.
- (3) If the Contractor proposes substitutions, the Engineer will record all time used to evaluate each proposed substitution. If an approved substitution requires revisions to the Contract Documents, the Engineer will record all time to accomplish the revisions. Whether or not the Engineer approves a proposed substitution all direct and indirect cost to evaluate the proposed substitution shall be deducted from amounts due or to become due to the Contractor.
- (4) No additional compensation or extension of time will be allowed the Contractor for any changes required to incorporate substituted materials or equipment.

### **3.04.4 STORAGE**

#### **3.04.4(1) On-Site Storage**

The Contractor shall store all equipment and materials in a safe and suitable place in accordance with the manufacturer's recommendations. Materials and equipment shall be covered or wrapped to protect them from moisture, dust and deterioration, as required or necessary. All on-site storage areas shall be approved in advance by the Owner and the Engineer.

#### **3.04.4(2) Off-Site Storage**

The Contractor may be required to provide offsite storage of equipment and materials to enable construction to occur at the Work site. The Contractor has full responsibility to secure all offsite storage areas, if needed, and shall include the costs for providing such storage areas in the bid Proposal for the individual equipment and material items requiring off-site storage. All off-site storage areas shall be enclosed or fenced and be secure.

### **3.04.5 DEFECTIVE MATERIALS, EQUIPMENT AND WORKMANSHIP**

- (1) Materials, equipment, or workmanship which, in the opinion of the Owner or the Engineer, does not conform to the Contract or are in any other way unsatisfactory or unsuited to the purpose for which they are intended may be rejected. The Contractor shall remove from the Work site without delay, all rejected materials, equipment and work, and shall promptly replace the same in strict conformity with the requirements of the Contract. Unsatisfactory materials, equipment and workmanship may be rejected at any time, notwithstanding any previous testing, inspection or acceptance of such materials, equipment or workmanship, or inclusion thereof in any previously issued progress estimates.
- (2) If the Contractor fails to correct defective Work, equipment or materials, the Owner shall have the right to exercise any of the following options or any combination thereof:
  - a. The Owner may replace the defective Work, materials or equipment by purchase from or contract with any other parties at the expense of the Contractor, and in this event, the Owner shall be entitled without compensation to the Contractor, to the use of the defective Work or equipment for such reasonable time as is necessary to enable Owner to replace such defective Work, materials or equipment.
  - b. The Owner may elect to accept the defective Work, materials or equipment and issue a Change Order reflecting a credit against the Contract price, computed under the terms of the Contract in an amount to be determined by the Engineer, which amount shall reflect the actual value to the Owner of the accepted Work.

- c. Upon receipt of notice from the Owner of any defects in material, equipment or workmanship which appear within a two-year period following the Substantial Completion Date, or within any other warranty or guarantee period required by the Contract or provided by a manufacturer or supplier, the Contractor shall promptly and with the least possible delay and inconvenience to the Owner, repair or replace such defective workmanship, material or equipment without expense to the Owner.
- d. The Contractor shall be responsible for the full cost of correcting defective Work and complying with warranties and guarantees as required by the Contract. Direct or indirect costs, including administrative and engineering, incurred by the Owner attributable to correcting and remedying defective or unauthorized work, or Work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Owner from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.
- e. All warranties, guarantees, and other obligations to correct work that does not comply with the Contract are material requirements of the Contract. The performance of all warranties, guarantees and other obligations shall be secured by the Performance Bond and the Public Works Payment Bond submitted by the Contractor at the time the Contract is signed.

#### **3.04.6 CHANGES IN THE WORK**

- (1) The Owner or the Engineer may, at any time, without notice to the Performance Bond or Public Works Payment Bond sureties, by written order designated or indicated to be a Change Order or Change Directive, make any change, including modifications to, additions to or deletions from the Work including, but not limited to, changes:
  - a. To the Contract Provisions and Contract Plans;
  - b. To quantities or performance of the Work;
  - c. To Owner-furnished facilities, equipment, materials, services or the Work site; or
  - d. To the schedule for the Work or the Contract Time.
- (2) A Change Order is an amendment to the Contract, which signifies changes in the scope of the Work, the Contract Time, and/or the Contract price. A Change Order shall be the complete expression of the agreement between the Owner and the Contractor. No claims or entitlement to an equitable adjustment or changes to the

Contract Time and/or Contract price will be allowed for alleged verbal or oral agreements or directives.

- (3) The Engineer will issue a written change order for any change. If the Engineer determines that the change increased or decreased the Contractor's costs or time to do any of the Work, the Engineer will make an equitable adjustment to the Contract. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Engineer will determine the amount of the equitable adjustment in accordance with Section 3.04.6(7) and adjust the time as the Engineer deems appropriate. Extensions of time will be evaluated in accordance with Section 3.04.15(2).

The Contractor shall proceed with the Work upon receiving:

1. A written change order approved by the Owner; or
2. An oral order from the Engineer before actually receiving the written change order.

Within 14 calendar days of delivery of the change order the Contractor shall endorse and return the change order, request an extension of time for endorsement or respond in accordance with Section 3.04.8. The Owner may unilaterally process the change order if the Contractor fails to comply with these requirements. Changes normally noted on field stakes or variation from estimated quantities, except as provided in Section 3.04.6(8), will not require a written change order. These changes shall be made at the unit prices that apply. The Contractor shall respond immediately to changes shown on field stakes without waiting for further notice.

The Contractor shall obtain written consent of the Surety or Sureties if the Engineer requests such consent.

- (4) All Change Orders will be prepared by the Owner or Engineer and executed in triplicate with one copy to the Owner, one to the Contractor, and one retained by the Engineer.
- (5) If the Contractor encounters any circumstances during the performance of the Work that the Contractor contends creates any entitlement to a change in the Contract Time, the Contract price, or both, the Contractor shall immediately provide written notice to the Engineer. Within 10 calendar days after providing written notice, the Contractor shall provide a written request to the Engineer for a change to the Contract Time and/or Contract price and provide detailed information supporting the request, including cost and schedule information.
- (6) No claim by the Contractor shall be allowed if the terms of this Section 3.04.6 are not strictly followed. In the event of any non-compliance, the Contractor shall be conclusively determined to have waived any claim or entitlement to an adjustment of the Contract Time or the Contract price.

- (7) The cost to be included in an adjustment for any changes to the Work, adjustment of the Contract Time or Contract price and any equitable adjustment or entitlement related to the Work or the Contract shall meet the notice provisions of Section 3.04.6, and will be determined strictly by one or a combination of the following methods:
- a. Contract unit bid prices previously agreed upon; or
  - b. If there are no unit bid prices, an agreed lump sum; or
  - c. If the amount of the adjustment cannot be agreed upon in advance or in the manner provided in subparagraph a or b above, the cost will be determined by the actual cost of:
    1. Labor including working foremen. Labor rates will only include the basic wage and fringe benefits, the current rates for Federal Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA) and State Unemployment Tax Act (SUTA), and the company's present rates for medical aid and industrial insurance premiums. Labor reimbursement calculations will be based on a "Labor List" (List) prepared and submitted by the Contractor and any Subcontractor before the Contractor commences force account Work. The Engineer may compare the List to payrolls and other documents and may at any time, require the Contractor to submit a new List.

In the event that an acceptable List is not received by the time that force account calculations are begun, the Engineer will develop a List unilaterally, utilizing the best data available.
    2. Materials incorporated permanently into the Work;
    3. The ownership or rental cost of equipment during the time of use on the extra work. Equipment rates shall be as set forth in the then current AGC/WSDOT Equipment Rental Agreement. These rates shall be full compensation for all costs incidental to furnishing and operating the equipment. The Contractor shall submit copies of the applicable portions of the AGC/WSDOT Equipment Rental Agreement to the Engineer. The rates listed in the Rental Rate Blue Book (as modified by the current AGC/WSDOT Equipment Rental Agreement) shall be full compensation for all fuel, oil, lubrication, ordinary repairs, maintenance, and all other costs incidental to furnishing and operating the equipment except labor for operation; plus

4. Overhead and Profit as follows:

For Work performed by the Contractor, an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes.

For Subcontractor Work, the Subcontractor will be allowed an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes. The Contractor will be allowed an additional markup of 10 percent to compensate the Contractor for all administrative costs, including home office and field overhead, profit, bonding, insurance, business and occupation taxes and any other costs incurred.

In no case will the total fixed fee for the Contractor and all Subcontractors of all tiers exceed 30 percent.

- (8) Payment to the Contractor will be made only for the actual quantities of Work performed and accepted in conformance with the Contract. When the accepted quantity of Work performed under a unit item varies from the original bid quantity, payment will be at the unit Contract price for all Work unless the total accepted quantity of any Contract item, adjusted to exclude added or deleted amounts included in change orders accepted by both parties, increases or decreases by more than 25 percent from the original bid quantity, and that bid item represents 10 percent or more of the total original Contract price. In that case, payment for Contract Work may be adjusted as described herein.

The adjusted final quantity shall be determined by starting with the final accepted quantity measured after all Work under an item has been completed. From this amount, subtract any quantities included in additive change orders accepted by both parties. Then, to the resulting amount, add any quantities included in deductive change orders accepted by both parties. The final result of this calculation shall become the adjusted final quantity and the basis for comparison to the original Proposal quantity.

- a. **Increased Quantities.** Either party to the Contract will be entitled to renegotiate the price for that portion of the adjusted final quantity in excess of 1.25 times the original Proposal quantity, if 10 percent or more of the original Contract price. The price for excessive increased quantities will be determined by agreement of the parties, or, where the parties cannot agree,

the price will be determined by the Engineer based upon the actual costs to perform the Work, including reasonable markup for overhead and profit. The final price will be determined by the Engineer.

- b. **Decreased Quantities.** Either party to the Contract will be entitled to an equitable adjustment if the adjusted final quantity of Work performed is less than 75 percent of the original Bid quantity, if 10 percent or more of the original Contract price. The Contractor shall submit the documentation to support the equitable adjustment to the Engineer. The equitable adjustment shall be based upon and limited to three factors:
1. Any increase or decrease in unit costs of labor, materials or equipment, utilized for Work actually performed, resulting solely from the reduction in quantity;
  2. Changes in production rates or methods of performing Work actually done to the extent that the nature of the Work actually performed differs from the nature of the Work included in the original plan; and
  3. An adjustment for the anticipated contribution to unavoidable fixed cost and overhead from the units representing the difference between the adjusted final quantity and 75 percent of the original plan quantity.

The following limitations shall apply to renegotiated prices for increases and/or equitable adjustments for decreases:

1. The equipment rates shall be actual cost but shall not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement.
2. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the extent that there is an unbalanced allocation of such expenses among the Contract Bid items.
3. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in quantities from those originally shown in the Proposal form, Contract Provisions, and Contract Plans.
4. The total payment (including the adjustment amount and unit prices for Work performed) for any item that experiences an equitable adjustment for decreased quantity shall not exceed 75 percent of the amount originally Bid for the item.

If the adjusted final quantity of any item does not vary from the quantity shown in the Proposal by more than 25 percent, then the Contractor and the Owner agree that all Work under that item will be performed at the original Contract unit price.

When ordered by the Engineer, the Contractor shall proceed with the Work pending determination of the cost or time adjustment for the variation in quantities.

The Contractor and the Owner agree that there will be no cost adjustment for decreases if the Owner has entered the amount for the item in the Proposal form only to provide a common Proposal for Bidders.

### **3.04.7 DIFFERING SITE CONDITIONS**

The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of: (1) pre-existing subsurface or latent physical conditions at the Work site that differ materially from those indicated in the Contract Documents, or (2) pre-existing unknown physical conditions at the Work site, of an unusual nature, that differ materially from those ordinarily encountered and generally recognized as inherent in the Work of the character required by the Contract. The Engineer shall be given an opportunity to examine such conditions in order to advise the Owner of possible modifications to the Work to mitigate such conditions. If the Engineer determines that conditions are materially different and cause a material increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, an equitable adjustment shall be made in the Contract Time and/or Contract price in accordance with other applicable provisions of the Contract relating to changes in the Work. Failure of the Contractor to give notice of such conditions at the time of discovery shall constitute a waiver of any claim for an equitable adjustment. Any such adjustments to the Contract price shall be computed strictly limited to amounts provided under paragraph 3.04.6.

### **3.04.8 PROTEST BY THE CONTRACTOR**

If the Contractor disagrees with anything in a Change Order or a written directive, or with any interpretation or determination by the Engineer, the Contractor shall:

- a. Immediately submit a signed written notice of protest to the Engineer before doing the Work;
- b. Supplement the written protest within 14 calendar days with a written statement and supporting documents providing the following:
  1. The date and nature of the protested order, direction, instruction, interpretation or determination;
  2. A full discussion of the circumstances which caused the protest, including names of persons involved, time, duration, and nature of

the Work involved and a review of the Plans and Contract Provisions referenced to support the protest;

3. The estimated dollar cost, if any, of the protested Work and a detailed breakdown showing how that estimate was determined; and
4. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption; and
5. If the protest is continuing, the information required above shall be supplemented upon request by the Engineer until the protest is resolved.

The Contractor shall keep detailed and complete records of extra costs and schedule impacts to Contract Time that in any way relate to a protest. The Contractor shall allow the Engineer to have access to all documents and records needed for evaluating the protest.

The Engineer will evaluate all protests that comply with this Section. If the Engineer determines that a protest is valid, the Engineer will adjust the Contract price and/or the Contract Time by an adjustment in accordance with Section 3.04.6 and 3.04.15(2).

During the time when any protest is pending, the Contractor shall proceed promptly with the Work, as the Engineer orders in writing.

The Contractor's failure to submit a protest in strict accordance with the requirements of this Section shall constitute a waiver of any claim for an adjustment to the Contract Time, the Contract price, or other relief.

### **3.04.9 SUBCONTRACTORS AND SUBCONTRACTS**

#### **3.04.9(1) Contractor Responsibility**

Nothing contained in the Contract shall create any contractual or other relationship between the Owner and/or the Engineer and any Subcontractor or lower tier Subcontractor, and no performance undertaken by any such Subcontractor or lower tier Subcontractor shall, under any circumstances, relieve the Contractor of its obligations and responsibilities under the Contract.

Prior to subcontracting any Work, the Contractor shall verify that every first tier Subcontractor meets the responsibility criteria stated below at the time of subcontract execution. The Contractor shall include these responsibility criteria in every subcontract, and require every Subcontractor to:

1. Possess any electrical contractor license required by 19.28 RCW or elevator contractor license required by 70.87 RCW, if applicable;
2. Have a certificate of registration in compliance with Chapter 18.27 RCW;

3. Have a current State unified business identifier number;
4. If applicable, have:
  - a. Industrial insurance coverage for the Subcontractor's employees working in Washington (Title 51 RCW);
  - b. An employment security department number (Title 50 RCW);
  - c. A state excise tax registration number (Title 82 RCW).
5. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or RCW 39.12.065(3);
6. Verify these responsibility criteria for every lower tier subcontractor at the time of subcontract execution; and
7. Include these responsibility criteria in every lower tier subcontract.

**3.04.9(2) Contractor Work Performance Requirement**

Work done by the Contractor's own organization shall account for at least 30 percent of the awarded Contract price.

**3.04.9(3) Approval of Subcontractors**

The Contractor shall not subcontract Work unless the Engineer approves in writing. Each request to subcontract shall be on the form the Engineer provides. If the Engineer requests, the Contractor shall provide proof that the Subcontractor has the experience, ability, and equipment the Work requires. The Contractor shall require each Subcontractor to comply with Section 3.03.4 and to furnish all certificates and statements required by the contract. Approval of a Subcontractor by the Owner shall not relieve the Contractor or Subcontractor of any obligations or responsibilities under the Contract. Any delays or other impacts caused by the failure of the Contractor to provide required information and obtain approval of any Subcontractor in a timely manner will not be considered as justification for additional compensation or an extension of the Contract Time.

**3.04.9(4) Subcontracts**

Upon approval of Subcontractors by the Engineer, the Contractor shall, if requested, provide the Owner with complete copies of all subcontracts entered into between the Contractor and any Subcontractor. Providing requested subcontracts to the Owner shall be a condition precedent to the Owner's obligation to make any progress payment to the Contractor.

**3.04.9(5) Incorporation of Contract**

Every subcontract entered into by the Contractor shall expressly bind each Subcontractor to all of the terms and conditions of the Contract, which the Contractor shall incorporate into each

subcontract by reference. The Contractor shall provide a copy of the Contract to all Subcontractors and obtain written confirmation from Subcontractors that the Subcontractor received a copy of the Contract. All Subcontractors shall provide a copy of the Contract to all lower tier Subcontractors and obtain written confirmation from lower tier Subcontractors that the lower tier Subcontractor received a copy of the Contract.

#### **3.04.9(6) Replacement of Subcontractors**

Subject to the requirements of state and/or federal agencies having jurisdiction over MBE/WBE/DBE requirements applicable to the Work, should it become impossible for a Subcontractor to perform the Subcontractor's intended work, the Contractor shall submit the information required above for an alternate Subcontractor at least 10 days prior to the time that the Subcontractor is scheduled to begin work. The failure of any Subcontractor to perform its portion of the Work in a timely or workmanlike fashion is the sole responsibility of the Contractor.

#### **3.04.10 MUTUAL RESPONSIBILITY OF CONTRACTORS**

The Owner reserves the right to perform other work on or near the Work site using its own forces and/or other contractors. The Contractor shall take all reasonable steps to coordinate its performance of the Work with the Owner and/or such other contractors and Subcontractors. If, through acts of commission or omission on the part of the Contractor, any other contractor or any Subcontractor shall suffer loss or damage with respect to the other work being performed by the Owner, the Contractor agrees to promptly settle with such other Contractor or Subcontractor by agreement or other dispute resolution process. The Contractor agrees to indemnify and hold harmless the Owner and the Engineer from all claims asserted against and liability incurred by the Owner or the Engineer resulting from disputes between the Contractor and any other contractor or any Subcontractor or material supplier. The indemnification rights of the Owner and the Engineer include expenses such as, but not limited to, salaries/wages of employees and all other expenses relating to any mediation, litigation, or arbitration, including costs, consulting fees and attorneys' fees. If such other Contractor or Subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained by an act or omission of the Contractor or anyone for whose acts it may be liable, the Owner or the Engineer shall notify the Contractor, which shall defend, indemnify and save harmless the Owner and the Engineer against such claim.

The coordination of the Work with other work by the Owner shall be taken into account by the Contractor as part of its site investigation obligations under Section 2.01.4, and all costs thereof shall be borne by the Contractor as part of the Contract price for the Work.

#### **3.04.11 RISK OF LOSS**

The Contractor shall have all risk of loss for all Work in progress, all materials, all equipment and all other items in any way relating to the Work through theft, fire, other casualty, act of God, or any other cause until the Contract Completion Date.

### **3.04.12 MEASUREMENT AND PAYMENT**

#### **3.04.12(1) General**

The Contract price for the Work, whether lump sum or unit prices, shall constitute full compensation for furnishing all facilities, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete all items of the Work in accordance with the Contract, notwithstanding that minor or incidental features of the Work may not be shown on the Contract Plans or Contract Provisions.

#### **3.04.12(2) Measurement**

Measurement for all items shall be as specified in the Contract for unit price and lump sum price items.

#### **3.04.12(3) Payment**

Payment for all of the Work will be made at the lump sum or unit Contract price as set forth in the Contract. Payment of the Contract price shall constitute full compensation for the complete performance of all of the Work.

#### **3.04.12(4) Access to Books and Records**

The Contractor shall, whenever so requested, give the Owner and/or the Engineer access to all invoices, bills of lading and other documents relating to the Work. The Contractor shall, without charge, provide personnel and measures and scales with adequate capacity for measuring or weighing any materials or other items paid for on a unit price basis.

#### **3.04.12(5) Progress Payment Estimates**

Progress payment estimates shall be prepared by the Engineer and reviewed by the Contractor and will be submitted with the Engineer's recommendation to the Owner for its approval on the first day of the month for all Work completed through the 26<sup>th</sup> day of the preceding month, unless otherwise agreed upon by the Owner, the Engineer and the Contractor. The Engineer will prepare progress payment estimates as accurately as available information permits. The Owner will make no payment under the Contract for the Work performed until the "Statement of Intent to Pay Prevailing Wages," in accordance with RCW 39.12.040, is submitted to the Engineer, including Subcontractor wage rates. In general, each progress payment will be based upon the payment schedule and the value of Work performed during the preceding pay period. Before the final progress payment estimate is prepared, all quantities will be reviewed by the Engineer.

#### **3.04.12(6) Payment for Materials on Hand**

The Owner may reimburse the Contractor for 90 percent of the invoice amount of materials and equipment purchased before their incorporation into the Work if properly stored on or near the Work site. Invoices for equipment and materials will be verified and approved by the Engineer. Each invoice shall be sufficiently detailed to enable the Engineer to determine actual costs.

Payment for materials on hand shall not exceed the total Contract cost of the Contract item. Payment will not be made for granular materials, forming materials, consumables, nails, tie wire, etc. Payment will not be made for materials for any invoice that is less than \$2,000.00 or for freight bills and similar items. Payment for equipment or materials on hand shall not constitute acceptance of the equipment or materials. Equipment and materials will be rejected if found to be faulty, even if payment for it has been made.

#### **3.04.12(7) Payments Withheld**

The Engineer may decide not to recommend approval of all or a portion of a progress estimate, and/or the Owner may decide to withhold from a progress estimate an amount sufficient to protect the Owner from loss because of:

- a. Defective Work not remedied;
- b. Third-party claims or reasonable evidence indicating the probability that a third-party claim will be asserted;
- c. Failure of the Contractor to make timely and proper payments to Subcontractors or for labor, materials or equipment;
- d. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract price;
- e. Damage to the Owner or another contractor;
- f. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance of the Contract price will not be adequate to cover actual or liquidated damages for the anticipated delay;
- g. Repeated failure by the Contractor to comply with the directions of the Owner or the Engineer or to carry out the Work in accordance with the Contract;
- h. Other appropriate reasons necessary to protect the Owner.

#### **3.04.12(8) Payment Upon Correction of Deficiencies**

When the reason or reasons for withholding payment are resolved, payment will be made for amounts previously withheld.

#### **3.04.12(9) Final Payment**

After final inspection (Section 3.04.16(2)) of the Work and a determination by the Engineer that the Physical Completion Date has been achieved, the balance of the Contract price due to the Contractor will be paid based upon the final estimate by the Engineer and presentation of a Final Contract Voucher Certification signed by the Contractor. The Final Contract Voucher Certification shall be deemed to be a release of all claims of the Contractor unless a claim is filed

in accordance with the requirements of Section 3.05 and is expressly excepted from release in the Contractor's Final Contract Voucher Certification. The date the Owner signs the Final Contract Voucher Certification constitutes the Contract Completion Date in accordance with Section 3.04.16(3).

If the Contractor fails, refuses, or is unable to sign and return the Final Contract Voucher Certification or any other documentation required in order to achieve the Contract Completion Date, the Owner reserves the right to establish a completion date (for the purpose of meeting the requirements of RCW 39.08 and RCW 60.28) and unilaterally accept the Work. Unilateral final acceptance will occur only after the Contractor has been provided the opportunity, by written request from the Engineer, to voluntarily submit such documents. If voluntary compliance is not achieved, formal notification of the impending establishment of a completion date and unilateral final acceptance will be provided by certified letter from the Owner to the Contractor, which will provide 30 calendar days for the Contractor to submit the necessary documents. The 30 calendar day period will begin on the date the certified letter is received by the Contractor. The date on which the Owner unilaterally signs the Final Contract Voucher Certification shall constitute the Contract Completion Date under Section 3.04.16(3). The Owner shall have the right to unilaterally establish a Contract Completion Date when either (1) the Physical Completion Date for the Work has been achieved in accordance with Section 3.04.16(2), or (2) the Owner terminates the contract in accordance with Section 3.07. Unilateral establishment of the Contract Completion Date by the Owner shall not in any way relieve the Contractor of any liability for failing to comply with the Contract or from responsibility for compliance with all federal, state, tribal, or local laws, ordinances, and regulations that affect the Work.

Payment to the Contractor of partial or final payment estimates and retained percentages shall be subject to applicable laws.

### **3.04.13 WORK HOURS**

Except in the case of emergency or unless otherwise approved by the Owner, the normal straight time working hours for the Contract shall be any consecutive 8-hour period between 7:00 a.m. and 6:00 p.m. of a working day with a maximum 1-hour lunch break and a 5-day work week. The normal straight time 8-hour working period for the Contract shall be established at the preconstruction conference or prior to the Contractor commencing the Work.

Written permission from the Engineer is required, if a Contractor desires to perform Work on holidays, Saturdays, or Sundays; before 7:00 a.m. or after 6:00 p.m. on any day; or longer than an 8-hour period on any day. The Contractor shall apply in writing to the Engineer for such permission, no later than noon on the working day prior to the day for which the Contractor is requesting permission to work.

Permission to work between the hours of 10:00 p.m. and 7:00 a.m. during weekdays and between the hours of 10:00 p.m. and 9:00 a.m. on weekends or holidays may also be subject to noise control requirements. Approval to continue work during these hours may be revoked at any time the Contractor exceeds the Owner's noise control regulations or complaints are received from the public or adjoining property owners regarding the noise from the Contractor's operations. The

Contractor shall have no claim for damages or delays should such permission be revoked for these reasons.

Permission to work Saturdays, Sundays, holidays, or other than the agreed upon normal straight time working hours Monday through Friday may be given subject to certain other conditions set forth by the Owner or Engineer. These conditions may include but are not limited to:

- The Engineer may require designated representatives to be present during the Work. Representatives who may be deemed necessary by the Engineer include, but are not limited to: survey crews; personnel from the Owner's material testing lab; inspectors; and other Owner employees when in the opinion of the Engineer, such Work necessitates their presence.
- Requiring the Contractor to reimburse the Owner all the costs in excess of straight time costs for the Owner's representatives who work during such times. These costs shall be deducted from amounts due or to become due to the Contractor.
- Considering the Work performed on Saturdays, Sundays, and holidays as working days with regard to the Contract Time.
- Considering multiple work shifts as multiple working days with respect to Contract Time, even though the multiple shifts occur in a single 24-hour period.

### **3.04.14 CONTRACT TIME**

The Contract Time shall begin on the first working day following the 10<sup>th</sup> calendar day after the issuance of the written Notice to Proceed or the first day on which the Contractor begins to perform Work on the site, whichever occurs first. Time is of the essence of the Contract. All of the Work shall be completed within the time limits set forth in the Contract, and the Contractor's unexcused failure to do so shall result in the assessment of liquidated damages as provided in the Contract.

The Contractor shall complete all of the physical Work within the number of working days that are specified as the Contract Time. Every day will be counted as a working day unless it is a non-working day or the Engineer determines the day to be an unworkable day. A non-working day is a Saturday, a Sunday, a day on which the Contract suspends work, or one of the following holidays: January 1<sup>st</sup>; the third Monday of January; the third Monday of February; Memorial Day; July 4<sup>th</sup>; Labor Day; November 11<sup>th</sup>; Thanksgiving Day; the day after Thanksgiving; and Christmas. Whenever any of these holidays falls on a Sunday, the following Monday shall be counted a non-working day. When the holiday falls on a Saturday, the preceding Friday shall be counted a non-working day.

The days between December 25<sup>th</sup> and January 1<sup>st</sup> will be classified as nonworking days, provided that the Contractor actually suspends performance of the Work.

An unworkable day is defined as a partial or whole day that the Engineer determines to be unworkable because of weather, conditions caused by the weather, or such other conditions beyond the control of the Contractor that prevent the satisfactory and timely performance of the Work, and

such performance, if not hindered, would have otherwise progressed toward physical completion of the Work.

Each working day shall be charged to the Contract Time as it occurs until the Work is physically complete. If requested by the Contractor in writing, the Engineer will provide the Contractor with a weekly statement that shows the number of working days: (1) charged to the Contract Time the week before; (2) specified for the substantial and physical completion of the Contract Time; and (3) remaining to achieve the substantial and physical completion of the Contract. The statement will also show the nonworking days and any partial or whole days that the Engineer declares to be unworkable. If the Contractor disagrees with any statement issued by the Engineer, the Contractor shall submit a written protest within 10 calendar days after the date of the statement. The protest shall be sufficiently detailed to enable the Engineer to ascertain the basis for the dispute and amount of time disputed. Any statement that is not protested by the Contractor as required in this Section shall be deemed as having been accepted as correct. If the Contractor elects to work 10 hours a day 4 days a week (a 4-10 schedule), the fifth day of that week will be charged as a working day if that day would be chargeable as a working day if the Contractor had not elected to utilize a 4-10 schedule.

### **3.04.15 CONSTRUCTION SCHEDULE**

#### **3.04.15(1) Progress Schedule**

- a. The Contractor shall submit to the Engineer four copies of a progress schedule no later than at the preconstruction conference, or some other mutually agreed upon submittal time. The schedule shall be a critical path method (CPM) schedule, bar chart, or other standard schedule format unless otherwise specified in the Technical Specifications. Regardless of which format is used, the schedule shall identify the critical path. The Engineer will evaluate the schedule and return the schedule for corrections. No progress payments will be made until the required progress schedules have been submitted in a form acceptable to the Engineer.
- b. Scheduling terms and practices shall conform to the standards established in Construction Planning and Scheduling, Second Edition, published by the Associated General Contractors of America. Except for Weekly Look-Ahead Schedules, all schedules shall meet these general requirements, and provide the following information:
  - i. Show the construction start date.
  - ii. Include all activities necessary to physically complete the Work on the project.
  - iii. Show the planned order of Work activities in a logical sequence.
  - iv. Show the durations of Work activities in working days as defined in Section 3.04.13 and 3.04.14.

- v. Show activities in durations that are reasonable for the intended Work.
- vi. Define activity duration in sufficient detail to evaluate the progress of individual activities on a daily basis.
- vii. Show the Substantial and Physical Completion of all Work within the Contract Time.

Total float belongs to the project and shall not be for the exclusive benefit of any party. If the Engineer determines that the Progress Schedule or any necessary Schedule Update does not provide the required information, then the schedule will be returned to the Contractor for correction and resubmittal.

- c. Each week the Work is performed, the Contractor shall submit a Weekly Look-Ahead Schedule showing the Contractor's and all the Subcontractors' proposed Work activities for the next two weeks. The Weekly Look Ahead Schedule shall include the description, duration and sequence of Work, along with the planned hours of Work. This schedule may be network schedule, bar chart, or other standard schedule format. The Weekly Look-Ahead Schedule shall be submitted to the Engineer by the mid-point of the week preceding the scheduled Work or some other mutually agreed upon submittal time.
- d. The Engineer may request a Schedule Update when any of the following events occur:
  - i. The project has experienced a change that affects the critical path.
  - ii. The sequence of Work is changed from that in the approved schedule.
  - iii. The project is significantly delayed.
  - iv. Upon receiving an extension of Contract Time.

The Contractor shall submit four copies of the Schedule Update within 15 calendar days of receiving a written request, or when an update is required by any other portion of the Contract. A "significant" delay in time is defined as 10 working days or 10 percent of the original Contract Time, whichever is greater.

In addition to the other requirements in this Section, Schedule Updates shall reflect the following information:

- v. The actual duration and sequence of as-constructed Work activities, including changed Work.
- vi. Approved time extensions.

- vii. Any construction delays or other conditions that affect the progress of the Work.
- viii. Any modifications to the as-planned sequence or duration of remaining activities.
- ix. The Substantial and Physical Completion of all remaining Work in the remaining Contract Time.

Unresolved request for time extensions shall be reflected in the Schedule Update by assuming no time extension will be granted, and by showing the effects to follow-on activities necessary to substantially and physically complete the project within the currently authorized time for completion.

- e. The original Progress Schedule and all Schedule Updates shall not conflict with any time and order-of-work requirement in the Contract.
- f. If the Engineer deems that the original or any necessary supplemental progress schedule does not provide the information required in this section, the Owner may withhold progress payments until a schedule containing the required information has been submitted by the Contractor and accepted by the Engineer.
- g. The Contractor shall comply with other progress schedule requirements that are further defined in the Technical Specifications.
- h. The Engineer's approval of any schedule shall not transfer any of the Contractor's responsibilities to the Owner. The Contractor alone shall remain responsible for adjusting forces, equipment, and work schedules to ensure completion of the Work within the time(s) specified in the Contract.

#### **3.04.15(2) Extensions of the Contract Time**

- a. The Contractor specifically waives claims for damages for any hindrance or delay, excepting unreasonable delays caused by the Owner. In lieu thereof, the Contractor will be granted equitable extensions of the Contract Time for which liquidated damages will not otherwise be claimed by the Owner under the following circumstances:
  - i. A delay caused by any suit or other legal action against the Owner will entitle the Contractor to an equivalent extension of time, unless the period of such delay exceeds 90 calendar days. When such period is exceeded, the Owner will, upon written request of the Contractor, either negotiate a termination of the Contract or grant a further extension of the Contract Time, whichever is in the best interests of the Owner.
  - ii. Should any other unforeseen condition occur that is beyond the reasonable control of Contractor, requires more time for the Contractor to complete the

performance of the Work by the Substantial Completion Date, the Contractor shall notify the Owner and the Engineer in writing prior to the performance of such Work, and in any event within 10 calendar days after the occurrence of the unforeseen condition. The notice shall set forth in detail the Contractor's estimate of the required time extension. The Owner will allow such equitable extension of the Contract Time that the Engineer determines to be appropriate. Failure to comply with the notice provisions required by the Contract shall be deemed a complete waiver of any entitlement to adjustment of the Contract Time.

### **3.04.15(3) Liquidated Damages**

- a. The Contractor acknowledges that the Owner will suffer monetary damages in the event of an unexcused delay in the Substantial Completion Date and the Physical Completion Date of the Work. If the Contractor fails, without excuse under the Contract, to complete the Work within the Contract Time, or any proper extension thereof granted by the Owner, the Contractor agrees to pay to the Owner the amount specified in the Proposal form, not as a penalty, but as liquidated damages for such breach of the Contract, for each day that the Contractor shall be in default after the time stipulated for the Substantial Completion Date and the Physical Completion Date of the Work.
- b. The amount of liquidated damages is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is specifically agreed to be a reasonable approximation of damages that the Owner would sustain as a result of an unexcused delay in the Substantial Completion Date and the Physical Completion Date; said amount may be retained from time to time by the Owner from current progress payments.

### **3.04.16 COMPLETION AND ACCEPTANCE OF THE WORK**

#### **3.04.16(1) Substantial Completion Date**

- a. When the Contractor considers the Work to be substantially complete and ready for its intended purpose, the Contractor shall notify the Engineer in writing and include an itemized list of remaining Work to be completed. On the Substantial Completion Date, the Owner shall have full and unrestricted use and benefit of all of the facilities that comprise the Work, both from an operational and safety standpoint, with only minor incidental work, replacement of temporary substitute facilities, or correction or repair of work remaining for the physical completion of the total Work.
- b. If the Engineer determines that the Work is not substantially complete, it will so notify the Contractor in writing identifying those items of the Work that shall be completed by the Contractor in order to achieve the Substantial Completion Date.

- c. If the Engineer believes that the Work is substantially complete, the Engineer will meet with the Contractor to: (1) prepare a list of incomplete or unsatisfactory items of the Work that shall be completed or corrected; (2) define the division of responsibility between Owner and Contractor with respect to security, operation, maintenance, heat, utilities, insurance, etc., for the facilities; and (3) describe any other issues related to approval of the substantially completed Work. Upon reaching agreement with the Contractor, the Engineer will notify the Owner that, in its opinion and based on the information supplied by the Contractor, the Work is substantially complete, listing the items of incomplete Work, defining the division of responsibilities for the facilities, and setting forth any other terms related to final completion and acceptance.
- d. The Owner, who has sole authority to make the determination of the Substantial Completion Date, will review the Engineer's recommendation that the Work is substantially complete and, if it concurs, will instruct the Engineer to notify the Contractor that the Work is accepted as being substantially complete. Except for any portion(s) of Work specified for early completion or required by the Owner for early possession, substantial completion will not occur for any portion of the Work until the entire Work is ready for possession and use. The approval notice will include a list of incomplete Work items, establish the Substantial Completion Date, and describe any other terms relating to such approval. The Contractor shall acknowledge receipt of the approval notice in writing, indicating acceptance of all of its terms and provisions.
- e. The date of Substantial Completion, as determined by the Engineer and agreed to by the Owner, shall be the date for the beginning of the warranty period.
- f. Subsequent to the Substantial Completion Date, the Owner may exclude the Contractor from the Work during such periods when construction activities might interfere with the operation of the project. The Owner, however, shall allow the Contractor reasonable access for completion of incomplete punch list items.

#### **3.04.16(2) Physical Completion Date**

- a. The Contractor shall complete all physical Work within the Contract Time.
- b. Upon physical completion of the Work, including completion of all corrective Work described in Section 3.04.16(1) above and the submission of all required record drawings, operation and maintenance manuals, manufacturers' affidavits, software and programming, and other items required by the Contract, the Contractor shall notify the Engineer in writing that the Work is physically complete. Upon receipt of the notification, the Engineer will determine if the Work is physically complete in accordance with the Contract. If the Engineer determines that any materials, equipment, or workmanship do not meet the requirements of the Contract, the Engineer will prepare a list of such items and submit it to the Contractor. Following the satisfactory completion of the corrective Work by the

Contractor, the Engineer will notify the Owner that the Work is physically complete in accordance with the requirements of the Contract.

- c. The Engineer, with the concurrence of the Owner, will give the Contractor written notice of the Physical Completion Date for all of the Work. The Physical Completion Date shall not constitute the Owner's acceptance of the Work.

**3.04.16(3) Contract Completion Date (Acceptance of the Project)**

- a. When all of the Contractor's obligations under the Contract have been performed satisfactorily, the Owner will provide the Contractor with written notice of the Contract Completion Date. The following events shall occur in order for the Contractor to achieve the Contract Completion Date:
  - 1. The Contractor shall have achieved the Substantial Completion Date and the Physical Completion Date for the Work; and
  - 2. The Contractor shall furnish all documentation required by the Contract and required by law. The documents shall include, but are not limited to, the following:
    - i. Complete and legally effective releases and/or waivers of liens or bond or retainage claims in a form acceptable to the Owner. Subject to prior approval of the Owner, the Contractor may, if approved by the Owner, submit in lieu of the lien or claims releases and waivers: (1) receipts showing payment of all accounts in full; (2) an affidavit that the release and receipts cover all labor, services, materials, and equipment for which a lien or other claim could be filed and that all payrolls, material, and equipment bills and other indebtedness connected with the Work for which the Owner or the Owner's property might in any way be responsible, have been paid; and (3) the consent of the surety, if any, to final payment. If any Subcontractor or supplier fails to furnish a release waiver or receipt in a form satisfactory to the Owner, the Contractor may be permitted by the Owner to furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any lien or similar claim;
    - ii. Certified Payrolls (Federal Aid projects or if requested);
    - iii. Final Contract Voucher Certification.
    - iv. Affidavits of Wages Paid for the Contractor and all Subcontractors must be submitted to the Owner.
- b. The Contractor agrees that neither completion nor final acceptance shall relieve the Contractor of the responsibility to indemnify, defend, and protect the Owner against any claim or loss resulting from the failure of the Contractor (or the Subcontractors

or lower tier Subcontractors) to pay all laborers, mechanics, Subcontractors, materialpersons, or any other person who provides labor, supplies, or provisions for carrying out the Work or for any payments required for unemployment compensation under Title 50 RCW or for industrial insurance and medical aid required under Title 51 RCW.

Final acceptance shall not constitute acceptance of any unauthorized or defective work or material. The Owner shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or material or from recovering damages for any such work or material.

#### **3.04.16(4) Use of Completed Portions of the Work**

The Owner reserves the right to use and occupy any portion of the Work which has been completed sufficiently to permit partial use and occupancy, and such partial use and occupancy shall not be construed as an acceptance of the Work as a whole or any part thereof. Any claims that the Owner may have against the Contractor shall not be deemed to have been waived by such partial use and occupancy.

#### **3.04.16(5) Waiver of Claims by Contractor**

The Contractor's acceptance of the final payment from the Owner constitutes an irrevocable and complete waiver of any and all claims against the Owner under the Contract or otherwise arising from the Work, except for those claims that have been properly identified in writing in advance of final payment, and for which timely and sufficient prior written notice has been given, all in accordance with the Contract.

#### **3.04.17 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT**

The Owner's final payment to the Contractor shall not relieve the Contractor of responsibility for faulty materials, equipment or workmanship. The Contractor shall promptly repair or replace any such defects discovered within the warranty or other applicable limitations period.

#### **3.04.18 RETAINAGE**

1. Pursuant to RCW 60.28, there will be retained from monies earned by the Contractor on progress estimates a sum not to exceed 5 percent of the monies earned by the Contractor. Such retainage shall be used as a trust fund for the protection and payment (1) to the State with respect to taxes imposed pursuant to RCW Title 82, which may be due from such Contractor, and (2) the claims of any other person or entity arising under the Contract or RCW 60.28.
2. Monies retained pursuant to RCW 60.28 shall, at the option of the Contractor, be:
  - a. Retained in a fund by the Owner;

- b. Deposited by the Owner in an interest-bearing account in a bank, mutual savings bank, or savings and loan association (interest on monies so retained may be paid to the Contractor);
- c. Deposited by the Owner in an escrow (interest-bearing) account in a bank, mutual saving bank, or savings and loan association (interest on monies so retained shall be paid to the Contractor). Deposits are to be in the name of the Owner and are not to be allowed to be withdrawn without the Owner's written authorization. The Owner will issue a check representing the sum of the monies reserved, payable to the bank or trust company;
- d. In choosing option (b) or (c), the Contractor agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retainage in securities.

At the time the Contract is executed the Contractor shall designate the option desired.

- 3. Release of retainage will be made within the statutory period following the last date for filing of claims pursuant to RCW Chapter 60.28, provided that the following conditions are met:
  - a. A release has been obtained from the Washington State Department of Revenue;
  - b. A "Certificate of Payment of Contributions Penalties and Interest on Public Works Contract" is received from the Washington State Employment Security Department;
  - c. The Washington State Department of Labor and Industries indicates the Contractor is current on the payment of industrial insurance and medical aid premiums;
  - d. All claims by the Owner against the Contractor have been resolved;
  - e. No claims have been filed against the retained percentage;
  - f. All required "Affidavits of Wages Paid" are on file with the Owner for the Contractor and all Subcontractors, regardless of tier;
- 4. In the event that claims are filed against the retainage, the Contractor will be paid the retained percentage less an amount sufficient to pay all such claims, together with a sum determined by the Owner to be sufficient to pay the costs of foreclosing on claims and to attorneys' fees, all in accordance with applicable law.

## **3.05 DISPUTES AND CLAIMS**

### **3.05.1 DISPUTES**

When disputes occur, the Contractor shall pursue resolution through the Engineer. The Contractor shall follow the notice and protest procedures outlined in Section 3.04. If negotiation using the procedures outlined in Section 3.04 fails to provide satisfactory resolution, the Contractor shall pursue the more formalized method set forth in Section 3.05.2 for submitting claims.

### **3.05.2 CLAIMS**

If the Contractor contends that additional payment is due, has provided timely notices and protests as required by Section 3.04, and the Contractor has pursued and exhausted all of the means provided in that section to resolve the dispute, the Contractor may submit a claim as provided in this Section. Any claim for an increase in the Contract price or for an extension of the Contract Time by the Contractor is waived if the written notifications and protests required in Section 3.04 have been not provided, or if the Engineer is not afforded reasonable access to the Contractor's complete records relating to the claim, as required by Section 3.04.8, or if a claim is not submitted in accordance with the requirements of this Section. The fact that the Contractor has provided proper notification, properly submitted a claim, or provided the Engineer with access to records, shall not in any way be construed as proving or substantiating the validity of the claim. If, after consideration by the Owner, the claim is found to have merit, the Owner will make an equitable adjustment to either the Contract price, the Contract Time, or both. If the Owner finds the claim to be without merit, no adjustment will be made.

All claims submitted by the Contractor shall be in writing and in sufficient detail to enable the Engineer to ascertain the basis for and amount of the claim. All claims shall be submitted to the Engineer in the manner in Section 3.03.6. The following information shall accompany each claim submitted:

1. A detailed factual statement of the basis for the claim for additional compensation and/or extension of time, including all relevant dates, locations, and items of work relating to the claim.
2. The date on which the events occurred that give rise to the claim.
3. The name of each person involved in or having knowledge about the claim.
4. The specific provisions of the Contract which support the claim and a statement of the reasons why such provisions support the claim.
5. If the claim relates to a decision of the Engineer that the Contract leaves to the Engineer's discretion or as to which the Contract provides that the Engineer's decision is final, the Contractor shall set out in detail all facts supporting its position relating to the decision of the Engineer.

6. The identification of any documents and the substance of any oral communications that support the claim.
7. Copies of any identified documents, other than Owner documents and documents previously furnished to the Owner by the Contractor, that support the claim (manuals which are standard to the industry may be included by reference).
8. If an extension of the Contract Time is sought:
  - a. The specific days and dates for which the extension is sought;
  - b. The specific reasons why the Contractor believes a time extension should be granted;
  - c. The specific provisions of Section 3.04.15(2) under which the time extension is sought; and
  - d. An analysis of the Contractor's progress schedule, demonstrating the reasons why a time extension should be granted.
9. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:
  - a. Labor;
  - b. Materials;
  - c. Direct equipment. The actual cost for each piece of equipment for which a claim is made, or, in the absence of actual cost, the rates established by the AGC/WSDOT Equipment Rental Agreement which was in effect when the Work was performed. The amounts claimed for any piece of equipment shall not exceed the rates established by the Equipment Rental Agreement, even if the actual cost for such equipment is higher. The Owner may audit the Contractor's cost records, as provided in Section 3.06, to determine actual equipment costs. The following information shall be provided for each piece of equipment:
    - i. Detailed description (e.g., make, model, year, diesel or gas, size of bucket);
    - ii. The hours of use or standby; and
    - iii. The specific day and dates of use or standby.
  - d. Subcontractor claims (in the same level of detail as specified herein); and
  - e. Other information as requested by the Engineer or the Owner.

10. A notarized statement containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

\_\_\_\_\_, \_\_\_\_\_  
(name) (title)

of \_\_\_\_\_  
(company)

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this Contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the Contract between the parties.

If the claim for extra time and/or compensation involves any work of a Subcontractor or lower tier Subcontractor, the undersigned duly authorized agent of the Contractor hereby swears that Contractor has investigated the basis for the Subcontractor's or lower tier Subcontractor's claims and has determined that all such claims are justified as to entitlement and amount of money and/or time requested, has reviewed and verified the adequacy of all back-up documentation and has no reason to believe and does not believe that the factual basis for the Subcontractor's or lower tier Subcontractor's claim is falsely represented.

Dated \_\_\_\_\_/s/\_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_

\_\_\_\_\_  
Notary Public

My Commission Expires:\_\_\_\_\_

It will be the responsibility of the Contractor to keep full and complete records of the costs and additional time incurred with respect to any claim. The Contractor shall permit the Engineer to have access to those records and any other records and documents as may be required by the Engineer to determine the facts or contentions involved in the claim. The Contractor shall retain all records and documents in any way relating to the Work for a period of not less than three years after the Contract Completion Date.

The Contractor shall in good faith attempt to reach a negotiated resolution of all claims with the Engineer or its designee.

The Contractor's failure to submit with the Final Contract Voucher Certification a list of all claims, together with the information and details required by this Section shall operate as a waiver of the claims by the Contractor, as provided in

Section 3.04.12(9).

If the Contractor submits a claim in full compliance with all the requirements of this Section, the Owner will respond in writing to the claim as follows:

1. Within 45 calendar days from the date the claim is received by the Owner, if the claim amount is less than \$100,000;
2. Within 90 calendar days from the date the claim is received by the Owner, if the claim amount is equal to or greater than \$100,000; or
3. If these time periods are unreasonable due to the complexity of the claim, the Contractor will be notified within 15 calendar days from the date the claim is received by the Owner of the amount of time which will be necessary for the Owner to evaluate the claim and issue a response.

Full compliance by the Contractor with the provisions of this Section is a condition precedent to the Contractor's right to commence a lawsuit or pursue other legal remedies.

### **3.05.3 TIMELINE AND JURISDICTION**

For the convenience of the parties to the Contract it is mutually agreed by the parties that any claims or causes of action which the Contractor has against the Owner arising from the Contract shall be brought within 180 calendar days from the date of Physical Completion (Section 3.04.16(2)) of the Contract by the Owner; and it is further agreed that any such claims or causes of action shall be brought only in the Superior Court of the county where the Owner headquarters is located, provided that where an action is asserted against a county, RCW 36.01.05 shall control venue and jurisdiction. The parties understand and agree that the Contractor's failure to bring suit within the time period provided, shall be a complete bar to any such claims or causes of action. It is further mutually agreed by the parties that when any claims or causes of action which the Contractor asserts against the Owner arising from the Contract are filed with the Owner or initiated in court, the Contractor shall permit the Owner to have timely access to any records deemed necessary by the Owner to assist in evaluating the claims or action.

### **3.05.4 CONTINUATION OF WORK PENDING RESOLUTION OF DISPUTES**

The Contractor shall expeditiously carry on the Work, adhere to the progress schedule, and comply with all written directives of the Owner or the Engineer regardless of any dispute or claim that may exist between the Owner and the Contractor. No Work shall be delayed or postponed pending resolution of any dispute or claim. Failure or refusal of the Contractor to comply with the written directives of the Owner or the Engineer shall constitute a material breach of the Contract and immediately constitute grounds for the Owner to withhold payments to the Contractor, suspend the Work or terminate the Contract. Notice under this Section shall be in accordance with other provisions of the Contract.

### **3.06 AUDITS**

If the Contractor requests an equitable adjustment to either the Contract price or the Contract Time, the Owner shall have the right to audit the Contractor's books, records, other documents, and accounting practices and procedures, and to inspect the Contractor's plant, equipment and facilities to examine all facts and verify all direct and indirect costs of whatever nature claimed to have been incurred or are anticipated to be incurred. The right to audit encompasses all subcontracts and is binding upon Subcontractors. All subcontracts that the Contractor enters into shall contain a clause allowing the Owner to audit all Subcontractor books, records, other documents, and accounting practices and procedures, and to inspect the Subcontractor's plant, equipment and facilities. All audits shall be performed by auditors of the Owner during normal working hours at the Contractor's or Subcontractor's office or any other location mutually agreed upon. The Contractor, Subcontractor, or lower tier Subcontractor shall cooperate fully with the auditor and shall make available all required information. Failure to cooperate or provide requested information shall be grounds for denial of the claim.

### **3.07 SUSPENSION OF WORK AND TERMINATION OF CONTRACT**

#### **3.07.1 SUSPENSION OF WORK**

1. The Owner or the Engineer may order suspension of all or any part of the Work if:
  - a. Unsuitable or other conditions that are beyond the reasonable control of the Contractor exist or arise that prevent satisfactory and timely performance of the Work; or
  - b. The Contractor does not comply with the Contract; or
  - c. It is in the public interest.
2. If the Engineer determines that the suspension is for reasons set forth in Subsection a. or c. above, an equitable adjustment will be made in the Contract Time but not the Contract price. If the Engineer determines that the suspension is for reasons set forth in Subsection b. above, no adjustment shall be made in the Contract Time or the Contract price.
3. If the Contract is suspended for reasons set forth in Subsection a. or c. above and the Contractor believes that the suspension of performance of all or part of the Work has continued for an unreasonable period of time, the Contractor shall give written notice to the Engineer of its intention to seek an equitable adjustment in the Contract Time or the Contract price. In the event that an equitable adjustment is allowed, no adjustment shall be allowed for any time lost or costs incurred more than 10 calendar days before delivery of the written notice to the Engineer. No profit of any kind will be allowed on any increase in costs due to the suspension, delay or interruption.

### **3.07.2 TERMINATION FOR DEFAULT**

1. The Owner may terminate the Contract for default, effective seven days following delivery of written notice of default to the Contractor, if the Contractor:
  - a. Refuses or fails to supply enough properly skilled laborers or conforming materials to complete the Work in a timely manner;
  - b. Refuses or fails to prosecute the Work with such diligence as will ensure its physical completion by the Physical Completion Date;
  - c. Performs work which deviates from the requirements of the Contract and refuses or fails to correct the non-conforming work;
  - d. Fails to make prompt payment to Subcontractors and/or suppliers for labor or materials;
  - e. Fails to comply with laws, ordinances, rules, regulations or orders of a public authority having jurisdiction; or
  - f. Otherwise fails to follow written directives of the Owner or the Engineer or is in default of a material provision of the Contract.
2. If the Contractor abandons the Work for any cause other than failure of the Owner to make monthly progress payments for Work properly performed, or if the Contractor refuses to comply with requirements of the Contract, the Owner has the additional right to notify the Contractor's performance bond surety and require the surety to complete the Work in accordance with the Contract.

### **3.07.3 TERMINATION FOR CONVENIENCE OF THE OWNER**

The Owner may by written notice terminate the Contract at any time in whole or in part, without cause, and except where termination is due to the Contractor's default, the Owner shall pay the Contractor that portion of the Contract price corresponding to the acceptable Work completed to the Owner's satisfaction, together with reasonable costs, as determined in the sole discretion of the Owner, necessarily incurred by the Contractor in terminating the remaining portion of Work, less any payments made before termination. In no event shall the Owner be required to pay the Contractor any amount in excess of the completed portion Contract price. The Owner shall not be required to pay the Contractor any amount for consequential damages including but not by means of limitation lost or anticipated profits on Work that is not performed as a result of termination.

### **3.07.4 RESPONSIBILITY OF THE CONTRACTOR AND SURETY**

Termination of the Contract shall not relieve the Contractor of any responsibilities under the Contract for Work performed. Nor shall termination of the Contract relieve the sureties of their obligations under the bonds required or permitted by the Contract or applicable law.

## **PART 4**

### **ECOLOGY SRF INSERTS**



**WASHINGTON STATE DEPARTMENT OF ECOLOGY**  
**WATER POLLUTION CONTROL REVOLVING FUND**

**SPECIFICATIONS INSERT**

Revised 1/22/21

The following clauses will be incorporated into construction contracts receiving financial assistance from the Washington State Department of Ecology Water Pollution Control Revolving Fund. In the event of conflict within the contract these clauses shall take precedence

**Required Bid Submittals**

The following submittals are required to be submitted with the bid proposal:

- Certification Of Nonsegregated Facilities (attachment 3)
- DBE Subcontractor Utilization Form (EPA Form 6100-4)
- One copy of DBE Subcontractor Performance Form (EPA Form 6100-3) for each DBE subcontractor.
- Complete Bidders List.

**Compliance with State and Local Laws**

The Contractor shall assure compliance with all applicable federal, state, and local laws, requirements, and ordinances as they pertain to the design, implementation, and administration of the approved project.

**State Interest Exclusion**

It is anticipated that this project will be funded in part by the Washington State Department of Ecology . Neither the State Of Washington nor any of its departments or employees are, or shall be, a party to this contract or any subcontract.

**Third Party Beneficiary**

Partial funding of this project is being provided through the Washington State Department of Ecology Water Pollution Control Revolving Fund. All parties agree that the State of Washington shall be, and is hereby, named as an express third-party beneficiary of this contract, with full rights as such.

**Access to the construction site and to records**

The contractor shall provide for the safe access to the construction site and to the contractor's records by Washington State Department of Ecology and Environmental Protection Agency (EPA) personnel.

The Contractor shall maintain accurate records and accounts to facilitate the Owner's audit requirements and shall ensure that all subcontractors maintain auditable records.

These Project records shall be separate and distinct from the Contractor's other records and accounts.

All such records shall be available to the Owner and to Washington State Department of Ecology and EPA personnel for examination. All records pertinent to this project shall be retained by the Contractor for a period of three (3) years after the final audit.

### **Protection of the Environment**

No construction related activity shall contribute to the degradation of the environment, allow material to enter surface or ground waters, or allow particulate emissions to the atmosphere, which exceed state or federal standards. Any actions that potentially allow a discharge to state waters must have prior approval of the Washington State Department of Ecology.

### **Funding Recognition**

All site-specific projects must have a sign of sufficient size to be seen from nearby roadways acknowledging department financial assistance and left in place throughout the life of the project. Department logos must be on all signs and documents. Logos will be provided as needed.

### **Inadvertent Discovery Of Archeological Resources**

The contractor shall obtain a copy of the Inadvertent Discovery Plan from the Project Owner. The contractor shall keep a copy of the inadvertent discovery plan for the project on the work site at all times. The contractor shall immediately stop all work if human remains, cultural, or archeological resources are discovered in the course of construction. The contractor shall follow the inadvertent discovery plan in dealing with the human remains, cultural, or archeological resources.

### **Use Of American Iron And Steel**

This provision applies to projects for the construction, alteration, maintenance, or repair of a "treatment works" as defined in the Federal Water Pollution Control Act (33 USC 1381 et seq.). This provision does not apply if the engineering plans and specifications for the project were approved by the Ecology prior to January 17, 2014.

The Contractor acknowledges to and for the benefit of the Project Owner and the State of Washington that it understands the goods and services under this Agreement are being funded with monies made available by the Water Pollution Control Revolving Fund which contains provisions commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project be produced in the United States ("American Iron and Steel Requirements") including iron and steel products provided by the Contractor pursuant to this Agreement. "Iron and Steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

The Contractor hereby represents and warrants to and for the benefit of the Project Owner and the State that:

- (a) the Contractor has reviewed and understands the American Iron and Steel Requirements,
- (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirements, unless a waiver of the requirements is approved, and
- (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirements, as may be requested by the Project Owner or the State.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Project Owner or State to recover as damages against the Contractor any loss, expense or cost (including without limitation attorney's fees) incurred by the Project Owner or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Project Owner). While the Contractor has no direct contractual privity with the State, as a lender to the Project Owner for the funding of its project, the Project Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of the Agreement necessary to give this paragraph force or effect shall be amended or waived without the prior written consent of the State.

### **Prevailing Wage**

The work performed under this contract is subject to the wage requirements of the Davis-Bacon Act. The Contractor shall conform to the wage requirements prescribed by the federal Davis-Bacon and Related Acts which requires that all laborers and mechanics employed by contractors and subcontractors performing on contracts funded in whole or in part by SRF appropriations in excess of \$2000 pay their laborers and mechanics not less than the prevailing wage rates and fringe benefits, and determined by the Secretary of Labor, for corresponding classes of laborers and mechanics employed on similar projects in the area. Attachment 1 to this specification insert and an up to date wage determination shall be included in full into this contract and in any subcontract in excess of \$2,000. Wage determinations can be found at <http://www.wdol.gov>.

The Contractor agrees that the Contractor is legally and financially responsible for compliance with the Davis-Bacon Act wage rules. All laborers and mechanics employed by contractors and subcontractors employed as part of this contract shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code.

### **Certification Regarding Suspension, Debarment, Ineligibility Or Voluntary Exclusion**

1. The CONTRACTOR, by signing this agreement, certifies that it is not suspended, debarred, proposed for debarment, declared ineligible or otherwise excluded from contracting with the federal government, or from receiving contracts paid for with federal funds. If the CONTRACTOR is unable to certify to the statements contained in the certification, they must provide an explanation as to why they cannot.

2. The CONTRACTOR shall provide immediate written notice to the Department if at any time the CONTRACTOR learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.
3. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department for assistance in obtaining a copy of those regulations..
4. The CONTRACTOR agrees it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under the applicable Code of Federal Regulations, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction.
5. The CONTRACTOR further agrees by signing this agreement, that it will include this clause titled “Certification Regarding Suspension, Debarment, Ineligibility Or Voluntary Exclusion” without modification in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
6. Pursuant to 2CFR180.330, the CONTRACTOR is responsible for ensuring that any lower tier covered transaction complies with certification of suspension and debarment requirements.
7. CONTRACTOR acknowledges that failing to disclose the information required in the Code of Federal Regulations may result in the delay or negation of this funding agreement, or pursuance of legal remedies, including suspension and debarment.
8. CONTRACTOR agrees to keep proof in its agreement file, that it, and all lower tier recipients or contractors, are not suspended or debarred, and will make this proof available to the Department upon request. RECIPIENT/CONTRACTOR must run a search in <http://www.sam.gov/> and print a copy of completed searches to document proof of compliance.

This term and condition supersedes EPA Form 5700-49, “Certification Regarding Debarment, Suspension, and Other Responsibility Matters.”

### **Disadvantaged Business Enterprises**

#### **General Compliance (40 CFR Part 33).**

The contractor shall comply with the requirements of the Environmental Protection Agency’s Program for Participation By Disadvantaged Business Enterprises (DBE) 40 CFR Part 33.

#### **Non-discrimination Provision (40CFR Appendix A to Part 33).**

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR

part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

The contractor shall comply with all federal and state nondiscrimination laws, including, but not limited to Title VI and VII of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and Chapter 49.60 RCW, Washington's Law Against Discrimination, and 42 U.S.C. 12101 et seq, the Americans with Disabilities Act (ADA).

Six Good Faith Efforts (40 CFR Part 33 Subpart C).

The contractor agrees to make the following good faith efforts whenever procuring subcontracts, equipment, services and supplies. The contractor shall retain records documenting compliance with the following six good faith efforts.

1. Ensuring Disadvantaged Business Enterprises are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing Disadvantaged Business Enterprises on solicitation lists and soliciting them whenever they are potential sources. Qualified Women and Minority business enterprises may be found on the Internet at [www.omwbe.wa.gov](http://www.omwbe.wa.gov) or by contacting the Washington State Office of Minority and Women's Enterprises at (866) 208-1064.
2. Making information on forthcoming opportunities available to Disadvantaged Business Enterprises and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by Disadvantaged Business Enterprises in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of thirty (30) calendar days before the bid or proposal closing date.
3. Considering in the contracting process whether firms competing for large contracts could subcontract with Disadvantaged Business Enterprises. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by Disadvantaged Business Enterprises in the competitive process.
4. Encourage contracting with a consortium of Disadvantaged Business Enterprises when a contract is too large for one of these firms to handle individually.
5. Using services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.
6. If the prime contractor awards subcontracts, requiring the subcontractors to take the six good faith efforts in paragraphs 1 through 5 above.

MBE/WBE Reporting (40 CFR Part 33 Parts 33.302, 33.502 and 33.503).

1. The contractor shall complete the DBE Subcontractor Utilization Form (EPA Form 6100-4).
2. The contractor shall require all DBE subcontractors to complete the DBE Subcontractor Performance Form (EPA Form 6100-3). The DBE Subcontractor Performance Form is only required to be completed by certified DBE subcontractors.

3. The contractor shall submit DBE Subcontractor Utilization Form (EPA Form 6100-4) and all completed DBE Subcontractor Performance Form(s) (EPA Form 6100-3) as part of the bid, or within one hour after the published bid submittal time (consistent with RCW 39.30.060)
4. The contractor shall provide DBE Subcontractor Participation Form (EPA Form 6100-2) to all DBE subcontractors. These subcontractors may submit Subcontractor Participation Form (EPA Form 6100-2) to the EPA Region 10 DBE coordinator in order to document issues or concerns with their usage or payment for a subcontract.

The 6100 forms can be found at:

<https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans/Facility-project-resources>

#### **Bidders List (40 CFR Part 33 part 33.501)**

All bidders shall submit the following information for all firms that bid or quote on subcontracts (including both DBE and non-DBE firms) as part of the bid, or within one hour after the published bid submittal time (consistent with RCW 39.30.060).

1. Firm's name with point of contact;
2. Firm's mailing address, telephone number, and e-mail address;
3. The work on which the firm bid or quoted, and when the firm bid or quoted; and
4. Firm's status as an MBE/WBE or non-MBE/WBE.

#### **Contract Administration Provisions (40 CFR part 33.302).**

The contractor shall comply with the contract administration provisions of 40 CFR, Part 33.302.

1. The contractor shall pay its subcontractor for satisfactory performance no more than 30 days from the contractor's receipt of payment.
2. The contractor shall notify the owner in writing prior to any termination of a DBE subcontractor.
3. If a DBE subcontractor fails to complete work under the subcontract for any reason, the contractor shall employ the six good faith efforts when soliciting a replacement subcontractor.
4. The contractor shall employ the six good faith efforts even if the contractor has achieved its fair share objectives.

#### **Equal Opportunity (EEO)**

If this Contract exceeds \$10,000, the Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60.

Contractor's compliance with Executive Order 11246 shall be based on implementation of the Equal Opportunity Clause, and specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4.

Equal Opportunity Clause (41 CFR part 60-1.4(b))

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.
3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
7. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to

enter into such litigation to protect the interests of the United States.

Federal Equal Employment Opportunity Construction Contract Specifications  
(Executive Order 11246 and 41 CFR part 60-4.3)

1. As used in these specifications:
  - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
  - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
  - c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
  - d. "Minority" includes:
    - i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
    - ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
    - iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
    - iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction

contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
  - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
  - b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
  - c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
  - d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
  - e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading

programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.
- l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
- n. Ensure that all facilities and company activities are nonsegregated except that

- separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
  - p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.
  9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).
  10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
  11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
  12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
  13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
  14. The Contractor shall designate a responsible official to monitor all employment related

activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

#### Reporting Requirements (EEO-1)

On or before September 30 of each year, a contractor that is subject to Title VII of the Civil Rights Act of 1964, as amended, and that has 100 or more employees, shall file with the EEOC or its delegate an "Employer Information Report EEO-1". Instructions on how to file are available on the EEOC's website at <http://www.eeoc.gov/employers/eeo1survey/howtofile.cfm>. The contractor shall retain a copy of the most recent report filed.

#### Segregated Facilities (41 CFR part 60-1.8)

The contractor shall ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensuring that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. This obligation extends to all contracts containing the equal opportunity clause regardless of the amount of the contract. The term "facilities," as used in this section, means waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, wash rooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees; Provided, That separate or single-user restrooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

#### Attachments:

1. Wage Rate Requirements For Subrecipients
2. Current Wage Rate Determination (to be provided by project owner)
3. Certification Of Nonsegregated Facilities
4. Notice To Labor Unions Or Other Organization Of Workers: Non-Discrimination In Employment

EPA Form 6100-4, EPA Form 6100.3, EPA Form 6100-2

## **ATTACHMENT 1 - WAGE RATE REQUIREMENTS FOR SUBRECIPIENTS. (To be included in full in any contract in excess of \$2,000)**

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Lorraine Fleury at [fleury.lorraine@epa.gov](mailto:fleury.lorraine@epa.gov) or at 215-814-2341 of EPA, Region III Grants and Audit Management Branch for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <http://www.dol.gov/whd/>

### **1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.**

Under the FY 2013 Appropriations Act, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

### **2. Obtaining Wage Determinations.**

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor [www.wdol.gov](http://www.wdol.gov) on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from [www.wdol.gov](http://www.wdol.gov) into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

### **3. Contract and Subcontract provisions.**

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2012 Appropriations Act , the following clauses:

#### **(1) Minimum wages.**

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, [www.wdol.gov](http://www.wdol.gov).

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably

anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional

Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/programs/dbra/wh347.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and

Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

#### **4. Contract Provision for Contracts in Excess of \$100,000.**

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act.

These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

## **5. Compliance Verification**

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/whd/america2.htm>.

## **ATTACHMENT 2**

### **DAVIS-BACON WAGE RATE DETERMINATION**

See Part 6 For Wage Rates

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## **ATTACHMENT 3**

### **CERTIFICATION OF NONSEGREGATED FACILITIES**

(Applicable to federally assisted construction contracts and related subcontracts exceeding \$10,000 which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certified, further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract.

As used in this certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or area, in fact, segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed contractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such, certification in this file.

Signature

Date

Name and title of signer (please type)

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

## **ATTACHMENT 4**

### **NOTICE TO LABOR UNIONS OR OTHER ORGANIZATION OF WORKERS: NON-DISCRIMINATION IN EMPLOYMENT**

TO: \_\_\_\_\_  
(name of union or organization of worker)

The undersigned currently holds contract(s) with \_\_\_\_\_  
(name of applicant)  
\_\_\_\_\_ involving funds or credit of the U.S. Government or (a)  
subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in accordance with Section 202 of Executive Order 11246 dated September 24, 1965, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

EMPLOYMENT, UPGRADING, TRANSFER OR DEMOTION

RECRUITMENT AND ADVERTISING

RATES OF PAY OR OTHER FORMS OF COMPENSATION

SELECTION FOR TRAINING INCLUDING APPRENTICESHIP, LAYOFF OR  
TERMINATION

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246.

Copies of this notice will be posted by the undersigned in conspicuous places available to employees or applicants for employment.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(contractor or subcontractor(s))  
\_\_\_\_\_  
(Date)

## **PART 5**

### **TECHNICAL SPECIFICATIONS**

# TECHNICAL SPECIFICATIONS

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## **DIVISION 1**

### **GENERAL TECHNICAL REQUIREMENTS**

## **SECTION 01110**

### **SUMMARY OF WORK**

#### **PART 1 GENERAL**

##### **1.1 SCOPE OF WORK**

The work specified in this Section consists of furnishing all labor, materials, and equipment necessary for construction of the WWTF Operations Building, as shown on the Plans, and hereinafter specified, at the existing wastewater treatment plant site. Work shall include, but not be limited to, the following:

- A. Demolish the remaining Operations Building and remove remaining piping and appurtenances.
- B. Construct the new Operations Building, including the new facility office, laboratory, restroom, sludge pump room, chlorine dosage and storage room, and electrical room.
- C. Furnish and install two new sludge pumps and pump controls.
- D. Install the currently used chlorine dosage equipment into the new chlorine dosage and storage room.
- E. Furnish and install all required electrical, instrumentation, and telemetry work.
- F. Install a chlorine emergency gas scrubber for mitigating sudden chlorine gas leakages.
- G. Furnish and install all required piping and appurtenances.
- H. Furnish and install all required plumbing, heating, and ventilating work.
- I. Construct required site grading and asphalt paving.
- J. Restore all surfaces disturbed by construction activities.
- K. Furnish and install required landscaping.
- L. Provide testing, commissioning, and training as specified herein.

- M. Provide all associated work as shown on the Plans and specified herein, for a complete and workable system.

## **1.2 PROJECT INFORMATION**

The Contract Documents show the location, arrangement, and type of work to be performed under the proposed project.

The Contractor shall be responsible for proper notification to and coordination with all utility districts, service districts, and all other persons and services that will be affected by this project at least one week in advance of beginning any construction that affects them.

It is the intent and purpose of these Contract Documents to have constructed complete facilities in good working order for the least practical cost to the Owner. Suggestions, recommendations, as well as inquiries from the Contractor that will serve this purpose are welcome and will be given consideration by the Owner and the Engineer.

## **1.3 WEB-BASED PROJECT COMMUNICATION SYSTEM**

The Contractor shall install and use the necessary computer hardware and software to receive and transmit project communications through the Engineer's web-based, online project communications system (G&O Construction Management System). This website will be used by the Engineer, Field Representative, Owner and Contractor to communicate online between these parties to clarify design and construction requirements, to provide information concerning construction issues, and to post certain project documents. The intent of this communication system is to provide an efficient means of communicating between the parties to present project information and answer project-related questions while reducing the amount of paperwork typically involved with project communication and record-keeping.

The web-based project communication system will use the secure website and programming developed by the Engineer. The Engineer will provide the Contractor with the instructions and credentials for access and use of the website. Access to the website will only be available through use of system passwords assigned to each participant. There is no fee charged by the Engineer for use of this website.

The website shall be used for posting and responding to the following communications and documents:

- Submittals

- Request to Sublet
- Progress Estimates
- Requests for Information
- Construction meeting minutes
- Job photos
- Change order proposals
- Weekly Working Day Reports
- Weekly Quantity Reports
- Material Testing Reports

Additional items may be added to the above list at the Owner's option.

The Engineer will administer and maintain the website. The Contractor, Owner and Engineer shall use the website to communicate project information instead of using hard copies and faxes, unless the website is unable to support the desired communication.

The communication system has been designed to operate with Mozilla Firefox (a free browser). The Contractor shall install the current version of Firefox on all PCs involved with the project communications. The Contractor shall provide and maintain the following hardware and software at the Contractor's computers at the project site, and at off-site computers as desired by the Contractor, to use the web-based project communication system:

- Internet/Wireless Services
- Microsoft Office
- Email address
- Sun JAVA (free software)
- Firefox web browser with Adobe Flash plug-in (free)
- Antivirus/anti-spyware software
- Computers with CD/RW burner drives
- Sufficient hardware capability to run the Windows operating system
- Tracker Software PDF X-Change Viewer (free software)
- Color flatbed scanner (or printer/scanner/fax) for PDF, TIFF, or GIF format scanning.

## **1.4 CONTRACTOR USE OF SITE AND PREMISES**

Construction operations shall be limited to the areas noted on the Plans and subject to the approval of the Engineer.

The Contractor shall allow representatives of the Owner, funding, and regulatory agencies access to the project site at all times.

The Contractor shall be aware that the Owner's archaeologist may observe and sample excavated material for cultural artifacts during Contractor's excavation work. The Contractor shall allow this work without extra compensation.

The Contractor shall notify the Owner (or other water utility purveyor) at least 48 hours in advance of any proposed water system shut downs. The Contractor shall also be responsible for notifying all impacted water users 48 hours in advance of any water shutoff.

## **1.5 ORDER OF WORK**

The order of work will be at the option of the Contractor, except as noted below, in keeping with good construction practice, time restrictions, requirements of the permits applicable to this project, and the order of work as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of work to allow the existing facilities to remain operational during the construction of the Project and shall coordinate all of their activities through the Engineer with the Owner's operations and maintenance staff. The Contractor shall provide a written plan of activities to the Engineer and Owner each Thursday for the following week, for review and coordination with existing facility operations.

The implementation of any measure required to protect the environment shall supersede any order of work designated within these Specifications. The Contractor shall meet the conditions as outlined in any and all permits and requirements of the Federal, State, County, and City regulatory agencies.

The Contractor shall keep the disruption of the existing facility operations to a minimum. Water system shutdowns shall be limited to 8 hours during any 24-hour period. Bypasses of untreated sewage will not be permitted. The Contractor shall be responsible for all temporary pumping to include all connections, piping, pumping equipment, temporary electrical service and controls, and appurtenances.

Access to the existing operations areas shall be maintained. Disruption of this access shall be kept to a minimum and must be prearranged and scheduled through the Engineer with the Owner's operations and maintenance staff.

The following summary shall be used as a general guideline of the construction tasks to be performed. The tasks are generally listed in the order of completion. The tasks, however, can be completed in a different order than listed herein, including performance of two or more tasks concurrently. The Contractor shall prepare a complete project schedule, which shall be provided in accordance with the limitations specified herein.

A. SLUDGE HOLDING TANK ISOLATION

Contractor shall provide two (2) weeks written notice to the Owner prior to commencing work on site. The City will empty the Sludge Holding Tank and the Contractor shall pothole, locate, and back flush the existing sludge pipe into the Sludge Holding Tank. The Contractor shall coordinate with the City to test the existing isolation valve and ensure operation. Contractor shall notify the City and Engineer in the event the valve is inoperable. The Sludge Holding Tank can only be out of service three (3) days for the back flush and valve testing operation.

As a second order of work, the Contractor shall locate the abandoned metering vault and install a blind flange on the sludge pipe. Installation of the blind flange shall be coordinated with the City's screw press operation, since the sludge pipe will be full of sludge.

B. DEMOLITION OF EXISTING OPERATIONS BUILDING

Demolish the existing Operations Building and prepare the area for the new building foundation. The Contractor shall coordinate with the City on the partial demolition or protection of the sludge drying beds.

C. WATER SYSTEM

Contractor shall coordinate water system shutdowns with the City. Two days notice shall be given prior to a system shut down.

D. CONSTRUCTION OF NEW OPERATIONS BUILDING

Construct the new Operations Building to include the new sludge pump room, chlorine gas dosage and storage room, electrical room, and facility office, restroom, and laboratory.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01150**

### **SURVEYS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes all survey for the project. The Contractor shall provide all construction survey for the Work. The Engineer will provide primary horizontal and vertical control data and monuments, as shown on the Plans.

At the Contractor's request, the Engineer will provide the Plans in electronic format. Electronic files are provided for the Contractor's convenience and are not part of the Contract. Calculations shall be made from the Plans.

During the prosecution of the work, the Contractor shall make all necessary measurements to prevent misfitting, and shall be responsible for the accurate construction of the work.

##### **1.2 DEFINITIONS**

The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping, and the American Society of Civil Engineers.

##### **1.3 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01720	Record Drawings

##### **1.4 QUALIFICATIONS**

The Contractor shall employ a Professional Land Surveyor (PLS) registered in the State of Washington and acceptable to the Owner. All surveying shall be completed by or under the direct supervision of the PLS.

## 1.5 SUBMITTALS

The Contractor shall submit the name, address, and license number of the Professional Land Surveyor before starting construction.

## 1.6 QUALITY ASSURANCE

The Contractor shall ensure a surveying accuracy within the following tolerances:

	<b><u>Vertical</u></b>	<b><u>Horizontal</u></b>
Slope Stakes	±0.1 feet	±0.10 feet
Subgrade Grade Stakes Set 0.04 foot Below Grade	±0.01 feet	±0.5 feet (parallel to alignment) ±0.1 feet (normal to alignment)
Stationing on Roadway	N/A	±0.1 feet
Alignment on Roadway	N/A	±0.04 feet
Surfacing Grade Stakes	±0.01 feet	±0.1 foot (parallel to alignment) ±0.1 feet (normal to alignment)
Roadway Paving Pins for Surfacing or Paving	±0.01 feet	±0.1 feet (parallel to alignment) ±0.05 feet (normal to alignment)
Alignment of sewer and storm manholes and catch basins	±.01 feet	±0.1 feet
Stationing on Structures		±.02 feet
Alignment on structures		±.02 feet
Superstructure elevations	±.01 feet variation from Plan elevation	
Substructure	±.02 feet variation from Plan grades	

When the following items are included in the project, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances:

- Piles
- Shafts
- Footings
- Columns

The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for accuracy by the Contractor

## **PART 2 PRODUCTS**

Not Used.

## **PART 3 EXECUTION**

The Contractor's PLS shall establish all secondary survey controls, horizontal and vertical, as necessary to assure proper placement of all Work based upon the primary control points provided by the Owner. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, clearing limit stakes, slope stakes, and grades for the Work. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the lines and grades shall be the Contractor's responsibility.

Survey records shall be maintained by the Contractor's PLS, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Engineer within three working days of Engineer's request.

All surveyed points shall be established by placing hubs and tacks with marked stakes in unpaved areas or P.K. nails with painted markings in paved areas. All surveying stakes shall be marked in accordance with WSDOT Standard Plan A-10.10-00. When stakes are needed that are not described in the Standard Plans, then those stakes shall be marked as ordered by the Engineer. The Contractor's surveyor shall maintain and replace survey hubs, stakes, nails and markings immediately if destroyed, removed, or the Engineer determines the stake or pavement markings are illegible.

For monuments to be removed or destroyed as shown on the Plans, the Contractor's PLS shall file all required permit forms with the Department of Natural Resources (DNR), as required by RCW 58.09.130 and WAC 332-120. The form "Application for Permit to Remove or Destroy a Survey Monument" shall be signed by the PLS, and submitted directly to DNR and the Owner. No work affecting monumentation shall commence until DNR has approved the permit. The form "Completion Report for Monument Removal or Destruction" shall be signed by the PLS and submitted to DNR and the Owner upon completion of work affecting monumentation.

The Contractor shall be responsible for locating and preserving existing monuments within the right-of-way, which shall include existing property corners on the right-of-way lines. In the event the Contractor disturbs or destroys any survey marker, monument, or property corner during the course of construction, not indicated to be removed on the Plans, the Contractor shall bear all costs of survey, resetting, legal claims and filing state forms as required by RCW 58.09.130 and WAC 332-120.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01160**

### **REGULATORY REQUIREMENTS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section contains information pertaining to permits and licenses, and use of private property.

##### **1.2 PERMITS AND LICENSES**

Except as noted below, the Contractor shall be responsible for obtaining and paying all fees associated with all the necessary permits, licenses, approvals, and construction permits necessary for the execution of this Contract, whether they be City, County, State, or federal permits.

The Owner will be responsible for obtaining the following approvals and permits, and will pay the fees associated with the application and procurement of such approvals and permits. The Contractor is advised to become familiar with these approvals and permits as necessary for this project. The Contractor shall comply with all conditions of each approval/permit as if the conditions were detailed herein.

- A. WSDOE plan review and approval (obtained by Owner)
- B. City of Bridgeport Building Permit (applied and paid for by Owner, obtained by Contractor)
- C. City of Bridgeport Business License (applied and paid for by the Contractor and Subcontractors, Business License is \$30)

##### **1.3 OTHER PERMIT REQUIREMENTS**

The Washington State Department of Ecology has prohibited bypassing of sewage to state waters. The existing wastewater treatment plant and transmission facilities shall remain operational during construction at all times. The Contractor shall maintain the conveyance and treatment facilities in continuous operation during the entire construction period and until the project has been accepted by the Owner. The Contractor shall pay all costs of any damages and/or Regulatory Agency penalties resulting from plant bypassing or overflows caused by their actions or inactions.

#### **1.4 USE OF PRIVATE PROPERTY**

The Contractor shall be responsible for all conditions of any arrangements the Contractor makes for the use of any privately owned property.

In the event any dispute occurs and claims for damages are filed by the property owners, the Owner will request that the Contractor give evidence that they have requested their insurance company to make personal contact with the claimants. Any settlement for insurance claims shall be strictly an act restricted to the claimant, the Contractor, and their insurance company.

The Contractor is advised that in the event of any property damage, the Owner reserves the right to withhold monies to protect the property owner.

#### **1.5 PROPERTY RELEASE FORM**

The Contractor shall be held responsible for acquiring signed property release forms, in the format provided on the following page, for all properties that have been disturbed or damaged by the Contractor's operations, or utilized by the Contractor for staging, storing, or stock piling of materials or equipment.

This work shall include submitting the form(s), as further shown herein, by certified mail to each property owner effected and further including therein a self addressed stamped envelope for the property owner's use. The enclosed self addressed envelope shall be addressed to: City of Bridgeport, 1206 Columbia Avenue, P.O. Box 640, Bridgeport, WA 98813. Contractor shall provide evidence of all certified mailings.

**\*\*\* END OF SECTION \*\*\***

## PROPERTY RELEASE

\_\_\_\_\_  
(Property Address)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DATE: \_\_\_\_\_

I, \_\_\_\_\_, owner of \_\_\_\_\_  
(Property Owner's Name) (Property Description or  
\_\_\_\_\_, hereby release  
Address)

\_\_\_\_\_, from any property  
(Contractor's Name)

damage or personal injury resulting from construction adjacent

to or on my property located at \_\_\_\_\_,  
(Property Address)

during construction of the Wastewater Treatment Facility Operations Building  
Restoration.

My signature below is my acknowledgment and acceptance that my property, as identified  
above, was returned to a satisfactory condition.

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

## SECTION 01200

### MEASUREMENT AND PAYMENT

#### PART 1 GENERAL

##### 1.1 SCOPE

This Section further defines Measurement and Payment for this project.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01290	Schedule of Values
01300	Submittals

##### 1.3 MEASUREMENT

Measurement for all items shall be as indicated in these Specifications for unit price and lump sum price bid items. Bid items are outlined in detail in this Specification Section and listed in the Proposal.

Measurement shall be in accordance with Section 1-09.1 of the WSDOT Standard Specifications. Volumes of gravel materials and concrete volumes shall be measured by the Engineer in the field and quantities will be limited to the relative neat line dimensions shown on the Plans or as approved by the Engineer in the field.

Weighing equipment, scale verification checks, load tickets for quarry spalls, rock riprap, cobbles, gravel materials, hot mix asphalt, bituminous construction materials, etc., shall conform to Section 1-09.2 of the WSDOT Standard Specifications. Load tickets shall include all gravel materials, cast-in-place concrete, cement grout, CDF, hot mix asphalt, ATB, and reinforcing steel. The Owner will pay for no material received by weight unless they have been weighed as required in this Section or as required by another method the Engineer has approved in writing. All costs incidental to weighing shall be merged into the various unit prices bid.

## **1.4 INDIVIDUAL BID ITEMS**

The following is a list of bid items for the project. The contract price for each item constitutes full compensation for furnishing all equipment, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the various bid items in accordance with the Contract Documents. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. If a particular item of work shown on the Plans or described in Specifications is not described in a specific bid item, this item of work shall be considered as incidental to the work and the costs for this work shall be merged into the various respective unit price and lump sum bid items.

### **A. WASTEWATER TREATMENT FACILITIES IMPROVEMENTS**

1. Measurement: Will be measured by lump sum.
2. Payment: The lump sum contract price for WASTEWATER TREATMENT FACILITIES IMPROVEMENTS shall include costs for the labor, materials, and equipment required to provide a complete and operable Wastewater Treatment Facility, as shown on the Plans and as specified herein, with the exception of all labor, materials and equipment included in other bid items.

### **B. MOBILIZATION AND DEMOBILIZATION**

1. Measurement: Will be measured by lump sum.
2. Payment: The lump sum contract price for MOBILIZATION AND DEMOBILIZATION shall include all costs for the labor, materials, and equipment required for mobilization and demobilization on the project as described in Section 01505.

Payment for MOBILIZATION AND DEMOBILIZATION shall be as follows:

35% Payment: When Contractor has mobilized on-site and temporary facilities are in place.

50% Payment: When 5 percent of the total pay items are completed (not including payment for materials on hand).

75% Payment: When 50 percent of the total pay items are completed (not including payment for materials on hand).

100% Payment: When Project is completed and recommended for acceptance.

C. MINOR CHANGE

1. Measurement: Will be negotiated prior to commencing any such work under this pay item and shall be for work to remedy unforeseen conditions, utility conflicts, minor landscaping, minor drainage improvements, or special surface restoration.
2. Payment: Payment or credits for changes amounting to \$15,000 or less may be made under the Bid Item MINOR CHANGE. At the discretion of the Owner, this procedure for Minor Changes may be used in lieu of the more formal procedure as outlined in General Conditions Section 3.04.6. The Contractor will be provided a copy of the completed order for Minor Changes. The agreement for the Minor Changes will be documented by signature of the Contractor or notation of the verbal agreement. If the Contractor is in disagreement with anything required by the order for Minor Changes, the Contractor may protest the order as provided in General Conditions Section 3.04.8.

Payments or credits will be determined in accordance with General Conditions Section 3.04.6. All Minor Change work will be within the scope of the Contract Work and will not change Contract Time. For the purpose of providing a common Proposal for all Bidders, the Owner has entered an amount for MINOR CHANGE in the Proposal to become part of the total Bid by the Contractor.

D. TRENCH EXCAVATION SAFETY SYSTEMS

1. Measurement: Will be measured by lump sum.
2. Payment: The lump sum contract price for TRENCH EXCAVATION SAFETY SYSTEMS shall include all costs for labor, materials, and equipment required to provide sheeting, shoring, and bracing of trenches and open excavations as required to meet the Washington Industrial Safety and Health Act,

Chapter 49.17 RCW and Section 02250. These costs shall not be considered incidental to any other bid item.

**E. UNSUITABLE EXCAVATION**

1. Measurement: Will be measured by the cubic yard, in-place and shall be to the limits as designated by the Engineer. There shall be no payment if the Engineer believes removal of materials is needed because of damage caused by the Contractor's operations.

All quantities will be measured and recorded by the Engineer in his Daily Report and the Contractor shall be responsible for reconciling his quantities with the Engineer on a daily basis.

2. Payment: The unit price per cubic yard for UNSUITABLE EXCAVATION shall include all cost for labor, material, and equipment to excavate and wastehaul unsuitable native subgrade materials, including backfilling the resulting excavations with compacted foundation gravel materials.

The Contractor is advised that the excavation of any and all unsuitable material must be authorized by the Engineer in writing prior to the commencement of said excavation by the Contractor.

**1.5 PROJECT MATERIALS ON HAND**

See General Conditions Section 3.04.12(6).

**1.6 PAYMENT**

Payment for all work will be made at the contract unit price or lump sum price as indicated in the Proposal, payment of which shall constitute full compensation, for a complete installation.

For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice.

Final operating and maintenance manuals per Section 01300 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01290**

### **SCHEDULE OF VALUES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section establishes the procedures for preparing the schedule of values used for preparation of the Contractor's progress pay estimates.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01200	Measurement and Payment
01300	Submittals

##### **1.3 DESCRIPTION**

Within 10 calendar days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all lump sum bid items showing the value assigned to each portion of the work, prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.

**\*\*\* END OF SECTION \*\*\***

## SECTION 01300

### SUBMITTALS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes requirements that apply to all equipment and materials supplied on the Project.

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Contract Documents. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where their submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors and shall verify such coordination on all submittals.

Where noted in the Contract Documents, the structural, mechanical, and electrical designs associated with the indicated equipment items are specific to the manufacturer and model number specified. Any structural, mechanical, or electrical modifications required to utilize an approved substitution to the specified equipment shall be made by the Contractor at no additional cost to the Owner. Where approved substitutions of specified equipment affect other materials or equipment, mechanical, structural, or electrical work, the Contractor shall note in the equipment submittal any necessary changes to accommodate the substituted equipment. It shall also be the responsibility of the Contractor to coordinate other mechanical, structural, or electrical equipment submittals to make sure that all changes necessary to accommodate the substituted equipment are addressed in these submittals as well. See General Condition 3.04.3.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01720	Record Drawings
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

### **1.3 WORK INCLUDED**

Submittals required for this work shall include any or all of the following as required by the particular specification section and the submittal schedule:

- A. SCHEDULES AND PLANS
- B. PRODUCT SUBMITTALS
  - 1. Manufacturer's Literature
  - 2. Shop Drawings
  - 3. Color and Material Samples
  - 4. Design Calculations
  - 5. Test Reports
- C. EQUIPMENT OPERATION AND MAINTENANCE MANUALS
- D. RECORD DRAWINGS (SEE SECTION 01720)

### **1.4 SUBMITTAL INFORMATION**

Shop, catalog, and other appropriate drawings and information shall be submitted to the Engineer for review prior to fabrication or ordering of all equipment and materials specified. The number of copies of submittal information to be submitted shall be as indicated below.

All submittal information shall be sent to the Engineer through the Contractor. The Contractor shall assign a separate submittal number to each item or group of items that relate to each specification section. Submittal numbers shall be assigned in consecutive ascending order, with the first project submittal assigned the number "1." Resubmittals shall be numbered using the same number followed by an alphabetical suffix. All submittals shall bear the Contractor's certification that they have reviewed, checked, and approved the submittal information prior to transmitting to the Engineer. The submittal number and related specification section shall be marked on each submittal.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

When the Contract Documents require a hard copy of a submittal, the Contractor shall submit the following number of documents.

<b>Type of Submittal</b>	<b>Number of Copies</b>
Product Submittal	8
Design Calculations	5
Test Reports	5
Preliminary Equipment Manuals	3
Final Equipment Manuals	4

The Contractor shall submit all submittals on the Web-Based Project Communication System. The Contractor shall submit the specified information as PDF files on the web-based project communication system, with a table of contents bookmarked to provide a navigation link to each section of the submittal. The PDF shall consist of one submittal for each submittal number and shall not be broken up into separate documents. Three CD ROM PDF version and four hard copies of all final equipment manuals shall be submitted.

### **2.2 PRODUCT SUBMITTALS**

#### **A. GENERAL**

When indicated in the Contract Documents the contractor shall submit product data for review by the Engineer. Unless otherwise specified, within 14 calendar days after receipt of the submittal, the Engineer shall review the submittal and return three copies of the marked-up submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment, or work method complies with the project Specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance

with the noted corrections. Where submittal information will be incorporated in operation and maintenance data, a corrected copy shall be provided.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at their own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
4. If the review indicates that the material, equipment, or work method does not comply with the project Specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations that have not been identified clearly may be rejected. Except at their own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

#### B. MANUFACTURER'S LITERATURE

Where the contents of submitted literature include data not pertinent to the submittal, the portion(s) of the contents being submitted for the Engineer's review shall be clearly indicated.

#### C. SHOP DRAWINGS

Shop drawings shall be submitted in the form of blue-line or black-line prints of each sheet. Blueprint submittals will not be acceptable.

All shop drawings shall be accurately drawn to a scale sufficiently large enough to show pertinent features and method of connection or joining. On all shop drawings, figure dimensions shall be used as opposed to scaled dimensions.

#### D. COLOR AND MATERIAL SAMPLES

All material samples shall be of the exact article proposed to be furnished for the work and shall be submitted in the quantity required. Samples shall be returned to the Contractor, with one retained by the Engineer.

Unless the precise color is specifically described in the Contract Documents, or whenever a choice of color or pattern is available in a

specified product, accurate color charts shall be submitted to the Engineer for their review and selection.

**E. DESIGN CALCULATIONS**

Where required in the Specifications, design calculations shall be submitted to the Engineer. Design calculations shall be complete, concise, and in an easy-to-read format. All design calculations shall be stamped by a Professional Engineer licensed in the State of Washington.

**F. TEST REPORTS**

Copies of all test reports shall be submitted to the Engineer.

**2.3 EQUIPMENT MANUALS**

**A. GENERAL**

For all items of equipment, manufacturer's equipment operation and maintenance manuals shall be submitted to the Engineer for review. One copy will be returned to the Contractor with comments.

The following information shall be furnished for all items of equipment installed on the project requiring operational and/or maintenance procedures, and for any additional items indicated by the Engineer.

**1. Lubrication Information**

This shall consist of the manufacturer's recommendations regarding the lubricants to be used and the lubrication schedule to be followed.

**2. Electrical and Control Diagrams**

Diagrams shall show internal and connection wiring.

**3. Startup Procedures**

These instructions consist of equipment manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.

4. Operating Procedures

These instructions consist of the equipment manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.

5. Preventive Maintenance Procedures

These instructions consist of the equipment manufacturer's recommended steps and schedules for maintaining the equipment.

6. Overhaul Instructions

These instructions consist of the manufacturer's directions for the disassembly, repair, and reassembly of the equipment and any safety precautions that must be observed while performing the work.

7. Parts List

This list consists of the generic title and identification number of each component part of the equipment.

8. Spare Parts List

This list consists of the manufacturer's recommendations of number of parts, which should be stored by the Owner and any special storage precautions, which may be required.

9. Exploded View

Exploded or cut views of equipment shall be provided if available as a standard item of the manufacturer's information. When exploded or cut views are not available, plan and section views shall be provided with detailed callouts.

10. Test Documentation

Reports, records, data and forms documenting the results of equipment factory tests, including pump and blower performance curves, shall be provided, with the operating points for the specific equipment designated. When a special factory test of the supplied equipment is not performed, the manufacturer's standard

performance reports and curves, with specified operating points, shall be provided for the supplied equipment.

11. Specific Information

Where items of information not included in the above list are required, they will be provided as described in the specifications for the equipment.

12. Warranty Information

13. Maintenance Information Summaries

In addition, the following items of equipment shall be provided with Maintenance Information Summaries in each appropriate section of the equipment manuals, prepared according to the format specified herein:

- Sludge Pumps
- Sump Pump
- Emergency Gas Scrubber
- Sampling Equipment
- Gas Chlorine Injection Equipment
- Heating and Ventilation Equipment
- Valves (larger than 1-inch in size)
- Facility Instrumentation, Telemetry and Control Equipment
- Electrical Equipment
- Chlorine Gas Leak Detector
- Emergency Chlorine Gas Shutoff Valve

Maintenance information summaries shall be prepared on 8-1/2-inch x 11-inch paper only and shall contain the following information compiled from manufacturer's recommendations in the order shown.

1. Description or name of item of equipment.
2. Manufacturer.
3. Name, address, and telephone number of local manufacturer's representative.

4. Serial number (where applicable). The Contractor shall verify that it matches the equipment installed on the project.
5. Equipment nameplate data including model number.
6. Recommended maintenance procedures:
  - a. Description of procedures.
  - b. Maintenance frequency required.
  - c. Lubricant(s) or other materials required (where applicable), including type of lubricant, lubricant manufacturer, and specific compound.
  - d. Additional information as required for proper maintenance.
7. Recommended spare parts.

The maintenance information summary shall be placed at the beginning of the manual.

All operation and maintenance information shall be comprehensive and detailed, and shall contain information adequately covering all normal operation and maintenance procedures.

For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment specification number as it appears in the project Specifications. The information shall be organized in binders. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.

Lubricants shall be described in detail, including type, recommended manufacturer, and manufacturer's specific compound to be used.

It shall be the responsibility of the Contractor to ensure that all operation and maintenance materials are obtained. Material submitted must meet the approval of the Engineer prior to project acceptance.

**B. EXTRANEIOUS DATA**

Where the contents of the manuals include manufacturers' standard brochures or catalog pages, the exact item(s) used in this installation shall be clearly indicated and all manufacturers' data which is extraneous shall be clearly deleted.

**C. FINAL EQUIPMENT MANUALS**

The Contractor shall be responsible for tracking and coordinating each separate manufacturer's equipment operation and maintenance manual submittal and shall resubmit, as necessary, until the Engineer's review indicates that the submittal is acceptable. The Contractor shall maintain equipment manual files until final approval copies are delivered to the Engineer. The Contractor shall be responsible for collating the approved operation and maintenance submittal sections into complete final manufacturers' equipment operation and maintenance manuals bound in post binders which are indexed to the Specifications. The Contractor shall deliver the complete final operation and maintenance manuals to the Engineer prior to project completion. All copies final manufacturers' equipment manuals submitted will be retained by the Engineer or Owner.

The Contractor shall also supply three CD-Rom or USB copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual.

**PART 3 EXECUTION**

**3.1 IDENTIFICATION OF SUBMITTALS**

**A. GENERAL**

Each submittal shall be accompanied by a letter of transmittal showing the date of transmittal, specification section, or drawing number to which the submittal pertains, submittal number, and a brief description of the material submitted.

**B. RESUBMITTALS**

When material is resubmitted for any reason, it shall be submitted under a new letter of transmittal and referenced to the previous submittal.

### **3.2 REVIEW OF SUBMITTALS**

The Engineer will review all submittals for general conformance with the design and other requirements of the Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents. Submittals may be rejected based on inadequate information and/or not meeting the requirements of the Contract Documents. Rejection of submittals requires action on the part of the Contractor to correct the reason for the rejection. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, and for techniques of assembly and installation.

### **3.3 COORDINATION OF PRODUCT SUBMITTALS**

#### **A. GENERAL**

Prior to submittal for review by the Engineer, all data shall be fully coordinated, including the following:

1. All field dimensions and conditions.
2. All trades and public agencies involved, including necessary approvals.
3. All deviations from the Contract Documents.

#### **B. GROUPING OF SUBMITTALS**

1. All submittals shall be grouped with associated items, unless otherwise specifically permitted by the Engineer.
2. The Engineer may reject the submittals in their entirety or any part thereof, if not in accordance with the Contract Documents.

#### **C. CERTIFICATION**

Submittals shall bear the Contractor's certification that they has reviewed, checked, and approved the shop drawings prior to forwarding them to the Engineer.

### **3.4 TIMING OF PRODUCT SUBMITTALS**

#### **A. GENERAL**

1. All submittals shall be made far enough in advance of installation to provide all required time for reviews and securing necessary approvals.
2. In scheduling, the Contractor shall allow for the time indicated in Part 2.2A for the Engineer's review following their receipt of the submittal.

#### **B. DELAYS**

No additional or separate payment will be made for costs of delays occasioned by tardiness of submittals on the part of the Contractor.

### **3.5 EQUIPMENT MANUALS**

The preliminary copies of the manufacturer's equipment manuals shall be delivered to the Engineer for review not later than the time of equipment delivery to the project site. The Contractor will not be paid for more than 90 percent of the purchase value of an item of equipment until the Engineer has received the preliminary equipment manual for that item of equipment.

Final copies of the manufacturer's equipment manuals shall be delivered to the Engineer at least 10 days prior to requesting payment in excess of 90 percent completion for the project. Progress payments for work in excess of 90 percent completion will not be made until the final equipment manuals have been received and accepted by the Engineer. Prior to submittal of the final equipment manuals, the Contractor shall check the manuals for accuracy and completeness and shall verify that prior review comments have been addressed.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01310**

### **PROJECT MEETINGS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes information pertaining to the various meetings that will be held during the course of constructing this project.

##### **1.2 PRECONSTRUCTION CONFERENCE**

As soon as possible following the award of the Contract, a preconstruction conference shall be scheduled for representatives of the Owner, the Contractor, the Engineer, funding agencies, regulatory agencies, and affected utilities.

##### **1.3 PROJECT PROGRESS MEETINGS**

The Owner and the Engineer will schedule and attend regular bi-weekly meetings with the Contractor for coordination, administrative, and procedural requirements of the project. The Contractor shall provide a meeting room with table and chairs at or near the site for project progress meetings.

##### **1.4 CONSTRUCTION MEETINGS**

The Contractor shall schedule and hold regular meetings during the project:

- A. Safety Meetings (Contractor's subcontractors shall attend if they are working onsite.)
- B. Project Progress Meetings
- C. Equipment Installation Meetings
- D. Coordination Meetings
- E. Startup and Testing Meetings

The Contractor shall notify the Owner and Engineer in advance of all meetings.  
The meetings may or may not be attended by the Owner and Engineer.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01320**

### **PROGRESS SCHEDULES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section further defines the progress schedule requirements described in the General Conditions Section 3.04.15(1). This Section specifies the procedures for preparing and revising the cost-loaded construction schedule used for planning and managing construction activities. The schedule provides a basis for determining the progress status of the project relative to the completion time, specific dates, and for determining the acceptability of the progress payment estimates.

##### **1.2 DESCRIPTION**

The Contractor shall prepare a time-scale network schedule using a critical path method (CPM). A general guide for preparing such a schedule is contained in "The Use of CPM in Construction, a Manual for Contractors and the Construction Industry," published by the Associated General Contractors of America.

The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted by the Contractor. Assigned values for each part of the work shall be indicated. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.

Completion time and all specific dates and sequencing requirements shall be shown on the schedule. Activities making up the critical path shall be identified.

No activity on the schedule shall have a duration longer than 14 days or an assigned value greater than \$25,000, except activities comprising only fabrication and delivery, which may extend for more than 14 days. Activities which exceed these limits shall be divided into more detailed components. The scheduled duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

### **1.3 SUBMITTALS**

The CPM Progress Schedule shall be prepared using a computerized system. The schedule shall be submitted in the form of an arrow diagram or precedence diagram with activity listings. The following shall be included:

- A. Network diagram shall show in detail and in order of sequence all significant activities, their descriptions, durations, and dependencies, as necessary and as required to complete all work and each separate part of the work.
- B. The activity listing shall show the following information for each activity shown on the network diagram:
  - 1. Description
  - 2. Duration
  - 3. Start and finish dates
  - 4. Total float time and free float time
- C. Milestone activity completions shall be shown and clearly defined.
- D. The critical path shall be clearly indicated.
- E. A legend defining any abbreviations used on the schedule shall be provided.
- F. All CPM schedules shall conform to the requirements of the Owner's overall Project schedule and the Contract Documents.

The Contractor shall submit four hard copies (blueprints or blacklines) plus an electronic file with each schedule submittal. The hard copies shall be full size 24 inch x 36 inch in size. All schedule reports shall be 8-1/2-inch x 11-inch format. The Contractor shall provide, in chronological order, a list of constraints used, if any, in the preparation of the schedule.

Within 14 calendar days after receipt of the schedule, the Owner and Engineer will return a copy of the schedule to the Contractor with comments. Review of the schedule is for purposes of evaluating the Contractor's ability to complete the Work within the Contract time. Review shall not constitute approval or acceptance of the Contractor's construction means, methods, or sequencing.

The Contractor shall submit an updated Progress Schedule with each application for payment or whenever actual construction progress deviates significantly from the current schedule.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01385**

### **DOCUMENTATION OF EXISTING CONDITIONS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the video recording requirements for the project.

The Contractor shall provide the Engineer with a DVD or computer-readable digital format of the project area prior to and upon completion of all construction. The video recording shall utilize equipment that will visually document an accurate audio-visual description of the existing and post-construction conditions.

The Contractor shall notify the Engineer prior to the recording to allow the Engineer to witness the video recording. The Contractor shall provide preconstruction video recording of the existing conditions for the entire project site.

Upon completion of the work, the Contractor shall provide video recording in the same manner and vantage point as the preconstruction video recordings. The intent of this Specification section is to provide a comparison between existing and post-construction conditions.

The rate of speed the documentation will be video recorded at, the panning rates, and the zoom-in/zoom-out rates will be controlled so that playback will produce a clear television picture of the areas video recorded.

The video recording shall be accomplished during a period of good visibility. Unless otherwise directed by the Engineer, video recording will not be allowed during times of precipitation or poor visibility.

When available light is not sufficient to produce a clear television image, additional lighting shall be supplied by the photographer to ensure good picture quality. The camera crew shall be able to work independent of any power source, utilizing battery power to operate the camera, and lighting.

A legible reader board shall be provided by the photographer to visually document the date, job title, and site identification. The audio portion of the video recording will be used for identification purposes, addresses, and any other audio required or as directed by the Engineer.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01400**

### **QUALITY CONTROL**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the control tests, test sample collection, required field-testing, and special inspections as specified herein, and indicated on the Plans.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
02300	Earthwork
02700	Gravel Materials
02710	Gravel Surfacing
02740	Hot Mix Asphalt
03300	Reinforced Concrete

##### **1.3 PAYMENT**

All testing as required by this Section shall be paid for by the Contractor. All costs to prepare and implement the sample and testing program shall be included in the bid prices for the various items associated with the sampling and testing program.

Retesting and reinspection required because of defective work and testing performed for the convenience of the Contractor shall also be paid for by the Contractor.

Testing requirements shall not be cause for claims of delay by the Contractor and all expenses accruing therefrom shall be deemed incidental to the performance of the Contract.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

The Contractor shall be responsible for all material testing specified in the Contract Documents and any applicable permits and codes. The materials testing laboratory shall be accredited for performing the various testing methods either by AASHTO R18, AASHTO 150/IEC 17025 or the American Association for Laboratory Accreditation and further approved by the Owner. The materials testing laboratory shall send test results directly to the Engineer.

### **2.2 EARTHWORK AND GRANULAR MATERIALS**

#### **A. COMPACTION CONTROL**

Optimum moisture content and maximum density tests shall be determined by the following method:

ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort

#### **B. IN-PLACE TESTS**

In-place density and moisture content tests shall be made by an independent testing laboratory according to the following methods:

ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

### **2.3 AGGREGATES**

All aggregates shall be tested in accordance with applicable WSDOT test methods:

<b><u>Title</u></b>	<b><u>Test Method</u></b>
Sampling	AASHTO T2
Sieve Analysis of Fine and Coarse Aggregates	104A
Material Finer than No. 200 Sieve in Aggregates	102A
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	603A

Organic Impurities	111A
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	101A
Sand Equivalent	109A

## 2.4 CAST-IN-PLACE CONCRETE

Cast-in-place concrete shall be tested in accordance with applicable parts of Chapter 16 of ACI 301. Concrete reinforcement and concrete special inspections shall be performed in accordance with local Building Official and WABO requirements.

## 2.5 HOT MIX ASPHALT

Paving asphalt shall be tested in accordance with the following WSDOT test methods:

<u>Characteristics</u>	<u>Test Method</u>
Tests on Residue from RTFC Procedure	208
Absolute Viscosity at 140 degrees F, poise	203
Kinematic Viscosity at 275 degrees F., cSt, min.	202
Penetration at 77 degrees F., 100 g/5 sec., min. <sup>(1)</sup>	201
Percent of Original Penetration at 77 degrees F, min.	2
Ductility at 45 degrees F., cm, min.	
Flashpoint, (Cleveland Open Cup), degrees F min. (test on original asphalt)	206
Solubility in Trichloroethylene percent, min. (test on original asphalt)	214

- (1) Original penetration, as well as penetration after RTFC loss shall be determined by AASHTO Test Method T 49.

### A. COMPLETE EXTRACTIVE OF UNCOMPACTED MIX

Test methods shall be in accordance with the following:

1. AASHTO T68
2. ASTM D2172
3. AASHTO T30

**B. DENSITY OF COMPACTED MIX**

Test method shall be in accordance with AASHTO T166.

1. The Contractor shall employ an independent testing laboratory approved by the Owner to conduct complete extraction tests on the uncompacted asphalt concrete pavement mix.
2. The Contractor shall provide the Engineer with an affidavit from the asphalt supplier of the characteristics of the paving asphalt. The paving asphalt shall be tested in accordance with WSDOT Construction Manual and Standard Specifications, latest editions.

**PART 3 EXECUTION**

**3.1 SAMPLING AND TESTING FREQUENCY**

**A. GENERAL**

The Contractor shall provide the following quality control tests at the number and frequency described herein. The precise location of the tests shall be designated by the Engineer. The Contractor shall cooperate with laboratory personnel employed to conduct the density testing, sampling of material(s), and special inspections. The Contractor shall provide safe access within the work site for laboratory personnel such that density testing and visual inspection can be performed. The Contractor shall provide samples of materials to be tested in the quantities required and herein specified to the appropriate laboratory personnel. The Contractor shall furnish all labor, equipment, tools, and materials necessary to obtain and deliver samples as herein designated. They shall also provide and repair any test holes required in order to facilitate the testing and sampling and to provide for the testing laboratory's exclusive use for storage and curing of test samples until removed to the laboratory.

Any areas tested and further failing compliance with the Specifications shall be recompact and retested at the Contractor's expense, until a successful density test indicating compliance with these Specifications has been achieved.

## B. SOIL TESTING

The following soil quality control tests shall be completed at the given frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling &amp; Testing Frequency</u>
Backfill for foundations, walls, trenches and roads	Gradation <sup>1</sup>	One every 500 cy or one per day for quantities exceeding 25 cy. For trenches, one every 750 feet of trench.
	In-Place Density <sup>2,3,4</sup>	One every 500 cy or one per day for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.
	Moisture-Density Relationship <sup>3</sup>	One prior to start of backfilling operation, one every 20 densities and any time material type changes.
Pipe Bedding	Gradation <sup>1</sup>	One every 750 feet of trench.
Subgrade and Fills	In-Place Density <sup>2,3</sup>	One every 500 cy of each type material.
	Moisture-Density Relationship	One for every 20 densities for each material.
	Gradation	One for every moisture-density.

1. All acceptance tests shall be conducted from in-place samples.
2. Additional tests shall be conducted when variations occur due to the Contractors, operations, weather conditions, site conditions, etc.
3. The nuclear densometer, if properly calibrated, may be used but only to supplement the required testing frequency and procedures. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.
4. Depending on soil conditions, it is anticipated that compaction tests shall be required at depths of 2 feet above the pipe and at each additional 5 feet to the existing surface plus a test at the surface.

### C. HOT MIX ASPHALT TESTING FREQUENCY

The following hot mix asphalt quality control tests shall be completed at the given frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling &amp; Testing Frequency</u>
Mix Design (By Contractor)	Submittal	Design Mix (include test results). Aggregate (each size) – 100 pounds. Asphalt - 1 gallon. Mineral Filler – 10 pounds.
Asphalt (including prime and tack coat)	Sample and Tests	Submit a 1-quart sample and material certification with test results for each shipment or lot of asphalt. A duplicate 1-quart sample shall be retained by the Contractor until the completion of the job.
Aggregates (from bins or source)	Gradation	One test prior to start of paving operation and one every 1,500 tons or 1,000 cy.
	Fractured Faces	Same as gradation.
	LA Abrasion	One test prior to start of paving and one test every 10,000 tons thereafter.
	Specific Gravity	Same as gradation.
Hot Mix Asphalt (including Asphalt Treated Base)	Marshall Method Test	One initial test during mix design and one per 3,000 tons thereafter.
	Specific Gravity	One per each Marshall test.
	Compaction	One per 50 Tons

### D. CONCRETE TESTING

All testing shall conform to applicable portions of ACI. Special inspections of concrete and concrete reinforcement shall comply with WABO requirements.

All concrete must meet the specified requirements for minimum 28-day compressive strength.

All concrete cylinders shall be molded and tested for strength by an independent testing laboratory employed by the Contractor.

The Contractor shall furnish all concrete required for molding of the cylinders. In cases where cylinders are stored at the project site, the Contractor shall provide storage and protection for the cylinders in accordance with ACI requirements.

Concrete tests and testing frequency shall be in accordance with the more stringent of the testing requirements specified in Section 03300-3.17 of these Specifications, and the following table:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling &amp; Testing Frequency</u>
Coarse Aggregate (for each grading size) <sup>1</sup>	Gradation	One test every 500 cy of concrete.
	Deleterious Substances	One test initially and thereafter when appearance makes the material suspect.
	L.A. Abrasion	One every 2,000 tons of aggregate.
	Moisture specific gravity and absorption <sup>1</sup>	One initially and every 250 cy thereafter. One moisture to be conducted prior to any batching and more frequently if hauling and storage does not provide a consistent moisture content.
Fine Aggregate <sup>1</sup>	Gradation and fineness modules	One every 250 cy of concrete.
	Deleterious Substances	(same as coarse aggregate).
	Moisture, specific gravity and absorption <sup>1</sup>	(same as coarse aggregate).
Concrete	Slump	Conduct one test every day of placement and one additional test for every 50 cy placed and more frequently if batching appears inconsistent. Conduct in conjunction with taking concrete cylinders.
	Entrained Air	Conduct with each slump test.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling &amp; Testing Frequency</u>
	Ambient and concrete temperatures	Conduct with each slump test.
Concrete	Compressive strength and evaluation of results per ACI 214. (includes unit weight of each cylinder)	For all concrete placement, take one set of four cylinders per day and one additional set of cylinders for every 50 cy of each class of structural concrete. Cylinders shall be 4 inch by 8 inch. Test one cylinder at 7 days and two at 28 days. Fourth cylinder shall be held in reserve. A plot and statistical evaluation shall be maintained in accordance with ACI 214 for compressive strength results. Field cure cylinders shall be made when insitu strengths are required to be known.
1. Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement (w/c) calculations.		

#### E. SPECIAL INSPECTIONS

Contractor shall perform all required Special Inspections per WABO requirements (Chapter 17 of the IBC). Special inspections include, but are not limited to, cast-in-place concrete, concrete reinforcement, structural welded connections, bolted connections, compaction testing for building and structure foundations, concrete masonry units (CMU), and epoxy adhesive bolting.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01500**

### **TEMPORARY FACILITIES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the temporary facilities required for this project, but not necessarily limited to:

- A. Temporary utilities such as water, electricity, telephone, off-site staging, and off-site parking.
- B. Temporary piping, pumps, valves, fittings, manholes, vaults, and appurtenances necessary to keep existing facilities fully operational during construction.
- C. Sanitary facilities.
- D. Temporary enclosures such as fences, tarpaulins, barricades, and canopies.
- E. Alarms or monitoring systems for any temporary pumping facilities.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01510	Maintenance of Treatment Facility
01520	Field Offices and Storage Sheds
01530	Temporary Bypass Pumping

#### **PART 2 PRODUCTS**

##### **2.1 UTILITIES**

###### **A. TEMPORARY ELECTRICITY**

The Contractor shall provide temporary power for construction at the project site. They shall make arrangements with the electrical utility (to obtain temporary power) and shall pay all costs and fees charged by the utility associated with connection of temporary power. The Contractor shall provide all special connections, receptacles, panelboards, etc., which are required for temporary service, and are not provided by the utility.

The Contractor shall furnish and install all temporary wiring and associated equipment required to keep all portions of the existing facilities in operation at all times.

Area distribution boxes shall be furnished, installed, and so located that the individual trades may use their own construction-type extension cords to obtain proper power and artificial lighting at all points where required. The Contractor shall provide a main disconnect on all temporary wiring panels, labeled "MAIN DISCONNECT," to ensure the safety of personnel using extension cords and hand tools. Panels shall also be properly grounded and equipped with GFCI breakers in accordance with WISHA requirements.

The Contractor shall provide the Engineer single line diagrams of the temporary wiring showing all circuit breakers. These diagrams shall be provided prior to installation of this wiring. These diagrams are necessary to provide information to Owner personnel for off-hours operation.

The Contractor shall pay all demand, consumption, taxes, and fees associated with the temporary electrical service.

#### **B. WATER**

The Contractor shall be responsible for providing water necessary for construction. This includes costs for supplying potable water for hydrostatic pressure leak testing of all water-holding structures and operational testing of all equipment and processes. Water is available from the Owner free of charge, provided that it is used responsibly. Water is available on site at various hose bibs. Larger amounts of water can be obtained from the Owner by coordinating with them to use a City fire hydrant. The Contractor shall install a meter with backflow prevention device prior to obtaining water from the Owner.

## **2.2 TEMPORARY PIPING**

The Contractor shall furnish and install all temporary piping and pumping and, upon completion of the work, remove all such temporary piping as required, except as designated on the Plans to remain as a part of the Project. Prior to installation, the Contractor shall submit drawings to the Engineer showing the proposed installation of temporary piping and pumps, including location, type of pipe, fittings, and valves. The Contractor shall obtain the Engineer's approval for temporary piping and pumping plan prior to installation.

Temporary piping and pumping shall be provided as necessary to maintain the existing facilities in operation until the new facilities are constructed, operational. An effort has been made on the Plans and/or Specifications to note instances and locations where temporary piping and/or pumping may be required; however, this in no way limits the temporary piping and pumping to be provided by the Contractor at these locations.

### **2.3 SANITARY FACILITIES**

The Contractor shall provide toilet and wash-up facilities for their workforce and the Engineer at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

### **2.4 OFF-SITE STAGING AND PARKING**

The Contractor shall note that space is limited throughout the construction site. Employees of the Contractor, all subcontractors, vendors, suppliers, and associated personnel shall not be allowed to park onsite during the course of construction. It shall be the responsibility of the Contractor to provide sufficient parking facilities in authorized area(s) other than the construction site for the above-mentioned personnel.

The Contractor shall not be allowed to stockpile and store equipment and materials throughout the construction site. The Contractor shall coordinate their schedule so that all equipment and materials shall be brought to the construction site only when they are to be installed/utilized.

The Contractor shall provide storage of equipment and materials at an offsite, bonded warehouse, to be approved by the Engineer. The Contractor shall pay all costs associated with off-site delivery, storage, and transfer to the construction site.

### **2.5 ENCLOSURES**

The Contractor shall furnish, install, and maintain during the project time all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

### **2.6 ALARM SYSTEMS**

The Contractor shall provide alarm systems for temporary pumping facilities utilized during construction. Alarms shall warn the Contractor and/or system

operators of high/low level alarms and similar conditions, which, if left unattended or uncorrected, could lead to spillage or overflow of raw or treated sewage or sludge from a wet well, pumping facility, or portion of a treatment plant or lift station.

### **PART 3 EXECUTION**

All temporary facilities and controls shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Owner.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01505**

### **MOBILIZATION AND DEMOBILIZATION**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section consists of mobilization and demobilization. Mobilization consists of preconstruction activities and preparatory work for the project necessary to mobilize labor, materials, and equipment to the project site. Demobilization consists of activities to remove materials and equipment from the project site upon project completion, including final cleanup. Items which are not considered mobilization or demobilization include but are not limited to:

- A. On-going activities throughout the duration of construction.
- B. Profit, interest on borrowed money, overhead, or management costs.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
Division 1	General Technical Requirements

#### **PART 2 PRODUCTS**

Products and materials required for mobilization and demobilization are described in the various sections of Division 1 and in other parts of the Contract Documents.

#### **PART 3 EXECUTION**

Complete mobilization and demobilization as required by the various sections of Division 1 and other parts of the Contract Documents.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01510**

### **MAINTENANCE OF TREATMENT FACILITY**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the steps that the Contractor shall take to ensure that the existing facilities or temporary facilities remain fully operational during all stages of construction and modifications to the various existing facilities. Bypasses of untreated sewage will not be permitted.

The Contractor shall be responsible for all scheduling and arrangements for temporary sewage handling. This shall also include all connections of temporary pumping equipment with temporary electrical service with controls. The Contractor shall coordinate work efforts with the Owner.

To ensure continuous operation of the existing treatment systems, the Contractor shall inform the treatment plant operator of the details of operation of all temporary piping and electrical power and controls.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01500	Temporary Facilities
01530	Temporary Bypass Pumping

##### **1.3 WASTEWATER TREATMENT FACILITY**

The Contractor shall schedule their work so as to minimize interruption of the treatment or the transportation of sewage. Prior to starting construction, the Contractor shall confer with the Engineer and the Owner and develop a construction sequence and schedule which will provide for adequate temporary pumping, if necessary, and/or treatment during the required modifications. The Contractor shall take all steps necessary to ensure that the existing facilities or a temporary facility remains fully operational during all stages of construction and modifications to the various existing facilities. Bypasses of untreated sewage will not be permitted. The Contractor shall be required to have a standby pump, equal in capacity to the temporary pump, onsite and capable of operation should the temporary pump fail.

In the event that inadequately treated sewage reaches the receiving water as a result of the Contractor's activities, the Contractor shall immediately notify the

Owner and take corrective action. Following any such incident, the Contractor shall submit to the Owner a written report summarizing the beginning and ending times of the bypass, approximate volume bypassed, reason for bypass, and corrective measures taken.

Any and all actions required by the Contractor to remedy waste spillage or contamination of receiving waters shall occur at their own expense.

#### **1.4 EXISTING UTILITIES**

There now exists within the site boundaries a domestic water system and sanitary sewer system owned by the Owner, as well as privately owned and operated telephone, communication, internet, and electric lines and poles, both underground and overhead. The utilities are vital to the continuous operation of the existing treatment facilities.

The Contractor shall be responsible for the protection of these utilities and be responsible for notifying the utility company if their services are necessary. All poles, piping, wiring, etc., of the various utilities shall be braced and protected from nearby excavations at the Contractor's expense.

Whenever the Contractor is excavating in the area of these utilities, they shall make arrangements to have emergency repair equipment, materials, and manpower available within 30 minutes of the project location. The Contractor shall submit their contingency plans to the Engineer for approval at least 10 calendar days prior to performing any excavation.

If any damage is done to these lines, the Contractor shall repair the line(s) immediately so the operation of the facility is unimpaired. If the Contractor fails to repair the lines, the Owner shall repair the line(s) and deduct the costs thereof from the monies or payments due or to become due to the Contractor.

Where the Contractor is responsible for damage to an underground or overhead utility, they shall make the repair immediately, at their expense.

The Contractor shall be responsible for protecting and repairing, if damaged, all existing roadway, catch basins, culverts, fences, rockeries, retaining walls, shrubbery, and all other items that are visible and where the removal or demolition is not ordered or provided for in this Contract.

A set of record drawings of the existing treatment plant are available for review from the Owner and/or the Engineer. Said record drawings are made available for information only and not as a warranty of existing conditions. The Contractor shall be held responsible for verifying the accuracy of the record drawings.

The Contractor shall work with the Owner's Public Works Department by calling 509-686-3613 and the Utilities Underground Location Center, by calling 1-800-424-5555 to advise them of the proposed construction area and the proposed schedule of work sequence so that respective participating utilities may mark their systems. The Contractor shall also check individually with those utilities not participating. The Contractor shall, by letter and copies thereof, demonstrate to the Owner their efforts to fully inform the nonparticipating utilities, Owner's Public Works Department and the Utilities Underground Location Center of their activities. Furthermore, the Contractor shall demonstrate full cooperation with each utility involved in this Project.

The Contractor is hereby advised that the exact locations of the existing underground pipes and conduits at the plant site are not known. The Contractor shall locate and mark these lines prior to construction.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01520**

### **FIELD OFFICES AND STORAGE SHEDS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section describes the requirements for field offices and storage sheds on this project. A field office is not required.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01500	Temporary Facilities

#### **PART 2 PRODUCTS**

##### **2.1 STORAGE SHEDS**

The Contractor shall provide storage for the protection of equipment, materials, supplies, and tools and shall ensure that a building be used for the storage of materials that deteriorate when exposed to moisture. Workshops and storage buildings shall be located in the general area of the work and shall be clean and in proper order. Storage of materials at the project sites shall not obstruct access or use by the Owner's employees of existing facilities.

#### **PART 3 EXECUTION**

All storage sheds shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities as rapidly as progress of the work will permit or as directed by the Engineer. The Engineer's field office and accessories shall remain in service until the project is accepted by the Owner.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01720**

### **RECORD DRAWINGS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the record drawings, which shall be maintained and annotated by the Contractor during construction.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals

##### **1.3 INFORMATION PROVIDED BY THE OWNER**

The Contractor will be provided with the following items to maintain record drawings for the project:

- A. One full size paper set of Plans.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

The Contractor shall maintain the following record drawings for the project:

- A. A neat and legibly marked set of Contract Plans showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;
- B. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Contract Documents; and
- C. Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during

normal working hours at the Contractor's field office. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Engineer.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

- A. Additions - Red
- B. Deletions - Green
- C. Comments - Blue
- D. Dimensions - Graphite

Legibly mark drawings to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

The Contractor's record drawings (full-size hard-copy) will be reviewed monthly for completeness by the Engineer prior to preparing the progress estimate for payment. If the record drawings do not reflect the work performed, payment for that item of work will not be included in the progress estimate.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01740**

### **CLEANUP**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the maintenance of the building, structures, and site(s) in a standard of cleanliness throughout the construction period as described herein.

Throughout the construction period, the Contractor shall maintain the cleanliness of the site and structures as described herein. The Contractor is also to maintain access to all existing, operating equipment such that the equipment may be serviced and operated.

Dust of all kinds, including concrete dust produced by construction activities, shall be controlled to avoid damage to existing, operating equipment. Enclosures, ventilation, and air scrubbing may be required where significant potential for damage is determined by the Engineer.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

In addition to standards described in this Section, comply with all requirements for cleaning up when described in other sections of these Contract Documents.

##### **1.3 QUALITY ASSURANCE**

###### **A. INSPECTION**

The Contractor shall conduct daily site inspections, and more often if necessary, to verify that requirements are being met.

###### **B. CODES AND STANDARDS**

In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

## **PART 2 PRODUCTS**

### **2.1 CLEANING MATERIALS AND EQUIPMENT**

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

### **2.2 COMPATIBILITY**

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

## **PART 3 EXECUTION**

### **3.1 PROGRESS CLEANING**

#### **A. GENERAL**

Retain all stored materials and equipment in an orderly fashion allowing maximum access, not impeding drainage or traffic, and providing protection.

Do not allow the accumulation of scrap, debris, waste material, and other items not required for this work.

At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.

Provide adequate storage for all materials awaiting removal from the project site, observing all requirements for fire protection and protection of the environment.

#### **B. SITE**

Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, arrange, or otherwise service all arrangements to meet the requirements above.

Maintain the site in a neat and orderly condition at all times so as to meet the approval of the Engineer.

**C. STRUCTURES**

Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, sweep clean all interior spaces. "Clean" shall be interpreted to mean free from dust and other materials that can be swept with a broom using reasonable diligence.

In preparing to install succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material. Use all equipment and materials required to achieve the required cleanliness.

**D. STREETS**

All paved and unpaved streets in the vicinity of the project shall be kept free of material tracked from the project site(s) or dropped from vehicles entering and leaving the site(s). The Contractor shall inspect roads in each active area daily, and all material deposited on the road from the Contractor's activities shall be removed prior to the end of the workday. This shall include sweeping, as required, to collect any mud, dirt and dust from the surface. All catch basins and culverts in the work area shall be inspected before completion and cleaned as directed by the Engineer.

**3.2 FINAL CLEANING**

**A. DEFINITION**

Except as otherwise specifically provided, "clean" shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance equipment and materials.

**B. GENERAL**

Prior to final inspection, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final project cleaning as described below.

## C. STRUCTURES

### 1. Exterior

Visually inspect all exterior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

### 2. Interior

Visually inspect all interior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only appropriate cleaning materials and equipment.

### 3. Glass

Clean all glass inside and outside.

## D. TIMING

Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean project, ready for occupancy.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01800**

### **TESTING, COMMISSIONING, AND TRAINING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems and completed portions of the work.

See also Section 16050 for additional electrical and instrumentation system testing requirements.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01110	Scope of Work
01300	Submittals
01400	Quality Control
01500	Temporary Facilities
15050	Piping Systems
15400	Plumbing
15700	HVAC
16050	Basic Electrical Materials and Methods

##### **1.3 QUALITY ASSURANCE**

###### **A. INSTALLATION**

All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the Contract Documents, including the manufacturer's requirements. Should a manufacturer's installation recommendation conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any additional costs arising out of changes authorized by the Engineer to accommodate manufacturer's installation recommendations will be considered extra work. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

## B. TESTING

### 1. General Requirements

All equipment and partially complete or fully completed portions of the work included in this Contract shall be tested and inspected to prove compliance with the Contract requirements. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor. For the purpose of this Section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic, or hydraulic connection. Installed leakage tests and other piping tests shall be as specified in Sections 15050 and 15400. Installed tests for heating and ventilation systems shall be as specified in Section 15700. Installed tests for electrical and instrumentation devices and systems shall be in accordance with Division 16.

No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

Tests and inspection shall include:

- a. The delivery acceptance test and inspections.
- b. The installed tests and inspections. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- c. The operational testing of completed sections of the facility. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- d. The commissioning of completed sections of the facility by Owner's personnel. The commissioning shall be performed with the process fluid at normal flows.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers. The Contractor shall allow for up to two additional setpoint changes during testing. No extra costs or time allowances shall be provided as long as this setpoint allowance is not exceeded.

The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in their presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms that include all test information, including specified operational parameters. The content of the forms used shall be acceptable to the Engineer.

A master test log book shall be maintained by the Contractor, which shall cover all tests including piping, equipment, electrical, and instrumentation. The master test log book shall be provided with loose-leaf pages that shall be copied weekly after updating for transmittal to the Engineer. The master test log book shall be transmitted to the Engineer upon completion of the project.

## 2. Delivery Acceptance Tests and Inspections

The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified herein and shall include the following:

- a. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this Contract. Tests other than those specified shall be in accordance with Section 01400.
- b. Inspection of all items delivered at the site or to any authorized place of storage so that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct their inspection. Should the Engineer find, in their opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance.

### 3. Installed Tests and Inspections

#### a. General

All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

#### b. Procedures

##### i. General

The procedures shall be divided into two distinct stages; preoperation checkout and water test. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Engineer, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.

##### ii. Preoperation Checkout

The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation. Preoperation checkout procedures shall include, but not necessarily be limited to:

- (1) Piping system pressure testing and cleaning as specified in Division 15.
- (2) Electrical system testing as specified in Division 16.
- (3) Alignment of equipment.
- (4) Preoperation lubrication.

iii. Water Test

Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has not found deficiencies in that portion of the work, individual systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including temperatures and vibration, to observe performance characteristics, including performance throughout the specified range for blowers, and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Engineer.

If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are

affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.

Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, excessive temperature, noise, and/or vibration or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. All machines or devices, which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.

Test results shall be within the tolerances set forth in the detailed Specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer, and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then, the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be conducted by the Contractor at their expense.

Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all water,

power, fuel, compressed air supplies, labor and all other necessary items and work required to complete all tests and inspection specified herein. The Contractor shall provide, at no expense to the Owner, temporary heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

4. Operational Testing

After completion of all installed testing and review by the Engineer that all equipment complies with the requirements of the Specifications, the Contractor shall conduct operational testing. All domestic water, oil, fuel, and chemical systems shall be filled with the specified fluid.

The Contractor shall operate the completed facility for a period of not less than that specified in Part 3.4 of this Section during which all systems shall be operated as a complete facility at various loading conditions, as directed by the Engineer. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

Record drawings of facilities involved must be accepted and ready for turnover to the Owner at the time of operational testing.

All costs for water, fuel, power, and chemicals required during operational testing shall be borne by the Owner.

5. Commissioning

After completion of the operational testing and certifications by the Engineer that the systems meet all performance requirements, commissioning will begin. The commissioning period for all systems shall be 15 days. The Contractor shall remove all temporary piping that may have been in use during the operational testing and shall assist the Owner with the placement of the facility

into its fully operational mode handling wastewater. The Owner's operations and maintenance personnel will be responsible for operation of the facility or portion of the facility during this period of time. The facility or portion thereof shall be fully and continuously operational, accepting all normal flow called for in design and performing all functions as designed.

The Contractor shall be available, with all appropriate subcontractors and trades, at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested. This assistance shall be available, if needed, on a 24-hour basis. The Engineer will not issue a certificate of Substantial Completion until the end of the commissioning period (including training) and then only when all corrections required to assure a reliable and completely operational facility have been complete. The Contractor shall be responsible for all costs in excess of the Owner's normal expected costs of operations during the commissioning period. The Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the portion of the plant being commissioned operational.

The commissioning period will be considered completed when the facility has been continuously operated without major interruption, equipment failure, or system breakdown for the specified commissioning period. A major interruption, failure or breakdown shall be a condition or event that prevents the facility from continuously and adequately handling normal flow, cannot be repaired or corrected immediately by the Contractor, and is not caused by improper operation and maintenance of the facilities by the Owner. An interruption of the commissioning period under these circumstances will require a re-start of commissioning once required repairs and corrections are made by the Contractor. Should the commissioning period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the commissioning shall be repeated until the specified continuous period has been accomplished without interruption.

Final O&M manuals for the facilities must be accepted and ready for turnover to the Owner before the start of commissioning.

#### C. TRAINING

During the phase of water testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers

of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof. The time required for this training shall be as covered in the specifications for the specific piece of equipment. The Contractor shall notify the Engineer of the time of the training at least 10 days prior to the start time of the training.

## **1.4 SUBMITTALS**

### **A. STARTUP AND TESTING PLAN**

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer five copies of a startup and testing plan with details of the installed tests and inspection procedures he proposes to adopt for testing and startup of all equipment to be operated singly and together.

### **B. TRAINING OUTLINE**

The Contractor shall submit five copies of a detailed outline of training activities to be performed by each manufacturer's representative 10 days prior to the start time of the training. This outline shall indicate how the manufacturer's representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

## **PART 2 PRODUCTS**

### **2.1 INSTALLATION**

Materials employed in the installation shall conform to the requirements of the Contract Documents and the recommendations of the equipment manufacturers.

### **2.2 TESTING**

#### **A. GAUGES, METERS, RECORDERS, AND MONITORS**

Gauges, meters, recorders, and monitors shall be provided by the Contractor as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Specifications. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to be consistent with the variables to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures shall be in

accordance with applicable standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review by the Engineer.

#### **B. RECORDS**

The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract. Sign-off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preoperation checkout, as well as signatures of representatives of the equipment manufacturers, the Contractor, and the Engineer.

#### **C. TEMPORARY TEST FACILITIES AND MODIFICATIONS**

The Contractor shall provide and install all necessary temporary piping, valves, pumps, tanks, controls, and other facilities and modifications to enable the operational testing of the permanent facility components. Operational testing requiring the recirculation of water or process fluids within the facility shall be performed by the Contractor using temporary facilities, if needed, provided and installed by the Contractor. Temporary facilities shall be removed by the Contractor once the required testing is completed.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

#### **3.2 TESTING**

Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole

responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

During the facility operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable, at conditions, which represent the full range of operating parameters as defined by the Contract Documents.

### **3.3 TRAINING**

Training of the Owner's personnel shall be done by experienced technical manufacturers' representatives. Training shall be provided during a scheduled, dedicated session and shall not be combined with other field services such as equipment testing, startup and check-out. When required by these specifications, the training sessions shall be video and audio-taped by the Contractor and the final DVD delivered to the Owner. These manufacturers' representatives shall follow the outline presented here:

#### **GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS**

##### **A. FAMILIARIZATION**

1. Overview explaining theory of operation.
2. Show catalog, parts lists, drawings, etc., in the shop drawings and O&M manuals. Clearly identify the model or identification number of the equipment for which training is being provided.
3. Check out the installation of the specific equipment items.
4. Demonstrate the unit and show that all parts of the Specifications are met.
5. Answer questions.

##### **B. SAFETY**

1. Point out safety references.
2. Discuss proper precautions around equipment.

##### **C. OPERATION**

1. Point out reference literature.

2. Explain all modes of operation (including emergency).
3. Check out Owner's personnel on proper use of the equipment. (Let them do it).

D. PREVENTIVE MAINTENANCE (PM)

1. Pass out PM list including:
  - a. Reference material.
  - b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.
2. Show how to perform PM jobs.
3. Show Owner's personnel what to look for as indicators of equipment problems.

E. CORRECTIVE MAINTENANCE

1. List possible problems.
2. Discuss repairs - point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

F. PARTS

1. Show how to use parts list and order parts.
2. Check over spare parts on hand. Make recommendations.

G. LOCAL REPRESENTATIVES

1. Where to order parts: Name, address, telephone, fax, e-mail.
2. Service problems:
  - a. Who to call.
  - b. How to get emergency help.

### **3.4 FACILITY OPERATIONAL TESTING**

The systems described below shall be tested to demonstrate the performance of mechanical, electrical, instrumentation and control subsystems together as an integrated system. Where the testing described in this Section conflicts with the testing requirements specified for individual equipment, or the manufacturer's recommended testing procedure, those requirements and procedures shall prevail.

Unless otherwise noted, a time period of 5 days shall be allowed for each facility operational test. Unless otherwise noted, each portion of the facility being operationally tested must perform through its complete design range for a period of 5 consecutive 24-hour days. Facility operational testing shall be sequenced in coordination with the work sequence specified in Section 01110. Temporary facilities necessary for operational testing are specified in Paragraph 2.2 of this Section and in Section 01500. Facility operational testing shall be divided as follows:

#### **A. LIQUID STREAM SYSTEMS**

Testing of the liquid stream systems shall include the chlorine gas injection, the non-potable water, and the sludge pump room drainage systems.

#### **B. SOLID STREAM SYSTEMS**

The Contractor shall perform an operational test of the sludge pumps and control equipment.

#### **C. HEATING AND VENTILATING**

Testing and balancing of the heating and ventilating systems shall be performed in accordance with Specification Section 15700. This shall include testing of the emergency gas scrubber.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 01900**

### **SALVAGE AND DEMOLITION**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section covers the demolition of existing structures, piping, equipment, and sitework, and the salvage of existing materials and equipment as indicated on the Plans and as specified herein.

All areas and facilities of the existing facility, which are not to be removed, must remain in continuous operation during the work in accordance with Section 01510. Demolition and salvage work shall create a minimum of interference with the operation of the facility.

The Plans show the major items to be demolished and removed. In addition to these items, the Contractor shall remove any other incidental above-grade items which are not to be used in the completed project.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01510	Maintenance of Treatment Facility

##### **1.3 SALVAGE**

Salvageable equipment and material shall be removed with care so as not to impair future uses and shall include all equipment and material so indicated on the Plans. Salvaged equipment and material not reused or rejected by the Owner shall be cleaned and protected from corrosion and weather and delivered by the Contractor to the Owner at the wastewater treatment facility or as otherwise noted on the Plans.

Reuse of salvageable equipment and material by the Contractor will not be permitted except where specifically indicated on the Plans and in the Specifications or where approved by the Engineer and Owner. Salvageable equipment and materials rejected in writing by the Owner shall become the property of the Contractor and shall be disposed of away from the site without additional cost to the Owner.

## **1.4 DEMOLITION**

The Contractor shall be responsible for compliance with current City, County, State, and Federal codes and regulations related to demolition.

The Contractor shall notify all affected utilities and comply with their respective requirements for abandonment of such utilities including power, telephone, natural gas, water, sanitary sewer, and storm sewer utilities.

The Contractor shall maintain access for the Owner's employees during the demolition period and provide barricades, fences, etc., as required for job site safety.

Demolition of concrete, masonry, roofing, asphalt, and other materials shall be done so as to avoid damage to existing structures intended to remain. Demolition or cutting required to add to or modify existing structures shall be done in such a manner that the appearance and utility of the existing structure is not impaired and so that a neat transition from new to old material may occur.

All piping and appurtenances located less than 4 feet below finished grade shall be removed and hauled to an approved disposal site. All piping and appurtenances located four feet or more below finished grade may be abandoned in place, unless shown otherwise on the Plans, as long as Contractor fully seals all pipe and appurtenance openings with grout.

All waste materials from demolition or cutting shall become the property of the Contractor and shall be removed from the site and hauled to an approved waste disposal site, if declared surplus by the Owner. All materials and equipment, however, are property of the Owner unless declared surplus. Some equipment and materials scheduled for salvage and delivery to the Owner are noted on the Plans.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 2**

## **SITEWORK**

## **SECTION 02050**

### **LOCATE EXISTING UTILITIES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the anticipated conflicts, which may exist with existing utilities. A reasonable attempt has been made to locate the existing utilities; however, the exact location, and/or depth are unknown in most instances. Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification. It shall be the responsibility of the Contractor to locate existing utilities and their depth.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01200	Measurement and Payment
02250	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork
02370	Erosion Control

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

The Contractor shall determine the difficulties to be encountered in constructing the Project and his locate effort based upon the information provided on the Plans, field investigation, and the Contractor's contacts with the existing utility companies. The Contractor shall determine the extent of exploration required to first prevent damage to those existing utilities, and secondly to determine if the proposed improvements are in conflict with existing utilities.

The Contractor shall locate existing utilities sufficiently ahead of construction so that the Engineer can modify the alignment, or grade prior to construction. Where underground utilities are found to be in the way of construction, such condition shall not be deemed to be a changed or differing site condition. If necessary, pipe alignment or grade shall be modified at the Contractor's expense.

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than 2 nor more than 10 business days before the scheduled date for commencement of excavation that may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project is (800) 424-5555. If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of the proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all know facilities in the vicinity of the excavation area have been located and marked.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 02230**

### **CLEARING AND GRUBBING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the clearing, grubbing, and stripping of the proposed project areas in preparation of foundations, embankment construction, and pipeline installation.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01200	Measurement and Payment
02305	Wet Weather Earthwork
02300	Earthwork
02370	Erosion Control

##### **1.3 DEFINITIONS**

“Clearing, grubbing, and stripping debris” as hereinafter used shall be considered as all material removed by the clearing, grubbing, and stripping operations.

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

##### **3.1 DISPOSAL OF CLEARING AND GRUBBING DEBRIS**

Clearing and grubbing debris shall be disposed of by hauling to waste and disposal sites approved by the Owner.

##### **3.2 CLEARING AND GRUBBING**

Clearing and grubbing shall be performed as required to complete the work shown on the Plans to a minimum depth of 4 inches in order to remove the root zone of existing vegetation.

This work shall include removal and disposal of all trees, logs, brush, stumps, roots, and minor manmade structures to include but not limited to concrete, asphalt abandoned metal and equipment, rubbish and debris to the limits indicated

on the plans or as required and approved by the owner. This work shall be to a depth necessary to remove stumps, large roots and all other objectionable material. This work shall also include the protection from injury or defacement of trees, bushes, shrubs, and other objects designated to remain.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 02240**

### **DEWATERING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes dewatering excavations of any kind and location, including but not limited to groundwater, surface water, and precipitation, until backfilling has been completed to finished grade.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02250	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork
02370	Erosion Control

##### **1.3 SUBMITTALS**

Prior to the start of construction, the Contractor shall submit a dewatering plan in accordance with Section 01300 containing both a graphical and narrative presentation identifying proposed methods, equipment sizes and contingency plans should dewatering cause settlement of any adjacent facilities. The dewatering plan shall show specific locations, in plan and section, where dewatering is expected as well as a general discussion of methods to be employed should water be encountered in other locations. The plan shall detail the depth, diameter and anticipated flow for dewatering wells, well points or sumps.

Acceptance by the Owner of the method, installation, and operation and maintenance details submitted by the Contractor shall not in any way be considered to relieve the Contractor from full responsibility for errors therein or from the entire responsibility for complete and adequate design and performance of the system in controlling the water level in the excavated areas, and for control of the hydrostatic pressures to the depths specified herein. The Contractor shall be solely responsible for the proper design, installation, proper operation, maintenance, and any failure of any component of the dewatering system.

## **1.4 REFERENCES**

“Rossum J.R., 1954, *Control of Sand in Water Systems*, Journal American Water Works Association, Volume 46, pp. 123-132”

Geotechnical Engineering Report, Bridgeport, Washington, PanGeo 2012

Construction Stormwater Permit

## **1.5 QUALITY CONTROL**

It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering efforts to avoid all objectionable settlement and subsidence. The Contractor shall comply with local codes and ordinances of governing authorities with regard to disposal of water pumped from dewatering operations.

Proposed discharge points shall be approved by the Owner prior to implementation of dewatering. The Contractor shall be responsible for taking all reasonable precautions necessary to ensure continuous, successful operation of the system.

## **PART 2 PRODUCTS**

Dewatering shall be in accordance with the guidance stated in the Geotechnical Report for this Project.

The Contractor shall have sufficient pumping equipment and/or other machinery available onsite before operations begin to assure that the operation of the dewatering system can be maintained. This shall include providing backup pumps of similar capacity and a standby generator of the capacity required to continuously operate the Contractor's dewatering system.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION AND APPLICATION**

During excavation, the installation of piping, conduits and structures and during the placing of backfill, excavations shall be kept free of water, subsurface or otherwise. The Contractor shall furnish all equipment necessary to dewater the excavations and shall dispose of the water so as not to cause a nuisance or menace to the public. The dewatering system shall be installed and operated by the Contractor so that the groundwater level outside the excavation is not reduced to

the extent that would damage or endanger adjacent structures or property. The release of groundwater to its static levels shall be performed so as to maintain the undisturbed state of the foundation soils, prevent disturbance of backfill and prevent movement of all structures and pipelines.

Design implementation and maintenance of any dewatering system shall be the responsibility of the Contractor.

The Contractor shall construct all dewatering wells in accordance with WAC 173-160. The dewatering system shall be sufficient to maintain the groundwater level at an elevation to protect the surface of the trench bottoms, the base of the bedding course or other foundation, and shall be accomplished prior to pipe laying and jointing or placement of reinforcing steel for concrete.

If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavations.

The Contractor shall design filters and screen slot sizes for all sumps, wells and well points which prevents the movement of fines during pumping. The Contractor shall develop the wells such that they produce no more than 10-ppm silica as measured with a Rossum Sand Tester (Rossum, 1954) or equivalent.

### **3.2 MONITORING**

The Contractor shall install water level observation wells in dewatered areas sufficient to determine whether groundwater levels are maintained as per Part 3.1 of this Section.

### **3.3 FIELD QUALITY CONTROL**

A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. The Contractor shall test all dewatering discharge using a Rossum Sand Tester or equivalent to determine the silica content of the discharge. The Contractor shall notify the Owner at least 24 hours prior to testing. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement that could develop.

Should settlement be observed, the Contractor shall cease dewatering operations and implement contingency plans as outlined in the Contractor's approved dewatering plan. The responsibility for conducting the dewatering operation in a

manner that protects adjacent structures and facilities rests solely on the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor. Permanent piping systems, existing or new, shall not be incorporated into the Contractor's dewatering system.

**\*\*\* END OF SECTION \*\*\***

## SECTION 02250

### TEMPORARY SHORING AND BRACING

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the temporary shoring and bracing for excavations including the trench excavation safety systems as shown on the Plans and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork

##### 1.3 GEOTECHNICAL REPORT

A Geotechnical Report has been provided in the Appendix

Geotechnical Engineering Report, Bridgeport, Washington, PanGeo 2012.

##### 1.4 WORK INCLUDED

The extent of temporary shoring and bracing work includes, but is not limited to:

- A. Temporary shoring and bracing necessary to protect the following against loss of ground or caving embankments: existing structures, buildings, roads, walkways, utilities, electrical transmission towers and support wiring, other facilities and improvements where required to comply with codes and authorities having jurisdiction.
- B. Trench excavation safety systems, pursuant to RCW Chapter 49.17 and WAC 296-155-655.
- C. Maintenance of shoring and bracing.

## **1.5 QUALITY ASSURANCE**

### **A. SHORING CONSULTANT**

The Contractor shall engage the services of a qualified geotechnical engineer and qualified structural engineer registered in the State of Washington to design temporary shoring and bracing when required by applicable regulations.

### **B. SHORING DESIGN**

The Contractor shall provide layout and design drawings and specifications for shoring and bracing when a trench box is inadequate for the purpose or will not be used and trench depth exceeds 4 feet and back sloping will not be used. Temporary shoring and bracing system design and calculations shall be prepared, stamped, and signed by a Professional Engineer registered in the State of Washington.

### **C. REGULATIONS**

The Contractor shall design sheeting, shoring and bracing in accordance with the Washington State Safety Code and any local codes and ordinances of governing authorities having jurisdiction. Pile driving will not be allowed on the site; drilling shall be required for all required piles.

## **1.6 SUBMITTALS**

The Contractor shall submit shoring and bracing layout and design drawings, calculations and other backup data to the Owner for review in accordance with Section 01300 prior to the start of construction.

## **1.7 PROJECT CONDITIONS**

### **A. SOILS INFORMATION**

A Geotechnical investigation has been conducted for this project and a copy of the report is included in Appendix B.

### **B. SITE SURVEY**

The background survey information provided on the Plans is shown for clarity only. The Contractor shall determine, before commencing work, the exact location of all existing features that may be disrupted by new construction, including existing underground utilities. The Contractor shall be fully responsible for any and all damages, which might be caused

by the Contractor's failure to exactly locate and/or preserve existing site features. Prior to commencing work, the Contractor shall check and verify governing dimensions and elevations.

The Contractor shall survey adjacent structures and facilities, establishing exact elevations at fixed points to act as temporary bench marks to monitor potential settlement from the contractor's ongoing operations. Clearly identify temporary bench marks and record existing elevations from the control points shown on the Plans.

During excavation, the Contractor shall resurvey bench marks weekly. The Contractor shall maintain and make available at the job site an accurate log of surveyed elevations for comparison with original elevations, and promptly notify the Owner if changes in elevations occur or if cracks, sags or other damage is evident.

## **1.8 EXISTING UTILITIES**

The Contractor shall protect existing active sewer, water, gas, electrical, and other utility services and structures that may be present. This shall also include all pipelines, services, and structures that are the property of the Owner.

## **PART 2 PRODUCTS**

The Contractor shall provide suitable shoring and bracing materials, which shall support loads imposed. Materials for shoring systems need not be new, but shall be in serviceable conditions.

## **PART 3 EXCAVATION**

### **3.1 VERIFICATION OF CONDITIONS**

The Contractor shall notify the Owner immediately if, during construction, subsurface conditions are different from those encountered in the exploratory holes or as described in the Geotechnical Report.

### **3.2 INSTALLATION AND APPLICATION**

The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The Contractor shall locate required bracing to clear all permanent work. Bracing which must be relocated shall be installed prior to the removal of original bracing. The Contractor shall not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to the Owner. The Contractor shall maintain bracing until structural

elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### **3.3 REMOVAL**

The Contractor shall remove shoring and bracing in stages to avoid disturbances to adjacent and underlying soils and damage to structures, pavements, facilities and utilities. The Contractor shall repair or replace, as acceptable to the Owner, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

### **3.4 EXCAVATION SAFETY SYSTEMS**

All work shall be carried out with due regard for public safety. Open trenches shall have proper barricades and at night they shall be distinctly indicated by adequately placed lights, as provided for elsewhere in the Specifications.

The Contractor is reminded that the Owner has not so delegated, and the Owner's Representative does not purport to be a trench or excavation system safety expert, is not so engaged in that capacity under this Contract, and has neither the authority nor the responsibility to enforce construction, safety laws, rules, regulations, or procedures or to order the stoppage of work for claimed violations of trench or excavation safety.

The furnishing by the Owner of resident representation and inspection personnel shall not make the Owner responsible for the enforcement of such laws, rules, regulations, or procedures, nor shall such make the Owner responsible for construction means, methods, techniques, sequences, procedures, or for the Contractor's failure to properly perform the work necessary for proper trench and excavation safety.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 02300**

### **EARTHWORK**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the earthwork, including trench excavation and backfill for piping, excavation and backfill for structures, and finish grading.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
02240	Dewatering
02250	Temporary Shoring and Bracing
02305	Wet Weather Earthwork
02370	Erosion Control
02510	Water Pipe
02700	Gravel Materials
02900	Landscaping

#### **PART 2 PRODUCTS**

##### **2.1 GRAVEL MATERIALS**

All gravel materials shall conform to Section 02700.

#### **PART 3 EXECUTION**

##### **3.1 PREPARATION**

Excavation may commence once all erosion control measures are in place in accordance with the Plans and Section 02370 and to the satisfaction of the Owner.

### **3.2 GENERAL REQUIREMENTS**

Excavation, compaction and backfill for structures, pipelines and the final site contours shall be formed by either excavating or compacting fill, as required, to provide the cross-sections as shown on the Plans.

All excavation performed on this Project shall be considered unclassified. Excavation shall consist of the removal of any and all material encountered, including debris, rubble, concrete, metal, topsoil, cutting and removal of existing surfacing, tree stumps, trees, logs, abandoned rail ties, abandoned piping, piling, riprap, etc.

Excavations shall be kept free of water, both surface water and groundwater, during the excavation, installation of pipelines and structures, and the placement of backfill. For additional requirements see Section 02240.

The Contractor's attention is also called to the depth of the structures and piping; for this reason, special shoring and bracing may be required. All shoring and bracing or sheeting required to perform and protect the excavation and to safeguard the employees, shall be furnished by the Contractor. For additional requirements see Section 02250.

No timber bracing, lagging, sheathing or other lumber shall be left in any excavation except with permission of the Engineer and in the event such permission is granted, no separate payment shall be allowed for burying such material.

All stockpiles shall be covered with plastic and no stockpile shall be higher than 6 feet above existing grade.

### **3.3 EXCAVATION AND BACKFILL FOR STRUCTURES**

Excavation and backfill for structures shall be in conformance with Section 2-09 of the WSDOT Standard Specifications, and as further described herein. All excavation for structures shall be done to the dimensions and levels indicated on the Plans or specified herein. Excavation shall be made to such width outside the lines of the structures to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

Excavation shall consist of the removal of any and all material encountered to the elevations shown on the Plans. Excavations for structures shall be continued down to the subgrade which is defined as 12 inches below concrete mat foundations, concrete footings, and slab on grade floors for the installation of foundation gravel material, unless otherwise noted on the Plans.

Fill material placed under structures, including footings and floor slabs, shall be foundation gravel free from debris and organics, as specified in Section 02700.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be under the unit price bid item entitled "UNSUITABLE EXCAVATION," as described in Section 01200. The Contractor shall then replace the material with compacted foundation gravel, as specified in Section 02700. Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

The Contractor shall notify the Engineer when excavation for compacted fill or structures is complete. No forms, reinforcing steel, or concrete shall be placed until the excavation has been inspected by the Engineer.

Backfill for structures shall be as specified in Section 02700.

There is no warranty that the native material is suitable for backfill or is suitable, as excavated, for placement and compaction as required by these Specifications. In the event that the Contractor is unable to find onsite, sufficient native material to accomplish the structure backfilling, the select material shall be specified in Section 02700.

### **3.4 PROTECTION OF FOUNDATION SURFACES**

Care shall be taken to preserve the foundation surfaces shown on the Plans in an undisturbed condition. If the Contractor unnecessarily over excavates or disturbs the foundation surfaces shown on the Plans or specified herein without written authorization of the Engineer the Contractor shall replace such foundations with concrete fill or other suitable material approved by the Owner in a manner which will show by test an equal bearing capacity with the undisturbed foundation material. No additional payment shall be made for the added quantity of concrete fill or other suitable material used because of unnecessary over excavation caused by the Contractor or their operations.

### **3.5 EXCAVATION AND BACKFILL FOR TRENCHES**

Excavation and backfill for trenches shall be in conformance with Sections 7-08 and 7-09 of the WSDOT Standard Specifications, and as further described herein. The following pipe materials shall be considered flexible:

- PVC
- Polyethylene Tubing
- FRP

- HDPE
- Polyethylene
- Corrugated Polyethylene

All other pipe materials shall be considered rigid.

Upon completion of work each day, all pipeline open trenches shall be completely backfilled, leveled, and temporarily patched or graveled, as herein specified. Under certain conditions, the trench may be left open at the last length of pipe laid during the day to avoid re-excavation the following morning, provided that the opening is adequately plated or covered for vehicle traffic. Special attention shall be given to barricading to keep vehicular traffic away from newly-backfilled trench areas until restored for traffic.

The Engineer reserves the right to restrict the Contractor in the amount of trench for pipeline that can be opened during the working day. Should the Contractor, in the Engineer's opinion, fail to diligently pursue backfilling, an allowable limit of open trench shall be 100 lineal feet and shall be strictly enforced.

The width of the trench at or below a point 12 inches above the top of the outside diameter of the pipe shall be carefully controlled and maintained to ensure the strength of the pipe and prevent pipe failures. Backfilling shall proceed as follows:

#### A. SUBGRADE PREPARATION

The subgrade for piping is defined as the elevation of the bottom of the pipe bedding material as shown on the Plans.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be paid as a change of condition per GC (change order). The Contractor shall then replace the material with compacted structural fill, as specified in Section 02700.

Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

#### B. BEDDING FOR RIGID PIPE

Above the foundation material, if any, the bedding material shall be gravel backfill for pipe bedding, as specified in Section 02700. This material shall be placed in lifts of approximately 8 inches up to a point 12 inches

above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

**C. BEDDING FOR FLEXIBLE PIPE**

Above the foundation material, if any, the bedding material shall be gravel backfill for pipe bedding, as specified in Section 02700. The material shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

**D. BACKFILL FOR TRENCHES**

Partial backfill to protect the pipe will be permitted immediately after the pipe has been properly laid in accordance with the Plans and these Specifications. Complete backfilling of trenches will not be permitted until the section of pipe installed has been inspected by the Engineer.

From the point 12 inches above the top of the pipe barrel, the backfill material to be used in the trench section shall be structural fill, as specified in Section 02700, except where required or shown on the Plans to use other material. The Contractor shall place backfill in horizontal lifts not to exceed 8 inches in thickness. All backfill shall be free of large rocks, organic matter, stumps, trees, pieces of pavement, broken concrete and other deleterious substances.

The Contractor shall remedy, at their expense, any defects that appear in the backfill prior to final acceptance of the work. Cleanup operations shall progress immediately behind backfilling to accommodate the return to normal use of the trench area.

During placement of the initial lifts, the backfill material shall not be bulldozed into the trench or dropped directly over the pipe with less than 3 feet of backfill material above the top of the pipe.

**3.6 ROCK EXCAVATION**

It is not anticipated that solid rock will be encountered. Should such material be encountered, however, it will be paid for change order as directed by the Engineer and approved by the Owner. Boulders or broken rock less than 2 cubic yards in volume as measured in the field by the Engineer, will not be classified as rock, nor will so-called "hard-pan" or cemented gravel, even though it may be advantageous to use explosives in its removal if blasting were allowed. For the purpose of this contract, rock excavation shall be defined as mineral matter in place and of such hardness and texture that, when it is encountered, cannot be

loosened by three passes of a ripper tooth mounted on the larger of a tracked backhoe of at least 25,000 pounds operating weight and 75 horsepower or the largest backhoe being utilized on the job by the Contractor. Where rocks occur as boulders that are smaller than the larger of: (1) 2 cubic yards in volume, or (2) the volume that can be readily handled by the largest backhoe being utilized on the job by the Contractor, they shall be considered incidental to excavation.

Where removal of a boulder results in a void below the desired elevation of the intended excavation, backfilling of the void shall be handled in the same manner as the replacement of unsuitable excavated material.

### **3.7 REUSE AND DISPOSAL OF EXCAVATED MATERIAL**

Excavated materials shall be properly protected and reused where possible. Excavated materials not used for fill shall be hauled to an approved waste site(s), as selected by the Contractor. The Contractor shall submit a list of approved waste haul site(s) to the Owner prior to the commencement of hauling of waste materials. Any permits required for waste haul and disposal shall be the responsibility of the Contractor.

### **3.8 FINAL SITE GRADING**

The site shall be graded consistent with the elevations shown on the Plans. The slopes between elevations shall be uniform or as shown on the Plans. Excavations and backfill shall be to the elevations required for the placement of all surface restorations, such as asphalt, concrete, gravel surfacing, or landscaping. All areas shall be graded to provide proper drainage. The final ground surface shall be smooth, raked free of debris and stones, and prepared for restoration as specified in Section 02900.

### **3.9 STRUCTURE COMPACTION**

The foundation gravel material placed underneath all structures shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers. The thickness of layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand-operated mechanical compactors. Water settlement is not allowed for compaction.

Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Prior to the placement of fill below structures, any and all groundwater and surface water shall be drained or pumped from areas to be filled.

Wall backfill material shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Small hand operated compaction equipment shall be used within 5 feet of the walls.

### **3.10 TRENCH COMPACTION**

Trench backfill materials shall be moisture conditions to within three percent of optimum moisture content. Water settlement is not allowed for compaction.

Pipe bedding materials, for both rigid and flexible pipes, shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in structural or paved areas shall be performed by using mechanical equipment to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 02305**

### **WET WEATHER EARTHWORK**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the procedures to be followed if earthwork is to be accomplished in wet weather or in wet conditions where control of soil moisture is difficult.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02370	Erosion Control
02700	Gravel Materials

#### **PART 2 PRODUCTS**

The size or type of construction equipment shall be selected as required to prevent soil disturbance. In some instances, it may be necessary to limit equipment size or to excavate soils with a backhoe, Gradall, or equivalent type of equipment to minimize subgrade disturbance caused by construction traffic.

Material used as structural fill during wet weather earthwork shall generally consist of clean granular material containing less than 5 percent fines (material passing the U.S. Standard No. 200 sieve), based on wet sieving the fraction passing the 3/4-inch sieve. The fines shall be non-plastic.

#### **PART 3 EXECUTION**

##### **3.1 WET WEATHER EXCAVATION AND FILL PLACEMENT QUALITY CONTROL**

Excavation and placement of fill or backfill material will be observed on a full-time basis by the Owner, to determine that all work is being accomplished in accordance with these Specifications.

### **3.2 WET WEATHER EARTHWORK PROTECTION**

The ground surface shall be sloped away from construction areas to promote the rapid runoff of precipitation and prevent ponding of water.

Earthwork shall be accomplished in small sections to minimize exposure to wet weather. Excavation or the removal of unsuitable soil shall be followed immediately by the placement and compaction of a suitable thickness (generally 8 inches or more if approved by the Owner) of clean foundation gravel.

No soil shall be left uncompacted and exposed to moisture. A smooth drum vibratory roller, or equivalent, shall be used to seal the ground surface after placement of fill or backfill materials.

All wet weather work shall meet local, state and federal codes as specified herein and as indicated on the Plans.

**\*\*\* END OF SECTION \*\*\***

## SECTION 02370

### EROSION CONTROL

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the temporary erosion and sedimentation control (TESC) in and around the site caused by the actions of the Contractor as shown on the Plans and as specified herein.

Work under this Section shall be directed towards site areas disturbed during construction as well as all off-site storage and parking areas maintained by the Contractor.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02300	Earthwork

##### 1.3 SUBMITTALS

###### A. Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300 and paragraph 1.5 of this specification section. **The SWPPP shall be submitted to the Owner for approval at the preconstruction conference.**

##### 1.4 CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)

The Contractor shall designate a Certified Erosion and Sediment Control Lead (CESCL) for this project. The CESCL shall have, for the life of this Contract, a current Certificate of Training in Construction Site Erosion and Spill Control signed by the WSDOT Water Quality Program Manager.

Duties of the CESCL shall include, but are not limited to:

- A. Inspecting temporary erosion and spill control Best Management Practice (BMPs) for proper location, installation, maintenance, and repair. Inspections shall be made as noted on the Plans and after each significant precipitation event, including those that occur during weekends and after working hours. A Temporary Erosion and Spill Control Inspection Report shall be prepared for each inspection and shall be included in the Temporary Erosion and Spill Control file. The inspection report shall include, but not be limited to:
  - 1. When BMPs are installed, removed or changed;
  - 2. Repairs needed or made;
  - 3. Turbidity monitoring results;
  - 4. Observations of BMP effectiveness and proper placement;
  - 5. Recommendations for improving performance of BMPs.
- B. Prepare and maintain a Temporary Erosion and Spill Control file on site that includes but is not limited to:
  - 1. Temporary Erosion and Spill Control Inspection Reports;
  - 2. Contractor's Stormwater Pollution Prevention Plan (SWPPP);
  - 3. Spill Prevention, Control, and Countermeasures (SPCC) Plan;
  - 4. All project permits, including but not limited to grading permits and Hydraulics Project Approval;
  - 5. Manufacturer instructions for all products used for TESC BMPs;
  - 6. Washington State Department of Ecology's Stormwater Management Manual for Eastern Washington, Chapter 7.

## **1.5 STORMWATER POLLUTION PREVENTION PLAN**

The CESCL Contractor shall be responsible for preparing a Stormwater Pollution Prevention Plan (SWPPP). The intent of the SWPPP is to reflect the Contractor's operations by supplementing the TESC Drawings, details, and notes shown on the Plans to provide comprehensive pollution control at the construction site, staging areas, stockpiles, and borrow sites. The SWPPP shall be prepared by the CESCL

for the project and submittal in accordance with Section 01300. The SWPPP shall be submitted to the Owner for approval at the preconstruction conference. **No work shall begin until the Contractor's SWPPP, as approved by the Owner, is implemented.** The SWPPP shall address, at least, the following items:

- Identification of construction haul routes and location of BMPs (e.g., stabilized construction entrance, silt fences, storm drain inlet protection).
- Waste disposal methods and locations.
- Detailed construction sequence and schedule, including identifying dates scheduled for BMP installation, removal, clearing, grading, seeding, and landscaping.
- Details for any temporary flow diversions, dewatering systems, and BMPs (in accordance with the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington) proposed by the Contractor.
- Calculations for temporary sedimentation ponds, if used
- A list of products to be used, including Material Safety Data Sheets.
- Identification of stockpile and staging areas, and BMPs to be implemented at these locations.

The SWPPP shall be prepared in accordance with details shown on the Plans, these Specifications, and Chapter 7 – BMPs from the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Eastern Washington, which are hereby referenced and made a part of the Contract Documents. Only those sections of the Stormwater Management Manual for Western Washington that address preparation, implementation, and maintenance of permanent and temporary erosion and sedimentation control BMPs are applicable.

The SWPPP shall include best management practices to control windblown dust.

## **PART 2 PRODUCTS**

### **2.1 SILT FENCES**

Silt fences shall conform to the details shown on the Plans and the fabric shall conform meet the requirements of Geotextile for Temporary Silt Fence of Section 9-33 of the WSDOT Standard Specifications.

### **2.2 STRAW BALES**

Straw bale dams shall conform to the details shown on the Plans.

### **2.3 STORM DRAIN INLET (CATCH BASIN) PROTECTION**

Storm drain inlet protection shall be with a “silt sack,” as manufactured by ACF Environmental or equal.

### **2.4 EROSION CONTROL BLANKET**

On all disturbed slopes steeper than 2H:1V, an erosion control blanket shall be placed and secured per manufacturer’s recommendation with a biodegradable means.

The erosion control blanket shall be temporary, biodegradable and is to remain in place.

The erosion control blanket shall be “Biomac C” as manufactured by MacCaferri, Inc. or “Curlex II,” as manufactured by American Excelsior Co., or Equal.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped.

### **3.2 BEST MANAGEMENT PRACTICES (BMPS)**

Silt fences and straw bale dams shall be constructed to control erosion and migration of soils disturbed during construction. The fences and dams shall provide temporary protection and shall be removed only upon approval of the Owner.

All areas or drainage ways downstream of the construction site shall have Best Management Practices (BMPs) installed prior to the beginning of any clearing

activities. Runoff from cleared or disturbed area shall be directed through the BMPs. Disturbed ground shall be stabilized at the end of each work day. Permanent soil stabilization and erosion and sedimentation control shall be implemented upon reaching finish grade. Slope protection shall be immediately implemented upon any soils showing signs of erosion. This shall be done in a manner approved by the Owner.

All BMPs shall be inspected, maintained and kept in a condition sufficient to provide effective erosion and sedimentation control at all times. The site shall be inspected to ensure the BMPs are properly located, constructed and operating as designed during the first storm. Any necessary adjustments or repairs shall be made immediately and be approved by the Owner. The BMPs shall be inspected thereafter and after all significant storm events. Turbidity monitoring will be held on a weekly basis at a minimum, or more frequently if necessary as determined by the CESCL.

All BMPs shall be removed no later than 30 consecutive calendar days after final site stabilization has been achieved as determined by the Owner. BMPs such as storm drain inlet protection, straw bales, silt fences and supports and plastic coverings shall be removed and properly disposed of offsite by the Contractor. Areas disturbed by removal of these BMPs shall be immediately stabilized in a manner approved by the Owner.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 02700**

### **GRAVEL MATERIALS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the various types of granular materials that are to be used in trenches and other excavations as shown on the Plans and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02305	Wet Weather Earthwork
02710	Gravel Surfacing

##### **1.3 SUBMITTALS**

The Contractor shall provide certificates of laboratory tests in accordance with Section 01300, indicating particle size distribution for review for each type of granular material furnished and proctor test reports for all material to be placed as pipe bedding material, trench backfill, backfill under and around structures and underneath crushed surfacing and asphalt concrete pavements.

The certificates and proctor test reports shall be provided to the Owner at least 5 calendar days prior to placement.

#### **PART 2 PRODUCTS**

##### **2.1 FOUNDATION GRAVEL**

Foundation gravel shall be Class A Gravel Backfill for Foundations in conformance with Section 9-03.12(1)A of the WSDOT Standard Specifications.

##### **2.2 GRAVEL BACKFILL FOR PIPE BEDDING**

Gravel backfill for pipe bedding shall meet the requirements of Section 9-03.12(3) of the WSDOT Standard Specifications except that no more than 5 percent passing shall pass the No. 200 Sieve.

##### **2.3 STRUCTURAL FILL**

On-site silty sand existing fill and granular alluvial soils may be considered for use as structural fill provided the soil can reach the specified compaction. The existing fill soils may not be used for structural fill during wet weather or below the groundwater table, due to relatively high fines content.

Imported structural fill shall be in conformance with Gravel Borrow per Section 9-03.14(1) of the WSDOT Standard Specifications. The material shall contain particles less than 4-inches maximum dimension with less than 7-percent passing the U.S. No. 200 size sieve. Gravel Borrow may be used above and below the groundwater table.

## **2.4 GRAVEL BORROW**

Gravel Borrow shall be free from organic matter or other deleterious materials and in conformance with Section 9-03.14(1) of the WSDOT Standard Specifications.

## **2.5 QUARRY SPALLS**

Materials used for quarry spalls shall meet the requirements of Section 9-13.6 of the WSDOT Standard Specifications, except that the size of material shall be revised as follows: 100 percent passing a 4-inch sieve size and 40 percent passing a 2-inch sieve size.

## **2.6 GRAVEL BACKFILL FOR WALLS**

On-site silty sand existing fill and granular alluvial soils may be considered for use as wall backfill provided the soil can reach the specified compaction. The existing fill soils may not be used for wall backfill during wet weather or below the groundwater table, due to relatively high fines content.

Imported wall backfill shall be structural fill. Wall backfill below the groundwater table shall be gravel borrow, permeable ballast or an approved equivalent.

## **2.7 CRUSHED SURFACING**

Crushed surfacing base course and top course shall conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

## **2.8 PEA GRAVEL**

Pea gravel shall be relatively round, processed, washed rock with 100 percent pass the 3/8 of an inch sieve and 0 percent passing the U.S. No. 4 sieve.

## **2.9 MISCELLANEOUS GRAVEL**

If the Plans call for a gravel that is not herein specified than the gravel shall conform to the type of gravel called for as per the WSDOT Specifications.

## **2.10 SAND DRAIN BACKFILL**

Sand drain backfill shall conform to Section 9-03.13 of the WSDOT Standard Specifications.

## **2.11 PERMEABLE BALLAST**

Permeable ballast shall conform to Section 9-03.9(2) of the WSDOT Standard Specifications.

# **PART 3 EXECUTION**

## **3.1 FOUNDATION GRAVEL**

Foundation gravel shall be placed and compacted underneath all structures to a minimum depth of 12 inches unless indicated otherwise on the Plans, and to a greater depth where foundations are unstable and excess suitable excavated material is unavailable to stabilize such foundations.

In the event the Contractor unnecessarily overexcavates the pipe trench or structure foundation, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

## **3.2 GRAVEL BACKFILL FOR PIPE BEDDING**

Bedding material shall be placed as specified in 02300. To assure uniform support, the material shall be carefully worked underneath the pipe haunches with a tool capable of preventing the formation of void spaces around the pipe. In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

### **3.3 STRUCTURAL FILL**

Provide structural fill as shown on the Plans and place as specified in 02300.

### **3.4 GRAVEL BORROW**

Provide structural fill as shown on the Plans and place as specified in 02300.

### **3.5 QUARRY SPALLS**

Quarry spalls shall be placed where shown on the Plans.

### **3.6 GRAVEL BACKFILL FOR WALLS**

Provide structural fill as shown on the Plans and place as specified in 02300.

### **3.7 CRUSHED SURFACING**

Crushed surfacing base course and/or top course shall be placed underneath asphalt paving, to the lines and grades shown on the Plans or as required by the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

### **3.8 PEA GRAVEL**

Pea gravel shall be placed around wall drains as noted on the Plans.

### **3.9 MISCELLANEOUS GRAVEL**

Miscellaneous gravel shall be installed per the Plans.

### **3.10 SAND DRAIN BACKFILL**

Sand drain backfill shall be placed as shown on the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

### **3.11 PERMEABLE BALLAST**

Permeable ballast shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

**\*\*\* END OF SECTION \*\*\***

## SECTION 02740

### HOT MIX ASPHALT AND ASPHALT TREATED BASE PAVING

#### PART 1 GENERAL

##### 1.1 SCOPE

The work in this section shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, 2021 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter “Standard Specifications”). Delete section 5-04 of the Standard Specifications, with the exception of 5-04.2(1), and replace it with the following:

The work specified in this Section includes providing and placing one or more layers of plant-mixed hot mix asphalt (HMA) on a prepared foundation or base in accordance with these Specifications and the lines, grades, thicknesses, and typical cross-sections shown in the Plans. The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these Specifications. WMA processes include organic additives, chemical additives, and foaming.

This work also consists of adjusting castings to grade, furnishing and installing temporary HMA, temporary cold mix per the details in the Contract Plans.

HMA shall be composed of asphalt binder and mineral materials as may be required, mixed in the proportions specified to provide a homogeneous, stable, and workable mixture.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01400	Quality Control
02300	Earthwork
02700	Gravel Materials

##### 1.3 SUBMITTALS

###### A. MIX DESIGN – OBTAINING PROJECT APPROVAL

1. ESALs

The number of ESALs for the design and acceptance of the HMA shall be 1 million.

Commercial HMA shall be an HMA Cl. 1/2" PG 64H-28 design mix.

No paving shall begin prior to the approval of the mix design by the Engineer.

**Commercial evaluation** will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Project Engineer. Sampling and testing of HMA mixture accepted by commercial evaluation will be at the option of the Project Engineer.

**Commercial Evaluation Mix Design** Approval of a mix design for "Commercial Evaluation" will be based on a review of a Mix Design from the current WSDOT QPL. At the discretion of the Engineer, agencies may accept verified mix designs older than 12 months from the original verification date with a certification from the Contractor that the materials and sources are the same as those shown on the original mix design. Testing of the HMA by the Contracting Agency for mix design approval is not required.

**Using Warm Mix Asphalt Processes.** The Contractor may elect to use additives that reduce the optimum mixing temperature or serve as a compaction aid for producing HMA. Additives include organic additives, chemical additives and foaming processes. The use of Additives is subject to the following:

- Do not use additives that reduce the mixing temperature more than allowed in subsection 3.3 F. in the production of mixtures.
- Before using additives, obtain the Engineer's approval using WSDOT Form 350-076 to describe the proposed additive and process.

## **PART 2 PRODUCTS**

### **2.1 HMA PAVEMENT**

HMA pavement, Commercial HMA, HMA Cl. ½” PG 64H-28.

#### **A. MATERIALS**

Materials shall meet the requirements of the following sections of the Standard Specifications:

Asphalt Binder	9-02.1(4)
Cationic Emulsified Asphalt	9-02.1(6)
Anti-Stripping Additive	9-02.4
HMA Additive	9-02.5
Aggregates	9-03.8
Recycled Asphalt Pavement	9-03.8(3)B
Mineral Filler	9-03.8(5)
Recycled Material	9-03.21
Portland Cement	9-01
Sand	9-03.1(2).
(As noted in subsection 3.3D.1. for crack sealing)	
Joint Sealant	9-04.2
Foam Backer Rod	9-04.2(3)A

The Contract documents may establish that the various mineral materials required for the manufacture of HMA will be furnished in whole or in part by the Contracting Agency. If the documents do not establish the furnishing of any of these mineral materials by the Contracting Agency, the Contractor shall be required to furnish such materials in the amounts required for the designated mix. Mineral materials include coarse and fine aggregates, and mineral filler.

The Contractor may choose to utilize recycled asphalt pavement (RAP) in the production of HMA. The RAP may be from pavements removed under the Contract, if any, or pavement material from an existing stockpile.

The Contractor may use up to 20 percent RAP by total weight of HMA. The asphalt content and gradation test data shall be reported to the Contracting Agency when submitting the mix design for approval on the QPL. The Contractor shall include the RAP as part of the mix design as defined in these Specifications.

The grade of asphalt binder shall be as required by the Contract. Blending of asphalt binder from different sources is not permitted.

The Contractor may only use warm mix asphalt (WMA) processes in the production of HMA with 20 percent or less RAP by total weight of HMA. The Contractor shall submit to the Engineer for approval the process that is proposed and how it will be used in the manufacture of HMA.

Production of aggregates shall comply with the requirements of Section 3-01 of the Standard Specifications.

Preparation of stockpile site, the stockpiling of aggregates, and the removal of aggregates from stockpiles shall comply with the requirements of Section 3-02 of the Standard Specifications.

## B. HMA TOLERANCES AND ADJUSTMENTS

### 1. Job Mix Formula (JMF) Tolerances

After the JMF is determined as required in subsection 3.6A. The constituents of the mixture at the time of acceptance shall conform to the following tolerances:

<b>Aggregate, percent passing</b>	<b><i>Nonstatistical Evaluation</i></b>	<b><i>Commercial Evaluation</i></b>
1", 3/4", 1/2", and 3/8" sieves	$\pm 6\%$	$\pm 8\%$
U.S. No. 4 sieve	$\pm 6\%$	$\pm 8\%$
U.S. No. 8 sieve	$\pm 6\%$	$\pm 8\%$
U.S. No. 200 sieve	$\pm 2.0\%$	$\pm 3.0\%$
Asphalt Binder	$\pm 0.5\%$	$\pm 0.7\%$

These tolerance limits constitute the allowable limits as described in Standard Specification Section 1-06.2. The tolerance limit for aggregate shall not exceed the limits of the control points section, except the tolerance limits for sieves designated as 100 percent passing will be 99-100. The tolerance limits on sieves shall only apply to sieves with control points.

## 2.2 TEMPORARY HMA AND TEMPORARY COLD MIX

Cold-mix material shall be MC-2 asphaltic concrete commonly referred to as "cold-mix," and shall be EZ Street or Contracting Agency approved equal.

Temporary HMA material shall meet the requirements for Commercial HMA.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Where paving occurs on a facility, the Contractor shall maintain access to the facility at all times. The Contractor shall provide 1-week notification to the Contracting Agency prior to paving and shall coordinate all work with the Contracting Agency to ensure his paving plan does not interfere with the Contracting Agency's on-going operations.

When paving occurs on a roadway open to traffic, the requirements of subsection 3.3B. apply.

The Contractor shall provide, place and maintain all temporary markings and signage as required to warn and direct facility traffic as necessary during his paving operations.

### **3.2 HMA PLACEMENT**

#### **A. WEATHER LIMITATIONS**

Do not place HMA for wearing course on any Traveled Way beginning October 1<sup>st</sup> through March 31<sup>st</sup> of the following year without written concurrence from the Engineer.

Do not place HMA on any wet surface, or when the average surface temperatures are less than those specified below, or when weather conditions otherwise prevent the proper handling or finishing of the HMA.

#### **Minimum Surface Temperature for Paving**

<b>Compacted Thickness (Feet)</b>	<b>Wearing Course</b>	<b>Other Courses</b>
Less than 0.10	55 degrees F	45 degrees F
0.10 to .20	45 degrees F	35 degrees F
More than 0.20	35 degrees F	35 degrees F

#### **B. PAVING UNDER TRAFFIC**

When the Roadway being paved is open to traffic, the requirements of this Section shall apply.

The Contractor shall keep intersections open to traffic at all times except when paving the intersection or paving across the intersection. During

such time, and provided that there has been an advance warning to the public, the intersection may be closed for the minimum time required to place and compact the mixture. In hot weather, the Engineer may require the application of water to the pavement to accelerate the finish rolling of the pavement and to shorten the time required before reopening to traffic.

Before closing an intersection, advance warning signs shall be placed and signs placed marking the detour or alternate route.

During paving operations, temporary pavement markings shall be maintained throughout the project. Temporary pavement markings shall be installed on the Roadway prior to opening to traffic. Temporary pavement markings shall be in accordance with Standard Specifications Section 8-23.

All costs in connection with performing the Work in accordance with these requirements shall be included in the unit Contract prices for the various Bid items involved in the Contract.

## C. EQUIPMENT

### 1. Mixing Plant

Plants used for the preparation of HMA shall conform to the following requirements:

#### a. Equipment for Preparation of Asphalt Binder

Tanks for the storage of asphalt binder shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the storage tank. The circulating system for the asphalt binder shall be designed to ensure proper and continuous circulation during the operating period. A valve for the purpose of sampling the asphalt binder shall be placed in either the storage tank or in the supply line to the mixer.

#### b. Thermometric Equipment

An armored thermometer, capable of detecting temperature ranges expected in the HMA mix, shall be fixed in the asphalt binder feed line at a location near the charging valve at the mixer unit. The thermometer location shall be

convenient and safe for access by Inspectors. The plant shall also be equipped with an approved dial-scale thermometer, a mercury actuated thermometer, an electric pyrometer, or another approved thermometric instrument placed at the discharge chute of the drier to automatically register or indicate the temperature of the heated aggregates. This device shall be in full view of the plant operator.

c. Heating of Asphalt Binder

The temperature of the asphalt binder shall not exceed the maximum recommended by the asphalt binder manufacturer nor shall it be below the minimum temperature required to maintain the asphalt binder in a homogeneous state. The asphalt binder shall be heated in a manner that will avoid local variations in heating. The heating method shall provide a continuous supply of asphalt binder to the mixer at a uniform average temperature with no individual variations exceeding 25 degrees F. Also, when a WMA additive is included in the asphalt binder, the temperature of the asphalt binder shall not exceed the maximum recommended by the manufacturer of the WMA additive.

d. *Sampling and Testing of Mineral Materials*

*The HMA plant shall be equipped with a mechanical sampler for the sampling of the mineral materials. The mechanical sampler shall meet the requirements of Standard Specification Section 1-05.6 for the crushing and screening operation. The Contractor shall provide for the setup and operation of the field testing facilities of the Contracting Agency as provided for in Standard Specifications Section 3-01.2(2).*

e. *Sampling HMA*

*The HMA plant shall provide for sampling HMA by one of the following methods:*

- i. *A mechanical sampling device attached to the HMA plant.*

- ii. *Platforms or devices to enable sampling from the hauling vehicle without entering the hauling vehicle.*

## 2. Hauling Equipment

Trucks used for hauling HMA shall have tight, clean, smooth metal beds and shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from adverse weather.

Whenever the weather conditions during the work shift include, or are forecast to include, precipitation or an air temperature less than 45 degrees F or when time from loading to unloading exceeds 30 minutes, the cover shall be securely attached to protect the HMA.

The Contractor shall provide an environmentally benign means to prevent the HMA mixture from adhering to the hauling equipment. Excess release agent shall be drained prior to filling hauling equipment with HMA. Petroleum derivatives or other coating material that contaminate or alter the characteristics of the HMA shall not be used. For live bed trucks, the conveyor shall be in operation during the process of applying the release agent.

## 3. Pavers

HMA pavers shall be self-contained, power-propelled units, provided with an internally heated vibratory screed and shall be capable of spreading and finishing courses of HMA plant mix material in lane widths required by the paving section shown in the Plans.

The HMA paver shall be in good condition and shall have the most current equipment available from the manufacturer for the prevention of segregation of the HMA mixture installed, in good condition, and in working order. The equipment certification shall list the make, model, and year of the paver and any equipment that has been retrofitted.

The screed shall be operated in accordance with the manufacturer's recommendations and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture. A copy of the manufacturer's recommendations shall be provided upon request by the Contracting Agency. Extensions will be allowed provided they produce the same results, including ride, density, and surface texture as obtained by the primary screed. Extensions without

augers and an internally heated vibratory screed shall not be used in the Traveled Way.

When specified in the Contract, reference lines for vertical control will be required. Lines shall be placed on both outer edges of the Traveled Way of each Roadway. Horizontal control utilizing the reference line will be permitted. The grade and slope for intermediate lanes shall be controlled automatically from reference lines or by means of a mat referencing device and a slope control device. When the finish of the grade prepared for paving is superior to the established tolerances and when, in the opinion of the Engineer, further improvement to the line, grade, cross-section, and smoothness can best be achieved without the use of the reference line, a mat referencing device may be substituted for the reference line. Substitution of the device will be subject to the continued approval of the Engineer. A joint matcher may be used subject to the approval of the Engineer. The reference line may be removed after the completion of the first course of HMA when approved by the Engineer. Whenever the Engineer determines that any of these methods are failing to provide the necessary vertical control, the reference lines will be reinstalled by the Contractor.

The Contractor shall furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for satisfactory operation of the automatic control equipment.

If the paving machine in use is not providing the required finish, the Engineer may suspend Work as allowed by Standard Specification Section 1-08.6. Any cleaning or solvent type liquids spilled on the pavement shall be thoroughly removed before paving proceeds.

#### 4. Material Transfer Device or Material Transfer Vehicle

A Material Transfer Device/Vehicle (MTD/V) shall only be used with the Engineer's approval, unless otherwise required by the contract.

Where an MTD/V is required by the contract, the Engineer may approve paving without an MTD/V, at the request of the Contractor. The Engineer will determine if an equitable adjustment in cost or time is due.

When used, the MTD/V shall mix the HMA after delivery by the hauling equipment and prior to laydown by the paving machine.

Mixing of the HMA shall be sufficient to obtain a uniform temperature throughout the mixture. If a windrow elevator is used, the length of the windrow may be limited in urban areas or through intersections, at the discretion of the Engineer.

- a. To be approved for use, an MTV:
  - i. Shall be self-propelled vehicle, separate from the hauling vehicle or paver.
  - ii. Shall not be connected to the hauling vehicle or paver.
  - iii. May accept HMA directly from the haul vehicle or pick up HMA from a windrow.
  - iv. Shall mix the HMA after delivery by the hauling equipment and prior to placement into the paving machine.
  - v. Shall mix the HMA sufficiently to obtain a uniform temperature throughout the mixture.
- b. To be approved for use, an MTD:
  - i. Shall be positively connected to the paver.
  - ii. May accept HMA directly from the haul vehicle or pick up HMA from a windrow.
  - iii. Shall mix the HMA after delivery by the hauling equipment and prior to placement into the paving machine.
  - iv. Shall mix the HMA sufficiently to obtain a uniform temperature throughout the mixture.

## 5. Rollers

Rollers shall be of the steel wheel, vibratory, oscillatory, or pneumatic tire type, in good condition and capable of reversing without backlash. Operation of the roller shall be in accordance with the manufacturer's recommendations. When ordered by the Engineer for any roller planned for use on the project, the Contractor shall provide a copy of the manufacturer's

recommendation for the use of that roller for compaction of HMA. The number and weight of rollers shall be sufficient to compact the mixture in compliance with the requirements of subsection 3.3J. The use of equipment that results in crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of the surface, displacement of the mixture or other undesirable results shall not be used.

#### D. PREPARATION OF EXISTING PAVED SURFACES

When the surface of the existing pavement or old base is irregular, the Contractor shall bring it to a uniform grade and cross-section as shown on the Plans or approved by the Engineer.

Preleveling of uneven or broken surfaces over which HMA is to be placed may be accomplished by using an asphalt paver, a motor patrol grader, or by hand raking, as approved by the Engineer.

Compaction of preleveling HMA shall be to the satisfaction of the Engineer and may require the use of small steel wheel rollers, plate compactors, or pneumatic rollers to avoid bridging across preleveled areas by the compaction equipment. Equipment used for the compaction of preleveling HMA shall be approved by the Engineer.

Before construction of HMA on an existing paved surface, the entire surface of the pavement shall be clean. All fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement. All pavements or bituminous surfaces shall be thoroughly cleaned of dust, soil, pavement grindings, and other foreign matter. All holes and small depressions shall be filled with an appropriate class of HMA. The surface of the patched area shall be leveled and compacted thoroughly. Prior to the application of tack coat, or paving, the condition of the surface shall be approved by the Engineer.

A tack coat of asphalt shall be applied to all paved surfaces on which any course of HMA is to be placed or abutted. Tack coat shall be uniformly applied to cover the existing pavement with a thin film of residual asphalt free of streaks and bare spots at a rate between 0.02 and 0.10 gallons per square yard of retained asphalt. The rate of application shall be approved by the Engineer. A heavy application of tack coat shall be applied to all joints. For Roadways open to traffic, the application of tack coat shall be limited to surfaces that will be paved during the same working shift. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.

Equipment shall not operate on tacked surfaces until the tack has broken and cured. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the HMA.

The tack coat shall be CSS-1, or CSS-1h emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be diluted once with water at a rate not to exceed one part water to one part emulsified asphalt. The tack coat shall have sufficient temperature such that it may be applied uniformly at the specified rate of application and shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

#### 1. Pavement Repair

The Contractor shall excavate pavement repair areas and shall backfill these with HMA in accordance with the details shown in the Plans and as marked in the field. The Contractor shall conduct the excavation operations in a manner that will protect the pavement that is to remain. Pavement not designated to be removed that is damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer at no cost to the Contracting Agency. The Contractor shall excavate only within one lane at a time unless approved otherwise by the Engineer. The Contractor shall not excavate more area than can be completely finished during the same shift, unless approved by the Engineer.

Unless otherwise shown in the Plans or determined by the Engineer, excavate to a depth of 1.0 feet. The Engineer will make the final determination of the excavation depth required. The minimum width of any pavement repair area shall be 40 inches unless shown otherwise in the Plans. Before any excavation, the existing pavement shall be sawcut or shall be removed by a pavement grinder. Excavated materials will become the property of the Contractor and shall be disposed of in a Contractor-provided site off the Right of Way or used in accordance with Standard Specifications Sections 2-02.3(3) or 9-03.21.

Asphalt for tack coat shall be required as specified in subsection D. A heavy application of tack coat shall be applied to all surfaces of existing pavement in the pavement repair area.

Placement of the HMA backfill shall be accomplished in lifts not to exceed 0.35-foot compacted depth. Lifts that exceed 0.35 foot of compacted depth may be accomplished with the approval of the

Engineer. Each lift shall be thoroughly compacted by a mechanical tamper or a roller.

E. PRODUCING/STOCKPILING AGGREGATES AND RAP

Aggregates and RAP shall be stockpiled according to the requirements of Standard Specifications Section 3-02. Sufficient storage space shall be provided for each size of aggregate and RAP. Materials shall be removed from stockpile(s) in a manner to ensure minimal segregation when being moved to the HMA plant for processing into the final mixture. Different aggregate sizes shall be kept separated until they have been delivered to the HMA plant.

F. MIXING

After the required amount of mineral materials, asphalt binder, recycling agent and anti-stripping additives have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials is ensured.

When discharged, the temperature of the HMA shall not exceed the optimum mixing temperature by more than 25 degrees F as shown on the reference mix design report or as approved by the Engineer. Also, when a WMA additive is included in the manufacture of HMA, the discharge temperature of the HMA shall not exceed the maximum recommended by the manufacturer of the WMA additive. A maximum water content of 2 percent in the mix, at discharge, will be allowed providing the water causes no problems with handling, stripping, or flushing. If the water in the HMA causes any of these problems, the moisture content shall be reduced as directed by the Engineer.

Storing or holding of the HMA in approved storage facilities will be permitted with approval of the Engineer, but in no event shall the HMA be held for more than 24 hours. HMA held for more than 24 hours after mixing shall be rejected. Rejected HMA shall be disposed of by the Contractor at no expense to the Contracting Agency. The storage facility shall have an accessible device located at the top of the cone or about the third point. The device shall indicate the amount of material in storage. No HMA shall be accepted from the storage facility when the HMA in storage is below the top of the cone of the storage facility, except as the storage facility is being emptied at the end of the working shift.

Recycled asphalt pavement (RAP) utilized in the production of HMA shall be sized prior to entering the mixer so that a uniform and thoroughly

mixed HMA is produced. If there is evidence of the RAP not breaking down during the heating and mixing of the HMA, the Contractor shall immediately suspend the use of the RAP until changes have been approved by the Engineer. After the required amount of mineral materials, RAP, new asphalt binder and asphalt rejuvenator have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials, and RAP is ensured.

**G. SPREADING AND FINISHING**

The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. HMA pavers complying with subsection 3.3C. shall be used to distribute the mixture. Unless otherwise directed by the Engineer, the nominal compacted depth of any layer of any course shall not exceed the following:

HMA Class 1"	0.35 feet
HMA Class 3/4" and HMA Class 1/2" wearing course	0.30 feet
other courses	0.35 feet
HMA Class 3/8"	0.15 feet

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other equipment or by hand.

When more than one job mix formula (JMF) is being utilized to produce HMA, the material produced for each JMF shall be placed by separate spreading and compacting equipment. The intermingling of HMA produced from more than one JMF is prohibited. Each strip of HMA placed during a work shift shall conform to a single JMF established for the class of HMA specified unless there is a need to make an adjustment in the JMF.

**H. AGGREGATE ACCEPTANCE PRIOR TO INCORPORATION IN HMA**

Sampling and testing of aggregates for HMA accepted by commercial evaluation will be at the option of the Engineer.

**I. SURFACE SMOOTHNESS**

The completed surface of all courses shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface of the wearing course of the following sections of

Roadway shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline on all Sections of roadway within the project limits that are posted less than 45 mph.

The completed surface of the wearing course of all other sections of Roadway shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline.

The transverse slope of the completed surface of the wearing course shall vary not more than 1/4 inch in 10 feet from the rate of transverse slope shown in the Plans.

When deviations in excess of the above tolerances are found that result from a high place in the HMA, the pavement surface shall be corrected by one of the following methods:

1. Removal of material from high places by grinding with an approved grinding machine; or
2. Removal and replacement of the wearing course of HMA; or
3. By other method approved by the Engineer.

Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

Deviations in excess of the above tolerances that result from a low place in the HMA and deviations resulting from a high place where corrective action, in the opinion of the Engineer, will not produce satisfactory results will be accepted with a price adjustment. The Engineer shall deduct from monies due or that may become due to the Contractor the sum of \$500.00 for each and every section of single traffic lane 100 feet in length in which any excessive deviations described above are found.

#### J. HMA ROAD APPROACHES

HMA approaches shall be constructed at the locations shown in the Plans or where staked by the Engineer. The Work shall be performed in accordance with Section 3.3.

### 3.3 TEMPORARY PAVEMENT REPAIR

During the course of construction, it may be necessary to provide improved temporary vehicle and/or pedestrian access within the project limits. Such

temporary access shall be provided by temporarily patching trench crossings or other areas with temporary HMA and temporary cold mix until such time as the permanent surface restoration is installed. Locations shall include those areas specifically indicated on the Plans, directed by the Engineer or as further specified herein. This material will be furnished, placed, compacted, and removed and wastehauled at various locations throughout the project. The trenches and/or subgrade shall be thoroughly compacted and brought to a smooth grade prior to placing the material. It shall be placed, maintained (daily), and removed and wastehauled by the Contractor. Typical compacted depth will be 4 inches. Temporary HMA and temporary cold mix shall also be used around castings, after grinding, to provide a transition until final lift of HMA paving is installed.

### **3.4 HMA JOINTS**

#### **A. TRANSVERSE JOINTS**

The Contractor shall conduct operations such that the placing of the top or wearing course is a continuous operation or as close to continuous as possible. Unscheduled transverse joints will be allowed and the roller may pass over the unprotected end of the freshly laid mixture only when the placement of the course must be discontinued for such a length of time that the mixture will cool below compaction temperature. When the Work is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

A temporary wedge of HMA constructed on a 20H:1V shall be constructed where a transverse joint as a result of paving or planing is open to traffic. The HMA in the temporary wedge shall be separated from the permanent HMA by strips of heavy wrapping paper or other methods approved by the Engineer. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The material that is cut away shall be wasted and new mix shall be laid against the cut. Rollers or tamping irons shall be used to seal the joint.

#### **B. LONGITUDINAL JOINTS**

The longitudinal joint in any one course shall be offset from the course immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the wearing course shall be located at a lane line or an edge line of the Traveled Way. A notched wedge joint shall be constructed along all longitudinal joints in the wearing surface of new HMA unless otherwise approved by the Engineer. The notched wedge joint shall have a vertical edge of not less than the maximum aggregate

size or more than 1/2 of the compacted lift thickness and then taper down on a slope not steeper than 4H:1V. The sloped portion of the HMA notched wedge joint shall be uniformly compacted.

### **3.5 QUALITY CONTROL**

#### **A. HMA MIXTURE ACCEPTANCE**

Acceptance of HMA shall be as provided under nonstatistical, or commercial evaluation.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, temporary pavement, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Engineer. Sampling and testing of HMA mix accepted by commercial evaluation will be at the option of the Engineer.

The mix design will be the initial JMF for the class of HMA. The Contractor may request a change in the JMF. Any adjustments to the JMF will require the approval of the Engineer and may be made in accordance with this section.

##### **1. HMA Tolerances and Adjustments**

See Section 2.2 for Job Mix Formula Tolerances.

- a. Job Mix Formula Adjustments – An adjustment to the aggregate gradation or asphalt binder content of the JMF requires approval of the Engineer. Adjustments to the JMF will only be considered if the change produces material of equal or better quality and may require the development of a new mix design if the adjustment exceeds the amounts listed below.
  - i. Aggregates – 2 percent for the aggregate passing the 1-1/2", 1", 3/4", 1/2", 3/8", and the No. 4 sieves, 1 percent for aggregate passing the No. 8 sieve, and 0.5 percent for the aggregate passing the No. 200 sieve. The adjusted JMF shall be within the range of the control points in Standard Specifications Section 9-03.8(6).

- ii. Asphalt Binder Content – The Engineer may order or approve changes to asphalt binder content. The maximum adjustment from the approved mix design for the asphalt binder content shall be 0.3 percent.

2. Mixture Acceptance – Commercial Evaluation

If sampled and tested, HMA mix produced under Commercial Evaluation and having all constituents falling within the tolerance limits of the job mix formula shall be accepted at the unit Contract price with no further evaluation. When one or more constituents fall outside the commercial tolerance limits in the Job Mix Formula shown in Section 2.2, the lot may be subject to rejection. When less than three sublots exist, backup samples of the existing sublots or samples from the street shall be tested to provide a minimum of three sets of results for evaluation.

- B. HMA COMPACTION ACCEPTANCE

HMA mixture accepted by commercial evaluation and HMA constructed under conditions other than those listed above shall be compacted on the basis of a test point evaluation of the compaction train or by testing of roadway cores. Compaction of the HMA mixture to a minimum of 92 percent of the reference maximum density is required for acceptance.

1. HMA Compaction – General Compaction Requirements

Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. Areas inaccessible to large compaction equipment shall be compacted by other mechanical means. Any HMA that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced with new hot mix that shall be immediately compacted to conform to the surrounding area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided the specified densities are attained. Unless the Engineer has approved otherwise, rollers shall only be operated in the static mode when the internal temperature of the mix is less than 175 degrees F. Regardless of mix temperature, a roller shall not be operated in a mode that results in checking or cracking of the mat. Rollers shall only be operated in static mode on bridge decks.

## 2. HMA Commercial Evaluation Compaction

The location of the HMA compaction tests will be randomly selected by the Engineer.

Tests for the determination of the pavement density will be taken by the Contractor, in accordance with the required procedures for measurement by a nuclear density gauge or roadway cores, after completion of the finish rolling.

HMA mixture accepted by commercial evaluation shall be compacted on the basis of a test point evaluation of the compaction train. The Contractor shall provide the RICE density test results for the HMA mixture, identifying the reference maximum density of the mix, prior to the first day of paving. The test point evaluation shall be performed by the Contractor, in accordance with instructions from the Engineer. The number of passes with an approved compaction train, required to attain a minimum of 92 percent of the reference maximum density, shall be used on all subsequent paving.

If the Contracting Agency uses a nuclear density gauge to determine density the test procedures FOP for WAQTC TM 8 and WSDOT SOP T 729 will be used on the day the mix is placed and prior to opening to traffic.

Alternatively, the HMA mixture accepted by commercial evaluation may be evaluated by testing of roadway cores taken after completion of the finish rolling, resulting in a minimum of 92 percent of the reference maximum density. Roadway cores for density shall be obtained by the Contractor in accordance with WSDOT SOP 734. The core diameter shall be 4-inches minimum, unless otherwise approved by the Engineer. Roadway cores will be tested by the Contractor in accordance with WSDOT FOP for AASHTO T 166. Core locations shall be outside of wheel paths and as determined by the Engineer

If the Contract includes the Bid item "Roadway Core" the cores shall be obtained by the Contractor in the presence of the Engineer on the same day the mix is placed and at locations designated by the Engineer.

## C. REJECT WORK

### 1. Reject Work General

Work that is defective or does not conform to Contract requirements shall be rejected. The Contractor may propose, in writing, alternatives to removal and replacement of rejected material. Acceptability of such alternative proposals will be determined at the sole discretion of the Engineer.

*HMA that has been rejected is subject to the requirements in Standard Specification Section 1-06.2(2) and this specification, and the Contractor shall submit a corrective action proposal to the Engineer for approval.*

### 2. Rejection by Contractor

The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material. Any such new material will be sampled, tested, and evaluated for acceptance.

### 3. Rejection Without Testing (Mixture or Compaction)

The Engineer may, without sampling, reject any batch, load, or section of Roadway that appears defective. Material rejected before placement shall not be incorporated into the pavement. Any rejected section of Roadway shall be removed.

No payment will be made for the rejected materials or the removal of the materials unless the Contractor requests that the rejected material be tested.

Commercial Evaluation: If the Contractor elects to have the rejected material tested, a minimum of three representative samples shall be obtained and tested by the Contractor. Acceptance of rejected material will be based on conformance with the commercial evaluation tolerances in Section 2.2. If one or more of the mixture components are out of tolerance then, no payment will be made for the rejected material; in addition, the cost of sampling and testing shall be borne by the Contractor. If the material is rejected before placement and all of the mixture components are within the commercial evaluation tolerances, then compensation for the rejected material will be at the unit Contract price, with an

addition of 25 percent of the unit Contract price added for the cost of testing, removal and disposal.

### **3.6 SAWCUTTING**

Where shown on the Plans or where directed in the field by the Contracting Agency, the Contractor shall make a neat vertical sawcut at the boundaries of the area to be removed. Care shall be taken during sawcutting so as to prevent damage to the existing HMA or cement concrete pavement, to remain in place. Any pavement or cement concrete surface that is damaged by the Contractor outside the area scheduled for removal due to the Contractor's operations or negligence shall be repaired or replaced to the Contracting Agency's satisfaction by the Contractor at no additional cost to the Contracting Agency.

All cuts shall be continuous, full depth, and shall be made with saws specifically equipped for this purpose. No skip cutting, wheel cutting or jack hammering will be allowed unless specifically approved otherwise in writing by the Contracting Agency. However, even if preapproved as a method of cutting, no payment will be made for this type of work, and it shall be considered incidental and included in the various unit contract and lump sum prices listed in the Proposal.

The location of all pavement cuts shall be preapproved by the Contracting Agency in the field before cutting commences.

All water and slurry material resulting from sawcutting operations shall not be allowed to enter the storm drainage or sanitary sewer system and shall be removed from the site and disposed of in accordance with the Washington State Department of Ecology regulations.

All existing pavement edges shall be saw cut back to sound material, in uniform lines immediately prior to paving operations. Any edges broken between the time of cutting and placement of new paving shall be recut to the satisfaction of the Contracting Agency at no additional cost to the Contracting Agency. All excess excavated materials shall be hauled to waste.

### **3.7 HMA TRENCH PATCH**

This work shall consist of the preparation, placing and compaction of HMA above trench sections, in accordance with the details included on the plans and the requirements outlined herein. The work shall be in conformance with Section 3.3 herein unless specifically directed otherwise by the Contracting Agency.

The Contractor shall restore all paved surfaces excavated or disturbed to a condition acceptable to the Contracting Agency or the municipality having control

of the road. The trench section shall be patched as indicated on the plans and in accordance with the following steps:

- A. Crushed rock/ATB/temporary HMA shall be installed to the top of the existing pavement. Crushed rock shall be installed in the trench section on a daily basis as required to maintain the existing pavement surface elevation. For areas that will be open to traffic, the Contractor shall inspect the condition of the temporary trench patch daily and maintain as directed by the Contracting Agency. Use of steel sheets to provide temporary trench protection for traffic is subject to Contracting Agency approval.
- B. Crushed rock/ATB/temporary HMA shall be removed to the depth of existing pavement or to the depth of the pavement section specified on the plans, whichever is thicker. The trench shall be paved to match the existing pavement surface. HMA trench patching shall be constructed by the Friday following pipe installation. All trench areas shall be patched and cleaned by close of work that day.

Before any HMA material is placed, all pavement cuts shall be trued so that marginal lines of the patch will form a rectangle with straight edges and vertical faces a minimum of 1 foot back from the maximum trench width.

The HMA shall be placed per subsection 3.3G., Spreading and Finishing. The HMA trench patch thickness shall match existing pavement thickness or the minimum pavement repair section indicated on the plans whichever is thicker.

Seal all joints per Section 3.5, HMA Joints.

### **3.8 PAVEMENT MARKINGS**

In those areas where the proposed work causes existing pavement with striping and/or pavement markings to be removed, the Contractor shall not only replace the pavement, as noted herein, and as shown on the Plans, but shall also re-mark and re-stripe the new pavement so as to restore the new pavement to its former condition.

Pavement markings shall conform to Standard Specification Section 8-22.2 and 8-22.3, and the latest edition and amendments thereto of the Manual on Uniform Traffic Control Devices (MUTCD) as adopted by the State of Washington, and shall be constructed as shown in the Plans except as modified herein.

Raised pavement markers shall conform to Standard Specifications Section 8-09.2 and 8-09.3.

### **3.9 ADJUSTING STRUCTURES TO GRADE**

All utility castings and monuments within the existing and/or new pavement area shall be referenced by the Contractor prior to any pavement removal or planing. The Contractor shall keep a record of such references and submit a copy to the Contracting Agency.

Existing structures and new structures shall be adjusted to the finished grade as shown on the Plans and as further specified herein. Existing boxes, rings, grates, covers, and lids shall be reset in a careful and workmanlike manner to conform to the required grades.

The new and existing utility castings and monuments shall be adjusted to grade in the following manner:

As soon as the street has been paved past each structure or casting, the HMA mat shall be scored around the location of the structure or casting. After rolling has been completed and the mat has cooled, it shall be cut along the scored lines. The structure or casting shall then be raised to finished pavement grade and the annular spaces filled as indicated on the Plans. The Contractor shall install the pavement to give a smooth finished appearance. All covers, lids, frames, and grates shall be thoroughly cleaned.

After pavement is in place, all new pavement joints shall be sealed with a 6-inch-wide strip of hot asphalt sealer. A sand blanket shall be applied to the surface of the hot asphalt sealer immediately after the placement of the sealer to help alleviate the tracking of the asphalt. The sealer shall meet the requirements of the Standard Specifications Section 9-04.2(1).

**\*\*\* END OF SECTION \*\*\***

## SECTION 02820

### CHAIN LINK FENCE AND GATES

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the furnishing and installing of chain link fencing and gates conforming to the lines, grades, and details and at the locations as shown on the Plans.

The furnishing, installing, maintaining, and removing of temporary fencing and gates shall be provided to provide site safety, security, and protection at the project site. The temporary fencing is required to stay in place until the permanent fence is installed.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
03300	Cast-in-Place Concrete

#### PART 2 PRODUCTS

##### 2.1 FENCING

The fence shall have continuous chain link wire, three strands of barbed wire supported on angled extension arms. The chain link shall have a 2-inch diamond mesh and 9-gauge wire, meeting ASTM 668, Class 2b. The total height of the fence shall be as shown on the Plans. The fence shall be heavy steel guard fence with top rail. Top and bottom selvages of chain link fabric are to have a twisted and barbed finish.

The posts shall be equipped with extension arms, designed to carry three strands of barbed wire at an angle of 45 degrees. The topmost barbed wire shall be located approximately 12 inches above the fabric, and approximately 12 inches out from the fence line. Extension arms for line posts shall be of 14-gauge (minimum) pressed steel, provided with slots for securely fastening the barbed wires. Corner and fence post arms are to be of similar construction, and shall be constructed from a minimum of 12-gauge strip steel or heavy malleable iron, and shall be designed to provide sufficient strength to support the barbed wire.

The barbed wire shall be of the 4-point pattern, each wire to be composed of two strands of No. 12-1/2-gauge wire, galvanized after weaving.

## **2.2 GATES**

Gates shall be installed for the full opening shown on the Plans as per the manufacturer's recommendations. The Contractor shall furnish padlocks and keys for gates, which comply with Owner standards. Gates shall conform to the Plans and ASTM F900.

Gate posts shall be provided in accordance with ASTM F900 and have a ball top.

## **PART 3 EXECUTION**

### **3.1 TEMPORARY FENCING**

The Contractor shall furnish and install temporary fencing around the site so as to protect the site and prevent unauthorized entry into the site. The Contractor shall also maintain the temporary fencing throughout the course of the construction and provide any and all security necessary for site safety and protection during periods when sections of the fence may be down or open. Temporary fencing shall be removed by the Contractor only after receiving written authorization from the Owner for its removal.

### **3.2 FENCING INSTALLATION**

The chain link fencing shall be erected in straight lines between angle points by skilled workmen experienced in this type of construction, in accordance with the manufacturer's recommendations and these Specifications. The new fence installation shall not commence until final grading is complete and finish grade elevations are established. The new fence shall be constructed to provide security for the site. There shall not be any gaps between finish elevations and the bottom links of the fence, which would allow entrance into the site.

The site fence shall be constructed in conformance with Section 8-12 of the WSDOT Standard Specifications. The maximum spacing for line posts shall be 10-feet on center. Post holes shall be a minimum depth of 3 feet below finished grade; holes for line posts shall be 10 inches in diameter; holes for gate, corner, and pull posts shall be four times the diameter of the post. Posts shall be set plumb in true line and to the depth of 3 feet and the remainder of the hole filled with concrete that must extend around the posts to a point 2 inches above finished grade. The top surface shall have a crowned watershed finish.

Concrete shall be proportioned to provide at least 2,500 psi strength at 28 days. Materials, methods of proportioning, mixing, transporting and placing shall

conform to Section 03300. After the concrete has set, accessories shall be installed; chain link fabric shall be fastened to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately 14-inch centers and 24-inch centers, respectively. Three lines of barbed wire shall be installed on the extension arms and drawn taut and secured at each bracket.

### **3.3 GATE INSTALLATION**

Install gateposts in accordance with manufacturer's instructions.

Gate posts shall be diagonally braced to adjacent line posts to ensure stability. Gates shall be hung and all hardware adjusted so that gates operate satisfactorily from open or closed position.

Concrete set gateposts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times greater than outside dimension of post, and depths approximately 6-inches deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36 inches below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

Install gates plumb, level, and secure for full opening without interference.

Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

**\*\*\*END OF SECTION\*\*\***

## **SECTION 02950**

### **SITE RESTORATION AND REHABILITATION**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes areas requiring restoration or rehabilitation as shown on the Plans or specified herein, including those areas that shall be graded, restored with hydroseeding or sod, areas restored with concrete sidewalk and driveway, and areas containing certain improvements and landscaping on and along the right-of-way including the adjacent private properties. The work also includes repair and replacement of fencing and other property features impacted construction.

Particular care shall be taken to minimize damage to landscaped areas within and adjacent to construction areas. In the event that construction is to be carried out in landscaped areas, appropriate measures shall be taken to restore such areas to conditions existing prior to construction.

Surface restoration type and location are shown on the Plans.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01200	Measurement and Payment
01300	Submittals
02230	Clearing and Grubbing
02300	Earthwork
03300	Cast-In-Place Concrete

##### **1.3 QUALITY ASSURANCE**

###### **A. PLANT MATERIAL**

Quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

**B. FERTILIZER**

Conform to Washington State Department of Agriculture Laws and Federal Specification O-F-241D pertaining to commercial fertilizers.

**C. SEED**

Conform to the standards for “certified”-grade seed or better.

Furnished in standard container on which the following information is shown: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

Furnish to the Owner duplicate copies of a statement signed by the vendor, certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the Project.

Seed that is wet, moldy, or otherwise damaged in transit or storage will not be accepted.

**PART 2 PRODUCTS**

**2.1 HYDROSEEDING**

The seed mixture for easement and property restoration shall have the following composition, proportion, and quality:

**Dryland Grass Mixture Typical Eastern Washington**

The seed mixture shall have the following composition, proportion and quality:

<b>Kind and Variety of Seed in Mixture</b>	<b>Percent By Weight</b>	<b>Minimum Percent of Pure Seed</b>	<b>Minimum Percent of Germination</b>
Dwarf Perennial Rye Grass	50%	49.4%	97%
Creeping Red Fescue	25%	24.8%	94%
Hard Fescue	25%	24.7%	94%
Maximum Percentage of Weed Seed			
Maximum Inert and Other Crops	1.0%		

The seed shall be applied at a minimum rate of 5 lbs. per 1,000 sf.

A commercial fertilizer of the following formulation shall be furnished as specified, and all fertilizer shall be premixed prior to use on the job. The fertilizer shall be applied at the rate of 500 lbs. per acre.

<b>Nitrogen (Inorganic) as N<sub>2</sub></b>	<b>Nitrogen (Organic) Ureaformaldehyde</b>	<b>Phosphorous as P<sub>2</sub>O<sub>5</sub></b>	<b>as K<sub>2</sub>O</b>	<b>Potassium lbs/Acre</b>
15%	38%	16%	16%	500

The fertilizer shall contain a minimum of 60 percent slow-release nitrogen and all minor elements as well.

## **2.2 SOD**

Should sod not be available on the project site the sod shall be of grass sod that is a premium quality, which closely matches existing grass sod in the immediate area. The sod shall be purchased locally and, as such, accustomed to the existing climate and soil conditions of the local area.

## **2.3 TOPSOIL**

Topsoil shall have a pH value between 6 and 8, shall be fertile, friable, natural loam, containing 5 to 8 percent of humus, and shall be capable of sustaining vigorous lawn growth. Topsoil shall be free of any admixtures of subsoil, stones 2 inches in diameter or larger, clods of earth, plants or their roots, sticks, or other extraneous material. All topsoil shall be furnished as necessary and approved by the Owner to complete the required restoration and seeding.

## **2.4 PLANT MATERIALS**

### **A. QUALITY**

Genera, species, and variety; quantity, size, and conditions as indicated on the Plans and Plant Schedule.

### **B. TREES AND SHRUBS**

Provide straight, single-leader trees except for multiple-stem (clump) trees. Deciduous trees and shrubs shall have full, bushy tops with healthy branches and buds.

Trees and shrubs shall be fertilized with Triple 14 (14-14-14) slow-release fertilizer granules.

## **2.5 CONCRETE**

Concrete for concrete curb and gutter shall meet the requirements of Section 8-04 of the WSDOT Standard Specifications. Concrete for driveway entrances shall meet the requirement of Section 8-06 of the WSDOT Standard Specification. Concrete for sidewalks shall be the requirements of section 8-14 of the WSDOT standard Specification.

## **2.6 FENCING REPAIR**

Certain individual site locations will require temporary removal of fencing for site access and construction. The Contractor shall be required to remove and replace existing barbwire, wood, and chain link fences. The Contractor is urged to inspect the construction site so as to ascertain the condition of existing fences. The fences shall be replaced as soon as practicable with matching materials. If existing fence posts are cast in concrete the contractor shall install new fence posts and cast them in place to match the original installation methodology.

## **2.7 LANDSCAPE ROCK**

Landscape rock and landscape fabric shall be installed in areas as shown on the Plans. The landscape fabric shall be of a commercial grade designed to block weed growth. The landscape rock shall be 3- to 6-inch-diameter river rock of uniform color and shall be 4 inches minimum in depth.

## **2.8 LANDSCAPE BARK**

Bark shall be derived from Douglas fir, pine or hemlock species. The bark shall not contain resin, tannin or compounds in quantities that would be hazardous to plant life. Bark shall be large size with greater than 50 percent larger than 4 inches in size.

## **2.9 LANDSCAPE FABRIC**

Landscape fabric shall be heavy duty fabric 4 to 6 ounce per square yard. This material shall be warranted to withstand full sun for 5 years and be able to pass water at  $3 \times 10^{-2}$  cm/sec.

# **PART 3 EXECUTION**

## **3.1 HYDROSEEDING**

Areas that have been cleared and grubbed and graded within the public right-of-way, which are not covered by gravel, concrete, or pavement, shall receive hydroseeding, fertilizing, and mulching. These areas shall be leveled, acceptable to Owner, existing topsoil broken up to a depth of 6 inches and hydroseeded. Graded areas shall receive 6 inches of topsoil prior to hydroseeding. Native materials selected by the Owner from material excavated for foundations and stockpiled onsite may be used for topsoil.

For those areas in which hydroseeding would be difficult, the Contractor may request approval from the Owner to hand-apply the hydroseeding mix. Approval

shall be granted for hand-application only after reviewing and approving the procedure that the Contractor recommends.

Seeding, fertilizing, and mulching shall be installed in conformance with Sections 8-01 and 9-14 of the WSDOT Standard Specification.

Seeding, fertilizing, and mulching shall be installed using an approved type hydroseeder.

When weather conditions are not conducive to satisfactory results from seeding operations, the Owner may order the work suspended and it shall be resumed only when the desired results are likely to be obtained.

Areas that have received an application of mulching shall be inspected upon completion of the work and again on the completion of the application of seed and fertilizer.

### **3.2 SOIL PREPARATION**

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 to 3 inches of topsoil over existing soil, mix and till to a depth of 6 inches. This material shall be suitable topsoil from the site or imported material.

### **3.3 TREE PLANTING**

Plant trees and shrubs upright and face to give best appearance or relationship to adjacent plants.

Excavate all planting holes twice the spread of the tree, shrub, or groundcover root ball or root system. Place 3 inches minimum of topsoil lightly compacted layer of prepared topsoil under root system of each tree and shrub. Loosen planting hole subsurface to a depth of 4 to 6 inches prior to placement.

Loosen and remove burlap from around at least upper 1/2 of root ball and remove excess burlap. Pulling burlap from under root balls will not be permitted on large and loose root balls. Cut off cleanly all broken or frayed roots.

Place and compact backfill soil consisting of two way topsoil carefully to fill all voids and avoid injury to roots. Mix moisture-retention agent into backfill per manufacturer's specifications. When hole is nearly filled, completely fill with water and allow water to soak away. Fill holes to finish grade and prepare for other work indicated.

Fertilize all trees, shrubs and groundcover with Triple 14 slow-release fertilizer. Place fertilizer on surface of mulch around plant. Apply in quantities per manufacturer's specifications.

### **3.4 SOD**

Areas of sod to be removed shall be laid out in square strips of such size as to provide easy handling and matching. The sod shall then be carefully cut along these lines to a depth of 4 inches, taking care to keep all cuts straight and cut all strips to the same width. After the sod has been cut vertically, it shall be removed to a uniform depth of approximately 3 inches with an approved type of sod cutter. This operation shall be performed in such a manner as to ensure uniform thickness of sod throughout the operation.

As the sod stripping proceeds, the sod strips shall be placed in neat piles at convenient locations, and from then on, they shall be maintained in a damp condition until the sod strips are replaced on the lawn. In no case shall the sod remain in piles longer than 10 days before replacement on the lawn.

Prior to replacing the strips of sod, the striped area shall be carefully shaped to proper grade and be thoroughly compacted. Wherever construction operations have resulted in the placement of unsuitable or poorer soils in the areas to be resodded, the surface shall be left low and covered with a minimum of 6 inches of topsoil.

All tools used shall be of the type specially designed for the work and be satisfactory to the Owner. There shall be no separate monies due the Contractor for removing and replacing existing grass sod.

### **3.5 TOPSOIL**

Those areas to receive topsoil shall have the trenched backfilled to within 6 inches of the finished grade. A compacted 6-inch depth of topsoil shall then be applied to the subgrade. The Contractor may elect to utilize and stockpile existing and

excavated topsoil material; however, no separate payment will be made for its use.

### **3.6 CONCRETE**

Concrete Curbs and Gutters shall be constructed per WSDOT Standard Specifications section 8-04. Sidewalks shall be constructed per WSDOT Standard Specifications 8-14. Driveway entrances shall be constructed per WSDOT Standard Specification 8-06.

Any curb, gutter, sidewalk or driveway entrance damaged, defaced, cracked, chipped, or determined to be of poor workmanship, in the opinion of the Owner, shall be removed, wastehauled and replaced by the Contractor, at the Contractor's expense. Sacking and grinding shall not be considered an acceptable means for repairing unacceptable sections. The Contractor shall further provide verbal and written notice (door hanger) to property owners identifying restricted use of their driveways, sidewalks, etc. This notice must be provided twice: at 1 week prior and again 1 day prior to the work being performed.

At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2 inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

Place preformed asphalt expansion joints in the adjacent curb, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk.

Provide contraction joints transversely to the walks at locations opposite the contraction joints in the curb. These joints shall be 3/16-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the surface of the walk. Walk areas wider than 20 feet shall have longitudinal contraction joints at spacings not to exceed 15 feet.

Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher requirement shall govern.

Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a joining tool. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Protect the sidewalk from damage for a period of 7 days.

Driveway access shall be maintained at all times. The Contractor shall use steel plates to bridge entrances or construct entrances in sections in order to protect new driveway entrances and allow access during the curing period.

The driveway entrance, curb and gutter and sidewalk shall be protected against damage or defacement of any kind until acceptance by the Owner. Any driveway entrance not acceptable, in the opinion of the Engineer, because of damage or defacement shall be removed, wastehailed, and replaced by the Contractor at the Contractor's expense. Sacking, grinding, or spot repair shall not be considered an acceptable means for repairing unacceptable sections.

### **3.7 LANDSCAPE FABRIC AND BARK**

Landscape fabric shall be spread smoothly across the final grade and the fabric shall be overlapped by 1 foot. The fabric shall be pinned by jute net pins on a approximate 10-foot grid and along the edge of the fabric.

The bark shall be placed to a depth of 4 inches.

### **3.8 LANDSCAPED AND IMPROVED AREAS**

Certain improvements and landscaping have been placed on and along the rights-of-way including the adjacent private properties. Wherever such property is damaged, destroyed, or the use thereof is interfered with due to the operation of the Contractor, it shall be immediately restored to its former condition by the Contractor. Notice should be given to the property owner along the route of construction by the Contractor advising them of the methods he will use to preserve and restore the improvements.

### **3.9 HYDROSEEDING, GRASS SOD, LANDSCAPING, WATERING MAINTENANCE AND PROTECTION**

The Contractor shall water, protect and care for all seeded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient watering of all planted areas until final acceptance.

Watering of hydroseeded, grass sod, and landscaped areas shall be at the Contractor's expense until new plantings are fully established.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any planted areas show signs of failure, such as dead or dying areas of grass or bare spots, or any shrubs or trees planted as part of the site restoration fail, the Contractor shall repair or replace all deficient seeded areas and replace all dead shrubs and trees to the satisfaction of the Owner. If any

seeded areas or plants require replacement, the Contractor's maintenance and guarantee period applicable to the replaced plants shall extend for an additional 1-year period after the time of the replacement.

The Contractor shall mow all newly established lawn areas a minimum of two mowings. The first mowing shall be performed only after an established and healthy stand of grass is judged to have grown. The second mowing shall occur upon establishment of second healthy stand of grass (4 inches in height).

### **3.10 FINISHING AND CLEANUP**

Before acceptance of the Project, all pipes, manholes, catch basins, and other appurtenances shall be cleaned of all debris and foreign material. After all other work on the Project is completed and before final acceptance, the entire roadway, including the roadbed, planting, sidewalk areas, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades and cross-sections shown on the Drawings and as hereinafter specified.

In undeveloped areas, the entire area which has been disturbed by the construction shall be shaped so that, upon completion, the area will present a uniform appearance, blending into the contour of the adjacent properties. All other requirements outlined previously shall be met. Slopes, sidewalk areas, planting areas and roadway shall be smoothed and finished to the required cross-section and grade.

Upon completion of the cleaning and dressing, the Project shall appear uniform in all respects. All graded areas shall be true to line and grade as shown on the typical sections and as required by the Owner.

All rocks in excess of 1-inch diameter shall be removed from the entire construction area and shall be disposed of the same as required for other waste material. In no instance, shall the rock be thrown onto private property. Overhang on slopes shall be removed and slopes dressed neatly so as to present a uniform, well sloped surface.

All excess excavated material within the limits of the Project shall be removed entirely. All debris resulting from clearing and grubbing or grading operations shall be removed and disposed.

Drainage facilities, such as inlets, catch basins, culverts, and open ditches, shall be cleaned of all debris resulting from the Contractor's operations.

All pavements and oil mat surfaces, whether new or old, shall be thoroughly cleaned. Existing improvements, such as Portland cement concrete curbs, curb

and gutters, walls, sidewalks, and other facilities which have been sprayed by the asphalt cement shall be cleaned to the satisfaction of the Owner.

Castings for manholes, monuments, water valves, lamp poles, vaults, and other similar installations which have been covered with the asphalt material shall be cleaned to the satisfaction of the Owner.

### **3.11 CONSTRUCTION ACCEPTANCE**

The Contractor shall protect and care for all seeded and sodded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any seed areas show signs of failure such as dead or dying areas of grass or bare spots, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

### **3.12 PERMANENT SIGNING AND APPURTENANCES**

During the life of the Contract all existing signs, mailboxes and other appurtenances that are damaged or removed shall be replaced by the Contractor at no additional expense to the Owner.

Existing signs may be temporarily relocated to portable sign stands for convenience of construction, subject to the approval of the Owner. When temporarily installed on posts, the signs shall be located as near as practical to their permanent locations and shall have a minimum vertical clearance above the pavement in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). Private signs and appurtenances shall be removed and provided to the Owner.

All portable sign stands shall be designed to rigidly support the sign in position without creating a hazard to the motorist. Portable sign stands shall be furnished by the Contractor and upon completion of the work shall remain the property of the Contractor and shall be removed from the Project.

All signs, unless specified herein, shall be mounted at a height of 7 feet as measured vertically from the ground (finished grade) to the bottom of the sign.

### **3.13 ADJUSTMENT OF NEW AND EXISTING STRUCTURES TO GRADE**

This work consists of constructing and/or adjusting all new and existing utility structures encountered on the Project to finished grade.

Prior to commencing manhole adjustments, a plywood and visqueen cover, as approved by the Owner, shall be placed over the manhole base and channel to protect them from debris.

The castings shall not be adjusted until the contractor has completed his paving operations. The asphalt concrete pavement around the casting shall be cut and removed to a neat circle, the diameter of which shall not exceed 6 inches from the outside diameter of the casting frame. The casting frame shall be brought up to the desired grade. Adjustment of manholes, catch basins and precast concrete vaults shall be made with the use of concrete adjustment rings or bricks. No iron adjustment rings will be allowed. An approved class of mortar (one part cement to two parts of plaster sand) shall be placed between adjustment rings or bricks and casting frame to completely fill all voids and to provide a watertight seal. No rough or uneven surfaces will be permitted inside or out. Adjustment rings or brick shall be placed and aligned so as to provide vertical sides and vertical alignment of ladder steps (if steps are necessary).

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 3**

## **CONCRETE**

## SECTION 03200

### CONCRETE REINFORCEMENT

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes reinforcement and associated items for all concrete, including, but not necessarily limited to: reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03300	Cast-In-Place Concrete
04200	Masonry

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 301	Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	American Concrete Institute - Detailing Manual
ANSI/ASTM A82	Cold Drawn Steel Wire for Concrete Reinforcement
ANSI/ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/AWS D1.4	Structural Welding Code for Reinforcing Steel
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement

##### 1.4 SUBMITTALS

Submit in accordance with provisions of Section 01300.

**A. SHOP DRAWINGS**

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

**B. MANUFACTURER'S CERTIFICATE**

Certify that reinforcing bar and welded wire fabric meet or exceed specified requirements.

Submit certified copies of mill test reports of reinforcement materials analysis.

**1.5 QUALITY ASSURANCE**

Perform Work in accordance with ACI 301.

**1.6 COORDINATION**

Coordinate with placement of formwork, formed openings, and other Work.

**PART 2 PRODUCTS**

**2.1 REINFORCEMENT**

**A. REINFORCING STEEL**

ASTM A615, deformed bars: Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, unless noted otherwise on the Plans.

**B. WELDED STEEL WIRE FABRIC**

ASTM A185 Plain Type; in flat sheets; plain.

**2.2 ACCESSORY MATERIALS**

**A. TIE WIRE**

Minimum 16-gauge annealed type.

**B. CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS**

Sized and shaped for strength and support of reinforcement during concrete placement conditions including load-bearing pad on bottom where required to prevent vapor barrier puncture.

**C. SPECIAL CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS  
ADJACENT TO WEATHER EXPOSED CONCRETE SURFACES**

Plastic-coated steel type; size and shape as required.

**D. MECHANICAL BAR SPLICES**

Comply with ACI 318 requirement of minimum tensile strength of 125 percent of specified yield for reinforcement.

Subject to compliance with the requirements and approval of the Engineer, products, which may be incorporated into the work include, but are not limited to, the following:

BAR-LOCK (MBT) Coupler Systems  
“ERICO” REBAR SPLICING

**E. ADHESIVE ANCHORS**

Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

1. Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:

- a. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.
- b. SET-XP, Simpson Strong Tie, Inc.
- c. PE1000+, Powers Fasteners, Inc.

**2.3 FABRICATION**

Fabricate concrete reinforcing in accordance with ACI SP-66. Obtain written approval from the Engineer prior to welding reinforcing steel. Weld reinforcement in accordance with ANSI/AWS D1.4.

## **EXECUTION**

### **2.4 PLACEMENT**

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal/plastic chairs, runners, bolsters, spacers, and hangers, as required.

Install reinforcing bars with clearance indicated on the Plans. Provide laps as shown and stagger locations to minimize the concentration of multiple reinforcing at joints. Bar lap splicing shall have full contact. Where full contact cannot be achieved, the maximum space between the spliced bars shall not exceed 2 inches. Unless noted otherwise on the Plans, provide two #5 minimum trim bars around all openings and penetrations. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

**\*\*\* END OF SECTION \*\*\***

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes schedules, notes, and details for the construction of cast-in-place concrete structures, landings, equipment piers, housekeeping pads and slabs on grade.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03200	Concrete Reinforcement
Division 7	Thermal and Moisture Protection

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 117	Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 212.3	Chemical Admixtures for Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Tightness Testing of Reinforced Engineering Concrete Structures and Commentary
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates

ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

#### **1.4 SUBMITTALS**

Submittals shall be in accordance with Section 01300.

##### **A. GENERAL**

The submittal for each included concrete mix shall include, as a complete package, the following as defined below:

1. Concrete Mix Design
2. Certified Test Results
3. Sieve Analysis
4. Product Data

An incomplete concrete mix submittal package may render a rejection of the mix or could delay the review process.

B. CONCRETE MIX DESIGN

Submit mix design for the proposed mix to be used on the Project, indicating components, and proportions by weight, including any admixtures. Mix design shall state chloride content. Mix designs to be provided are:

1. Unspecified Concrete
2. Lean Concrete
3. Cement Grout

C. CERTIFIED TEST RESULTS

Submit laboratory test results indicating compressive strength of concrete in compliance with requirements specified herein and in accordance with ACI 301.

D. SIEVE ANALYSIS

Submit sieve analysis for proposed coarse and fine aggregates indicating components, source, gradation, and WSDOT aggregate source approval report, including WSDOT Aggregate Source ID.

E. PRODUCT DATA

Provide product data on all proposed admixtures, accessories, and embedded items to be used on the Project, including, but not limited to:

1. Cement; source and type
2. Air Entraining Agent
3. Water Reducing Admixtures
4. Pozzolans
5. Bonding Agents
6. Curing Compounds/Floor Hardeners
7. Non-Shrink Grout; Non-metallic and Metallic

8. Waterstops
9. Plastic Joint Formers
10. Vapor Barriers
11. Stair Nosings

For admixtures other than those proposed for air entrainment, submit a letter from the manufacturer describing the benefits of its use for the project and effect of its use on the properties of the concrete. Product data shall expressly state admixtures are chloride free, or the manufacturer shall submit a letter certification stating the same.

**F. MATERIAL DELIVERY TICKETS**

Provide copies of all concrete and grout material delivery tickets for the Project to the Engineer.

**1.5 QUALITY ASSURANCE**

Perform work in accordance with ACI 301. Acquire cement and aggregates from same source for all work performed on the Project. Conform to ACI 305 when concreting during hot weather. Conform to ACI 306 when concreting during cold weather. Provide or coordinate field and laboratory testing as described later in this Section and under provisions of Section 01400.

**1.6 COORDINATION**

Coordinate work in accordance with provisions of Section 01310. Coordinate the placement of embedded items with erection of concrete formwork and placement of form accessories.

**PART 2 PRODUCTS**

**2.1 FORM MATERIALS**

**A. FORMS FOR EXPOSED FINISH CONCRETE**

Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Plans.

**B. FORMS FOR UNEXPOSED FINISH CONCRETE**

Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

**C. FORMS FOR CYLINDRICAL COLUMNS AND SUPPORTS**

Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

**D. FORM COATINGS**

Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

**E. FORM TIES**

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units, which will leave no metal closer than 1-1/2 inches to surface. Unless noted otherwise on Plans, provide ties with plastic cone devices which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

**2.2 CONCRETE MATERIALS**

**A. CEMENT**

ASTM C150, Type II – Moderate or Type I - II. Use one brand of cement throughout the project, unless otherwise approved by the Engineer. Provide low alkali cement where Alkali-Silica Reaction (ASR) mitigation measures are required by WSDOT Aggregate Source Approval.

**B. FINE AND COARSE AGGREGATES**

Comply with ASTM C33. Provide aggregates from a single source. Coarse aggregate shall be size designation 467 (Nominal size 1-1/2 inch to No. 4 sieve) for all liquid containing structures, and size designation 67 (Nominal size 3/4-inch to No. 4 sieve) for all other concrete. Aggregates shall show a loss of weight not exceeding 35 percent after 500 revolutions

in a Los Angeles wear machine, when tested in accordance with ASTM C131 or ASTM C535. Aggregates shall be from a WSDOT approved source.

Coarse aggregate will be the largest nominal size permitted by ACI 301/318.

C. WATER

Clean, potable, and not detrimental to concrete, in compliance with ASTM C94.

## 2.3 ADMIXTURES

Except for air entrainment, use of all other admixtures used shall be subject to approval of the Engineer and at no additional cost to the Owner. Only admixtures expressly stated by the manufacturer as being chloride-free shall be used. Subject to compliance with requirements, products, which may be incorporated into the work include, but are not limited to, the following:

A. AIR ENTRAINMENT

ASTM C260 certified by manufacturer to be compatible with other proposed admixtures.

Master Builders MB AE 90 or MICRO-AIR  
Sika AER  
W.R. Grace Daravair or Darex Series

B. WATER REDUCING ADMIXTURE

ASTM C494 Type A.

Master Builders PolyHeed  
Sika Plastocrete 161  
W.R. Grace WRDA Series

C. ACCELERATING ADMIXTURE

ASTM C494 Type C.

Master Builders Pozzoloth NC534  
Sika Plastocrete 161 FL  
W.R. Grace Polarset or DCI

D. WATER REDUCING, RETARDING ADMIXTURE

ASTM C494, Type D.

Master Builders Pozzolith 100XR  
Sika Plastiment  
W.R. Grace Daratard Series

E. WATER REDUCING, ACCELERATING ADMIXTURE

ASTM C494, Type E.

Euclid Chemical Co. Accelguard 80  
Master Builders Pozzutec 20  
W.R. Grace Daracel

F. HIGH RANGE WATER REDUCER (HRWR)

ASTM C494, Type F.

Master Builders Rheobuild 1000/3000 FC  
Sika Sikament 10 ESL  
W.R. Grace ADVA 100

G. HIGH RANGE WATER REDUCER AND RETARDER

ASTM C494, Type G.

Master Builders Pozzolith 440N  
W.R. Grace Daracem-100

H. POZZOLAN

ASTM C618 - CLASS F, with a CaO maximum content of 10 percent.

**2.4 ACCESSORIES**

A. BONDING AGENT

ASTM C881, Type I and II, Grade 2, Class C, Epoxy Resin. Subject to Contract requirements, provide one of the following or equal:

Sika Armatec 110  
Conspec SpecBond 100

W.R. Meadows Sealtight Rezi Weld 1000

B. CURING COMPOUND/CHEMICAL FLOOR HARDENER

ASTM C309, Type I, Class A and B. Subject to Contract requirements, provide one of the following or equal:

W.R. Meadows Sealtight 1100-Clear  
Conspec RX cure  
Chemrex, Inc. Masterkure  
Burke Spartan-Cote WB

C. GENERAL PURPOSE NON-SHRINK NON-METALLIC GROUT

Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 Mpa) in 48 hours and 7,000 psi (48 Mpa) in 28 days. Subject to Contract requirements, provide one of the following or equal:

Sika SikaGrout 212  
Conspec 100 Non Metallic  
Chemrex, Inc. Masterflow 928 Grout  
W.R. Meadows Sealtight 588

D. WATERSTOPS

Provide waterstop of type and size at construction joints and other joints as indicated on the Plans.

1. PVC (Polyvinyl Chloride)

Serrated (ribbed), 3/8 of an inch minimum thickness for 6 inches and larger and 3/16 of an inch minimum thickness for 4 inches. Comply with Corps of Engineers CRD-C-572. No reclaimed PVC will be allowed in waterstop.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak  
Vinylex Corporation  
W.R. Meadows

2. Cold Joint Waterstop

Install where shown on the Plans or at locations approved by the Engineer. Cold joint waterstop shall be certified by the manufacturer to be compatible for use in wastewater (sewage) containment structures. Unless otherwise shown in the Plans, size shall be 1-inch thick and 1-inch wide.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Hydrotite, Greenstreak

E. PLASTIC JOINT FORMER

Provide and install, per manufacturer's recommendations, where shown on the Plans or at locations approved by the Engineer. Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak  
Vinylex Corporation  
W.R. Meadows

F. STAIR NOSINGS

American Safety Tread Co., Inc., Style 816 with steel wing anchors with nuts and anchor bolts or equal.

G. VAPOR BARRIER

Six-mil fabric reinforced plastic film.

**2.5 CONCRETE MIX**

A. GENERAL

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as that used for field quality control testing.

The maximum water soluble chloride ion content, expressed as a percent of the cement, contributed from all ingredients of the concrete mix, including water, aggregates, cementitious materials, and admixtures, shall not exceed 0.10 percent. Pozzolans may be counted as part of the total cementitious material in the concrete mix design. The cementitious material is the “minimum cement content” specified in the mix design for each type of concrete. When pozzolans are used as part of this “cement content,” the minimum content shall be 15 percent by weight of the total cementitious materials (Portland cement and pozzolans) and not more than 20 percent.

Where ASR mitigation measures are required by WSDOT, provide a minimum of 15 percent pozzolan included in the cementitious material in the design mix.

## B. MIX DESIGNS

Provide normal weight concrete with the following properties, unless noted otherwise on the Plans.

### 1. Unspecified Concrete

Structural concrete of general use in structures, sidewalks, and where no specific class of concrete is designated.

Minimum compressive strength @ 28 days:	4,000 psi
Minimum cement content:	6 sacks per cubic yard
Maximum water cement ratio by weight:	0.45
Nominal coarse aggregate size:	1-1/2" to No. 4 (size designation 467)

### 2. Lean Concrete

Concrete for pipe thrust blocks or for use as noted as “Concrete Fill” on the Plans.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	5 sacks per cubic yard

### 3. Cement Grout

Material for filling guard posts, grouting of clarifier bottoms or for other uses as shown on the Plans. Cement grout shall be sand and cement only and shall not contain coarse aggregate.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	6.5 sacks per cubic yard
Maximum water cement ratio by weight:	0.54

## C. ADMIXTURES

### 1. Air Entrainment

Use air-entraining admixture complying with ASTM C260 in all exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement in accordance with ASTM C173 or C231 having total air content with a tolerance of plus or minus 1 percent within the following limits:

5.5 percent for 1.5 inch max. coarse aggregate size

6.0 percent for 1.0 inch max. coarse aggregate size

7.0 percent 0.50 inch or less max. coarse aggregate size

### 2. Other Admixtures

Use of all other admixtures shall be subject to the approval of the Engineer, and shall be in accordance with ACI 212.3 and Manufacturer's recommendations. Only admixtures stated by the manufacturer to be chloride free shall be used.

## D. SLUMP LIMITS

Proportion and design mixes to result in concrete slump (1 inch  $\pm$  of the maximum) at the point of placement in accordance with ASTM C143 as follows:

Ramps, slabs, and sloping surfaces: 3 inches.

Reinforced foundation systems: 3 inches.

Other concrete: 4 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2- to 3-inch slump concrete.

## **CONCRETE MIXING**

Comply with requirements of ASTM C94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

### **3.2 FORMS**

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back up at all joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast-in-place concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Provide Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer all exposed corners and edges and other areas shown on the Plans, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

### **3.3 JOINTS AND WATERSTOPS**

#### **A. CONSTRUCTION JOINTS**

Locate and install construction joints where indicated, or locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise shown on the Plans.

#### **B. WATERSTOPS**

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

#### **C. ISOLATION JOINTS IN SLABS-ON-GRADE**

Unless otherwise noted, construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as shown on the Plans.

## SLAB (CONTROL) JOINTS

Construct joints in slabs-on-grade as shown on the Plans. Use saw cuts 1/8 of an inch wide x 1/4 of the slab depth or inserts 1/4-inch wide x 1/4 of the slab depth.

### D. PREMOLDED (CONTROL) JOINTS

Insert premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

### E. EDGE FORMS AND SCREED STRIPS FOR SLABS

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

## 3.4 INSTALLATION OF EMBEDDED ITEMS:

### A. GENERAL

Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use installation drawings, diagrams, instructions, and directions provided by suppliers of items to be embedded.

### B. CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### C. REGLETS

Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing as shown at lintels, relieving angles, and other conditions.

### **3.5 VAPOR BARRIER INSTALLATION**

Following leveling and tamping of granular base material for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of concrete placement.

Lap joints a minimum of 6 inches and seal with appropriate approved tape. After placement of vapor barrier, cover with sand material and compact to depth as shown on the Plans.

### **3.6 PLACING REINFORCEMENT**

See Section 03200.

### **3.7 PREPARATION OF FORM SURFACES**

Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### **3.8 PREPARATION OF EXISTING CONCRETE SURFACES**

The Contractor shall bush hammer all existing concrete surfaces that are to have new concrete cast against them. Apply epoxy bonding agent prior to placing concrete.

### **3.9 CONCRETE PLACEMENT**

#### **A. GENERAL**

Comply with ACI 304 and as herein specified.

Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting

such work. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during concrete placement.

#### B. PLACING CONCRETE IN FORMS

Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

#### C. PLACING CONCRETE SLABS

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Maintain reinforcing in proper position during concrete placement operations.

#### D. COLD WEATHER PLACING

Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before

mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

#### **E. HOT WEATHER PLACING**

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is at Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed. Upon approval, water-reducing retarding admixture (Type D) may be used when required by high temperatures, low humidity, or other adverse placing conditions.

### **3.10 FINISH OF FORMED SURFACES**

Provide smooth form finish for all formed concrete surfaces exposed-to-view including all surfaces exposed to water or wastewater, or that are to be covered with a coating material applied directly to the concrete, or a covering material applied directly to concrete, such as veneer plaster, painting, or other similar type of system.

Provide smooth form finish for surfaces to be waterproofed or dampproofed. Surfaces must comply with recommendations of the manufacturer of the product being utilized.

Provide rough form finish for formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.

A. SMOOTH FORM FINISH

This is to be the as-cast concrete surface obtained utilizing selected form facing material, arranged orderly and symmetrically with a minimum of seams, and as specified herein.

Repair and patch tie holes and defective areas, with all fins or other projections completely removed and smoothed, by one of the following methods:

1. Provide smooth rubbed finish to concrete surfaces after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
2. Provide grout "sacked" cleaned finish. The sacking grout shall be one part Portland cement to 1-1/2 parts fine sand by volume, and mixed with water to consistency of thick paint. Proprietary additives such as epoxy bonding agents or adhesives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts to be determined by trial patches, so that final color of dry grout matches adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep sacked surfaces damp by fog spray or other acceptable method so surfaces do not dry out.

B. ROUGH FORM FINISH

This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/8 of an inch in height rubbed down or chipped off. All "bug holes" exceeding 1/2 inch in diameter and exceeding 1/4-inch depth shall be repaired or filled in.

C. RELATED UNFORMED SURFACES

At tops of walls, horizontal offsets, and similar unformed surfaces occurring at adjacent formed surfaces, continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

D. TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:
  - a. In the lines and surfaces of columns, pier, walls and in arises      In any 10 feet of length – 1/4 inch. Maximum for entire length – 1 inch
  - b. For exposed corner columns, control-joint grooves, and other conspicuous lines      In any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch
2. Variations from level or from the grades indicated on the Plans:
  - a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores      In any 10 feet of length – 1/4 inch. In any bay or opening, or in any 20 feet of length – 3/8 of an inch. Maximum for entire length – 3/4 inch
  - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines      In any bay or opening, or in any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch
3. Variations in the linear building lines from the established position in plan view      In 20 feet of length – 1/2 inch. Maximum for entire length – 1 inch
4. Variations in distance between walls, columns and partitions      In any 10 feet of distance – 1/4 inch. In any bay or opening – 1/2 inch. Maximum total variation – 1-inch.
5. Variations in the sizes and locations of sleeves, floor openings and wall openings      Minus – 1/4 inch  
Plus – 1/2 inch

- |                            |  |   |
|----------------------------|--|---|
| 6.                         | Variations in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls    | Minus – 1/4 inch<br>Plus – 1/2 inch   |
| 7. Variations in footings: |  |   |
| a.                         | Variation from dimensions on Plans when formed or plus 3-inches when placed against unformed excavations | Minus – 1/2 inch<br>Plus – 2 inches   |
| b.                         | Misplacement of eccentricity   | 2 percent of the footing width in the direction of the misplacement, but not more than 2 inches |
| c.                         | Reduction in thickness of specified thickness  | Minus – 5 percent   |
| 8. Variations in steps:    |  |   |
| a.                         | In a flight of stairs  | Riser – 1/8 of an inch<br>Tread – 1/4 inch  |
| b.                         | In consecutive steps   | Riser – 1/16 of an inch<br>Tread – 1/8 of an inch   |

### **3.11 MONOLITHIC SLAB FINISHES:**

#### **A. SCRATCH FINISH**

Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping, including grout finishes where indicated on plans, or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. Slope surfaces uniformly to floor drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

**B. FLOAT FINISH**

Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

**C. TROWEL FINISH**

Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth surface defects that would telegraph up through applied floor covering system.

**D. TROWEL AND FINE BROOM FINISH**

Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

**E. NON-SLIP BROOM FINISH**

Apply non-slip broom finish to exterior concrete platforms, landings, steps, and ramps, sidewalks and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner before application.

**F. CHEMICAL-HARDENER FINISH**

Apply chemical-hardener finish to interior exposed concrete floors and steps, unless noted otherwise. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

**G. TOLERANCES FOR MONOLITHIC SLAB FINISHES**

The flatness of the concrete shall be carefully controlled and the tolerances shall be measured by the straight edge system as specified in paragraph 4.5.7 of ACI 117, using a 10-foot straight edge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straight edge can be placed.

Bullfloated	1/2 inch
Float Finish	3/16 inch
Trowel Finish	1/8 inch
Straightedges	5/16 inch

**3.12 CONCRETE CURING AND PROTECTION**

**A. GENERAL**

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep concrete continuously wet for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried out. Continue final curing for at least 7 days in accordance with ACI 301 curing methods. Avoid rapid drying of concrete at the end of final curing period.

**B. CURING METHODS**

Perform curing of concrete by use of curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

Provide moisture curing by the following methods. Keep concrete surface continuously wet by covering with water, or provide continuous water-fog spray.

Covering concrete surface with absorptive cover, thoroughly saturating cover with water and keeping continuously thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in wide as practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walls, sidewalks, and curbs, as follows:

Apply curing and sealing compound to concrete slabs and walls as soon as initial curing operations are complete or immediately after the forms have been stripped (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Completely cover the concrete surfaces with curing and sealing compound. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair any damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

#### C. CURING FORMED SURFACES

Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period and until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.

**D. CURING UNFORMED SURFACES**

Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of an appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover.

**3.13 SHORES AND SUPPORTS**

**A. GENERAL**

Comply with ACI 347 for shoring, and as herein specified. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until all concrete has attained its required 28 day strength and heavy loads due to construction operations have been removed.

**B. REMOVAL OF FORMS**

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete, such as beam soffits, joints, suspended slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained 70 percent of the design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens, representative of concrete location or members.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

### **3.14 REUSE OF FORMS**

Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Provide new form facing material. Apply new form coating compound as specified for new formwork prior to reuse of forms.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, unless approved by the Engineer and acceptable to the Owner.

### **3.15 MISCELLANEOUS CONCRETE ITEMS**

#### **A. FILLING-IN**

Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work. Fill-in all form tie holes and other forming system holes with non-shrink grout.

#### **B. CURBS**

Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

#### **C. BASE PLATE, EQUIPMENT BASES AND FOUNDATIONS**

Provide machine and equipment bases (housekeeping pad/pier) and foundations, as shown on the Plans. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturers furnishing machines and equipment.

Provide 4-inch-high, square or rectangular concrete pad around all conduits and small diameter pipes that penetrate through floor slabs.

Provide leveling grout under base plates and equipment frames using non-metallic, non-shrink grout. Minimum thickness for leveling grout shall be 1/2 inches unless noted otherwise on the Plans or specified by equipment manufacturer.

D. STAIR NOSINGS

Provide stair nosings at all exterior cast-in-place concrete stairs or steps. The stair nosings shall be installed in accordance with the manufacturer's written instructions.

**3.16 CONCRETE SURFACE REPAIRS**

A. PATCHING DEFECTIVE AREAS

Repair and patch defective areas immediately after removal of forms. Cut out honeycomb, rock pockets, voids or bugholes over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. For water and wastewater containment structures, utilize an epoxy resin bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. REPAIR OF FORMED SURFACES

Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, bug holes, honeycomb, rock pockets; fins and other discolorations that cannot be removed by cleaning. Flush out form tie holes and form bolt holes, fill with non-shrink grout, or precast concrete cone plugs or rubber plugs secured in place with bonding agent or epoxy adhesive.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. All repairs shall be approved by the Engineer. If defects cannot be repaired, the Contractor shall remove and replace the concrete.

C. REPAIR OF UNFORMED SURFACES

Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inches wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3 inches of clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to approval of the Engineer. If acceptable repairs cannot be made, the Contractor shall remove and replace the concrete at no cost to the Owner.

### **3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION**

#### **A. GENERAL**

Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete

ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump

ASTM C143: one test at point of discharge for each day's placement of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content

ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's placement of each type of air-entrained concrete.

4. Concrete Temperature

Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens is made.

5. Compression Test Specimen

ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests

ASTM C39; one set for each day's placement exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above

the first 25 cubic yards of each concrete class placed in any 1 day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When total quantity of a given class of concrete is less than 50 cubic yards, Engineer may waive strength test if, in their judgment, adequate evidence of satisfactory strength is provided.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Engineer and Contractor within 24 hours after testing. FAX of test results is acceptable; however, mailing hard copies of test results is also required. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7 day tests and 28-day tests.

7. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection of concrete.

8. Additional Tests

The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in a structure, as directed by the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for cost of such tests when unacceptable concrete is verified.

### **3.18 WATERTIGHTNESS**

All water and wastewater holding tanks, basins and structures listed on the Structural Plans shall be tested for watertightness. Each tank, structure or basin shall be tested independently.

Watertightness tests shall be made after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placement. Watertightness shall conform to the requirements of ACI 350.1.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan. Suitable evaporation pan shall be approved by Owner and shall be provided by Contractor.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks shall be required. All costs associated with location (re-excavation and backfilling) and repair of leaks shall be borne by the Contractor.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 4**

### **MASONRY**

## **SECTION 04200**

### **MASONRY**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes masonry construction as indicated on the Plans and schedules. The types of masonry work include but are not limited to the following: Concrete masonry units (CMU) and brick masonry, notes and details to show size and location of units and typical connections for installation and construction of units.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete

##### **1.3 REFERENCES**

This Section references the latest revisions of the following documents:

<b><u>Reference</u></b>	<b><u>Title</u></b>
ACI SP-66	ACI Detailing Manual
ASTM A82	Steel Wire, Plain, for Concrete Reinforcement
ASTM C67	Sampling and Testing Brick and Structural Clay Tile
ASTM C90	Load-Bearing Concrete Masonry Units
ASTM C140	Sampling and Testing Concrete Masonry Units and Related Units
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C404	Aggregates for Masonry Grout
ASTM C476	Grout for Masonry
ASTM C578	Rigid, Cellular Polystyrene Thermal Insulation
ASTM C780	Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

ASTM C1363	Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus
IMAC	International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction

## **1.4 SUBMITTALS**

Submittals shall be in accordance with Section 01300.

### **A. SHOP DRAWINGS**

Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI SP-66.

### **B. PRODUCT DATA**

Submit manufacturer's product data for each type of masonry unit, accessory, and other types of manufactured products. Unless noted otherwise on the plans, provide a color palette of at least six colors for color selection by Owner.

### **C. CERTIFICATES**

Submit manufacturer's certificate certifying that each product meets or exceeds specified requirements.

## **1.5 QUALITY ASSURANCE**

### **A. QUALIFICATIONS**

#### **1. Installer**

Company specializing in performing the work specified in this Section shall have minimum 5 years of documented experience.

### **B. SINGLE SOURCE RESPONSIBILITY**

Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Obtain mortar ingredients of uniform quality, including color for exposed masonry, from manufacturer for each cementitious component and from one source and producer for each aggregate.

#### C. TESTING

Test the following materials by the methods indicated:

##### 1. Concrete Masonry Units (CMU)

Test each type, class, and grade of concrete masonry unit per ASTM C140.

##### 2. Mortar

Test each mortar type per ASTM C780.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver masonry materials to project in undamaged condition. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, or other causes.

Store cementitious materials off ground, under cover and in dry location. Store aggregates where grading and other required characteristics can be maintained. Store masonry accessories including metal items to prevent deterioration and accumulation of dirt.

### 1.7 PROJECT CONDITIONS

#### A. PROTECTION OF WORK

During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

## B. STAINING

Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.

Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from droppings of mortar.

## C. COLD WEATHER PROTECTION

Do not lay masonry units that are wet or frozen. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch. Remove masonry damaged by freezing conditions.

Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout.

For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F (6 degrees C).

Range: 40 degrees F (4 degrees C) to 32 degrees F (0 degrees C)

Mortar:	Heat mixing water to produce mortar temperature between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C).
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Grout:	Follow normal masonry procedures.
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Range 32 degrees F (0 degrees C) to 25 degrees F (-4 degrees C)

Mortar:	Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.
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Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Range: 25 degrees F (-4 degrees C) to 20 degrees F (-7 degrees C)

Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.

Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Heat both sides of walls under construction using salamanders or other heat sources.

Use windbreaks or enclosures when wind is in excess of 15 mph.

20 degrees F (-7 degrees C) and below:

Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.

Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Masonry Units: Heat masonry units so that they are above 20 degrees F (-7 degrees C) at time of laying.

Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F (4 degrees C) for 24 hours after laying units.

Do not heat water for mortar and grout above 160 degrees F (71 degrees C).

Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

Range: 40 degrees F (4 degrees C) to 32 degrees F (0 degrees C)

Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

Range: 32 degrees F (0 degrees C) to 25 degrees F (-4 degrees C)

Completely cover masonry with weather-resistant membrane for at least 24 hours.

Range: 25 degrees F (0 degrees C) to 20 degrees F (-7 degrees C)

Completely cover masonry with weather-resistant insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

20 degrees F (-7 degrees C) and below:

Except as otherwise indicated, maintain masonry temperature above 32 degrees F (0 degrees C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry, maintain heated enclosure to 40 degrees F (4 degrees C) for 48 hours.

## **PART 2 PRODUCTS**

### **2.1 CONCRETE MASONRY UNITS**

#### **A. GENERAL**

Comply with referenced standards and other requirements indicated, applicable to each form of concrete masonry unit required. Provide special shapes where required for lintels, corners, jambs, sash control joints, headers, bonding and other special conditions. Provide square-edged units for outside corner, except where indicated as bullnose.

All material for exterior block walls shall contain the manufacturer's recommended amount of the Dry Block System Admixture for water repellency.

All mortar for exterior block walls shall contain the recommended amount of the Dry Block Mortar Admixture for water repellency and to assure proper bond strength.

Provide units complying with characteristics indicated for grade, type, face size, exposed face, and weight classification.

**B. HOLLOW LOAD-BEARING BLOCK UNITS**

ASTM C90, Grade N, Type I, moisture controlled, medium weight (density shall exceed 110 pcf).

**1. Size**

Unless noted otherwise on the Plans, provide manufactured standard units with nominal face dimensions 16 inches long by 8 inches tall (15-5/8 inches x 7-5/8 inches actual) by thickness shown on the Plans.

**2. Color and Pattern**

Interior Wall Units: Smooth faced, natural color.

Exterior Wall Units: Split faced, color per plans.

Provide color palette of at least six colors for Owner selection.

**2.2 MORTAR AND GROUT MATERIALS**

**A. PORTLAND CEMENT**

ASTM C150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color. Mortar color shall coordinate with block color. Provide mortar color options to the Owner for selection.

## B. HYDRATED LIME

ASTM C207, Type S.

### C. AGGREGATE FOR MORTAR

ASTM C144.

#### D. AGGREGATE FOR GROUT

ASTM C404.

## E. ADMIXTURES

Comply with Section 03300.

### Dry Block Mortar Admixture.

## F. WATER

Clean, potable and free of oils.

## 2.3 REINFORCEMENT AND ANCHORAGE

### A. REINFORCING BARS

Comply with Section 03200.

## B. SINGLE WYTHE JOINT REINFORCEMENT

Truss or Ladder type; hot dip galvanized after fabrication cold-drawn steel conforming to ASTM A82, 3/16 of an inch (4.8 mm) side rods with 3/16 of an inch (4.8 mm) cross ties; manufactured by National Wire, or equal.

## 2.4 FLASHINGS

### A. COPPER/KRAFT PAPER FLASHINGS

3-oz/sq. ft. (915-g/sq. m) sheet copper bonded to fiber-reinforced asphalt treated Kraft paper; manufactured by York Manufacturing, or equal.

## **2.5 ACCESSORIES**

### **A. PREFORMED CONTROL JOINTS**

Synthetic Rubber material. Provide with corner and tee accessories, cement fused joints, manufactured by Williams Products, Inc., or equal.

### **B. CLEANING SOLUTION**

Not harmful to masonry work or adjacent materials.

Do not use Muriatic Acid.

Subject to compliance with requirements, product(s), which may be incorporated into the work include, but are not limited to, the following:

Fabrikleen Masonry Cleaner, by Fabrikem Chemicals, International

### **C. DAMPPROOFING**

Apply a clear siloxane sealer with an active solids content of 6.5 percent on the exterior of all CMU (follow manufacturer's recommended coverage rate and application instructions).

Provide one coat of Chemprobe Corporation Prime-A-Pell Plus and then one finish coat of Chemprobe Corporation Conformel clear. Apply coating at a maximum rate of 150 square feet/gallon.

### **D. INSULATED CMU WALLS**

Provide insulated CMU walls as shown on the Plans.

The expanded polystyrene insulation shall be individually molded to have a minimum density of 1.0 lb/ft<sup>3</sup>, and shall conform to ASTM C578 Standard Type 1.

Thermal capabilities of insulated CMU walls when tested in accordance with ASTM C1363:

<b>Nominal CMU Wall Thickness</b>	<b>U, Value for 2 Core Insulated CMU Wall System</b>
8-Inch	0.19
10-Inch	0.17
12-Inch	0.15

Subject to compliance with requirements, the products, which may be incorporated in the work, include, but are not limited to, the following:

ICON Universal Inserts by Concrete Block Insulating Systems, Inc.  
(CBIS, Inc.)

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

For Insulated CMU Walls install insulation in block cores at the block manufacturer's plant in conformance with Korfil installation requirements.

Thickness: Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

Build chases and recesses as shown or required for the work of other trades. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.

Use dry cutting saws to cut concrete masonry units.

Match masonry coursing, bonding, color, and texture of new masonry work with existing masonry work.

Provide smooth exterior face CMU where the masonry is to receive attachments such as light fixtures, water faucets, electrical boxes, etc.

### **3.2 CONSTRUCTION TOLERANCES**

#### **A. VARIATION FROM PLUMB**

For vertical lines and surfaces of columns, walls and arises do not exceed 1/4 inch in 10 feet, corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4 inch in any story. For vertical alignment of head joints, do not exceed plus or minus 1/8 inch in 10 feet.

#### **B. VARIATION FROM LEVEL**

For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 foot maximum. For top surface of bearing walls, do not exceed 1/8 of an inch between adjacent floor elements in 10 feet or 1/16 of an inch within width of a single unit.

#### **C. VARIATION OF LINEAR BUILDING LINE**

For position shown on the Plans and related portion of columns, walls and partitions, do not exceed 3/8 of an inch in any bay or 20 feet maximum.

#### **D. VARIATION IN CROSS-SECTIONAL DIMENSIONS**

For columns and thickness of walls, do not exceed minus 3/8 of an inch nor plus 3/8 of an inch from dimensions shown on the Plans.

#### **E. VARIATION IN MORTAR JOINT THICKNESS**

Do not exceed bed joint thickness indicated by more than plus or minus 1/8 of an inch or do not exceed head joint thickness by more than plus or minus 1/8 of an inch from dimensions shown on the Plans.

### **3.3 TEMPORARY FORMWORK**

Provide temporary formwork and shoring as required for support of masonry construction. Construct formwork to conform to shape, line and dimensions shown on the Plans. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

Allow not less than the following minimum time to elapse after completion of members before removing shoring or forms, provided suitable curing conditions have been obtained during the curing period.

- Ten days for girders and beams
- Seven days for slabs
- Seven days for reinforced masonry soffits

### **3.4 PLACING REINFORCEMENT**

#### **A. GENERAL**

Clean reinforcement of loose rust, mill scale, earth, ice or other materials that will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Plans or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or one inch (whichever is greater).

For columns, piers and pilasters, provide a clear distance between vertical bars as shown on the Plans, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties as shown on the Plans.

Splice reinforcement bars where shown. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie. Provide not less than minimum lap shown on the Plans.

Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8 of an inch on exterior face of walls and 1/2 inch at other locations. Lap units not less than six inches at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fire-proofing, pipe enclosures and other special conditions.

**B. ANCHORING**

Anchor reinforced masonry work to supporting structure as shown on the Plans.

**3.5 INSTALLATION OF CONCRETE MASONRY UNITS**

**A. GENERAL**

Do not wet concrete masonry units (CMU).

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work. As the work progresses, build-in items specified under this and other sections of these Specifications. Fill in solidly with masonry around build-in items.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise shown on the Plans.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and road mortar or grout into core to completely fill the masonry unit.

Fill cores in hollow concrete masonry units with grout three courses (24 inches) under bearing plates, beams, lintels, posts and similar items, unless otherwise shown on the Plans.

Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8-inch joints.

Cut joints flush for masonry walls, which are to be concealed or to be covered by other materials, unless otherwise shown on the Plans.

Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise shown on the Plans.

Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units, which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

Use special blocks as required to provide solid CMU face at all surfaces including, but not limited to, jambs, headers and sills. Exposed ends of CMU cores are not allowed.

## B. FLASHING OF MASONRY WORK

Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetration in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

Extend flashing the full length of lintels and shelf angles and minimum of 4 inches into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches and through the inner wythe to within 1 inch of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches. At heads and sills turn up ends not less than 2 inches to form a pan. Install flashing to comply with manufacturer's instructions. Provide weep holes in the head joints where shown on the Plans.

## C. WALLS

### 1. Pattern Bond

Lay CMU wall units in half-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise shown on the Plans. Bond and interlock each course at corners and intersections. Use special shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

## 2. Option

Where all vertical cores are not shown to be grouted, Contractor may elect to fill all vertical cores with grout, in which case requirements for mortar bedding of cross-webs and closing of core spaces below bond beams do not apply.

## D. LINTELS

Install steel lintels where shown on the Plans. Provide masonry lintels where shown and wherever openings of more than 1 foot for brick size units and 2 feet for block size units are shown without structural steel or other supporting lintels. Provide minimum bearing of 8 inches at each jamb, unless otherwise shown on the Plans.

## E. CONTROL AND EXPANSION JOINTS

Provide vertical and horizontal expansion, control and isolation joints in masonry where shown on the Plans. Build in related items as the masonry work progresses.

Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.

Build flanges of factory-fabricated expansion joint units into masonry.

Build in non-metallic joint fillers where shown on the Plans.

F. COLUMNS, PIERS, AND PILASTERS

Use CMU units of the size, shape and number of vertical core spaces shown. If not shown on the Plans, use units that provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown on the Plans. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

G. GROUTING

Use "Fine Grout" per ASTM C476 for filling spaces less than 4 inches in one or both horizontal directions.

Use "Coarse Grout" per ASTM C476 for filling 4 inch spaces or larger in both horizontal directions.

Use "Concrete Mix" for filling spaces 10 inches or larger.

H. GROUTING TECHNIQUE

1. General

At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements that follow.

2. Low-Lift Grouting

Provide minimum clear dimension of 2 inches and clear area of 8 square inches in vertical cores to be grouted.

Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.

Lay CMU to maximum pour height. Do not exceed 5 foot height, or if bond beam occurs below 5 foot height, stop pour at course below bond beam.

Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt

pouring of grout for more than 1 hour. Terminate grout pours 1-1/2 inches below top course of pour.

Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

### 3. High-Lift Grouting

Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3 inches and 10 square inches, respectively.

Provide cleanout holes in first course at all vertical cells, which are to be filled with grout. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.

Construct masonry to full height of maximum grout pour specified, prior to placing grout.

Limit grout lifts to a maximum height of 5 feet and grout pour to a maximum height of 24 feet for single wythe hollow concrete masonry walls, unless otherwise shown on the Plans.

Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10 feet.

Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.

Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing shown on the Plans.

Place horizontal beam reinforcement as the masonry units are laid. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.

Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8-gauge wire ties spaced 16 inches on center for members with 20 inches or less side dimensions, and 8 inches on center for members with side dimensions exceeding 20 inches.

## I. PREPARATION OF GROUT SPACES

Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Owner.

Limit grout pours to sections, which can be completed in 1 working day with not more than one hour interruption of pouring operation. Place grout in lifts that do not exceed 5 feet. Allow not less than 30 minutes, nor more than 1 hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

Place grout in lintels or beams over openings in one continuous pour.

Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1 inch of vertically reinforced cavities, during construction of masonry.

When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2 inches of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

J. FIELD QUALITY CONTROL

1. General

Contractor shall employ, a testing laboratory experienced in performing types of masonry field quality control tests for masonry as specified in Section 01400.

2. Unit Test Method

a. Brick Tests

For each type and grade of brick indicated, test units by methods of sampling and testing of ASTM C67 except select five bricks at random for each 10,000 units or fraction thereof installed.

b. Concrete Masonry Unit Tests

For each type, class and grade of concrete masonry unit indicated, test units by method of sampling and testing of ASTM C140.

c. Mortar Tests

For each type indicated, test mortar by ASTM C780 methods for sampling and testing. Conduct tests no less frequently than that required to evaluate mortar used to install each increment of masonry units indicated above from which samples are taken for testing.

K. REPAIR, POINTING, AND CLEANING

1. General

Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

2. Pointing

During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

3. Final Cleaning

After mortar is thoroughly set and cured, clean masonry as follows:

Remove large mortar particles by hand with wooden paddles and non-metallic scrape, hoes or chisels.

Test cleaning methods on sample wall panel; leave panel uncleaned for comparison purposes. Obtain Owner's approval of sample wall cleaning before proceeding with cleaning of masonry.

Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.

Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

For masonry made of clay or shale, clean masonry with cleaning solution in accordance with manufacturer's recommendations. Muriatic acid shall not be used. Apply acidic cleaner in compliance with directions of cleaner manufacturer.

Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

Provide final protection of masonry work and maintain conditions in a manner acceptable to the Owner that ensures unit masonry work to be without damage and deterioration at time of substantial completion.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 5**

### **METALS**

## SECTION 05500

### MISCELLANEOUS METAL FABRICATIONS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the miscellaneous metal fabrication work including, but is not limited to, the following: preassembled stairs, ladders, handrails, railings, grating, including stair treads and nosings; floor plates and covers, custom fabricated pipe brackets, supports, and pipe sleeves.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Quality Control
01400	Project Meetings
03300	Cast-In-Place Concrete
09900	Painting

##### 1.3 REFERENCES

This section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM A36	Structural Steel
ASTM A53	Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe
ASTM A123	Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A283	Carbon Steel Plates, Shapes, and Bars
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A325	High Strength Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B241	Aluminum-Alloy Seamless Pipe and Seamless Extruded Steel Tube
NAAMM	National Association of Architectural Metal Manufacturers, "Metal Bar Grating Manual"
AISC	American Institute of Steel Construction
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
SSPC	Steel Structures Painting Council

## **1.4 SUBMITTALS**

Submit under provisions of Section 01300.

Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

#### **A. STRUCTURAL STEEL**

Structural steel members and sections as defined in the AISC "Code of Standard Practice" are specified in Section 05120.

#### **B. STEEL CASTINGS**

Comply with ASTM A27. Grade 65-35, medium strength carbon steel.

#### **C. CAST IRON**

Comply with ASTM A48, Class 20.

#### **D. STAINLESS STEEL**

Comply with ASTM A276, Type 316.

#### **E. ALUMINUM ALLOY EXTRUDED BARS, RODS, WIRE, SHAPES AND TUBES**

Comply with ASTM B221, Alloy 6061-6.

F. WELDING MATERIALS

As specified in Section 05120.

G. ZINC COATING

Comply with ASTM A123 or ASTM A153.

H. FASTENERS, ANCHORS, AND ANCHOR BOLTS

As specified in Section 05120.

I. PAINTING

Comply with Section 09900.

J. GROUT MATERIALS

As specified in Section 03300.

## **2.2 PRODUCTS**

A. HANDRAILS AND RAILINGS

Handrails and railings shall be clear satin finish, anodized 1-1/2-inch nominal diameter Schedule 40 extruded aluminum tubing conforming to ASTM B241, Alloy 6063 with concealed aluminum spigot splice connectors and fasteners countersunk and flush. Fasteners shall be 316 stainless steel. Maximum post spacing shall be 6'-0" on center.

Post connections shall be cast aluminum R&B Wagner Interna-Rail or approved equal. Mounting shall be cast aluminum R&B Wagner-Interna-Rail drive on flange or approved equal; other acceptable manufacturers are Golden Railings, Inc., or Alumaguard Corporation.

B. GRATING AND STAIR TREADS

Grating and stair treads shall be serrated, aluminum alloy 6063, rectangular bar grating complying with the requirements of NAAMM "Metal Bar Grating Manual"; in addition stair treads shall be provided with 1-1/4" corrugated nosings.

Unless noted otherwise on the Plans, minimum size of aluminum grating shall be 1-1/2" x 3/16" bearing bars at 1-3/16 inch on center with cross bars at 4 inches on center for a maximum span of 4'-6". For spans greater

than 4'-6", grating shall be designed for 100 psf uniform load and 250 pounds concentrated load and 1/2 inch maximum deflection.

Stair treads shall be designed for 300 pound concentrated load with 33 1/3 percent impact.

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to the following:

AMICO Bar Grating  
IKG Borden  
McNichols Co.  
Seidlehuber Metal Products

## **2.3 FABRICATION**

Fit and shop assemble components in the largest practical size for delivery and installation at site.

### **A. STRUCTURAL STEEL MEMBERS AND SECTIONS**

Fabrication of structural steel members and sections shall comply with Section 05120.

Provide galvanized fasteners with zinc coated items except as noted below. For all items installed in submerged, intermittently submerged, or areas subject to splash and spill, or corrosive atmospheres, fasteners shall be 316 stainless steel. The term fasteners includes nut, bolts, washers, leveling nuts, and U-bolts.

### **B. HANDRAIL AND RAILINGS**

Unless noted otherwise, handrail and railing assemblies shall include a minimum 1/4" x 4" aluminum kick plate. Fabricate components with joints tightly fitted and secured. Fabricate anchors and related components of the same material and finish unless noted otherwise. Coordinate and accurately form components to suit stairs, landings and building structure. All stair stringers shall have handrail installed on them, unless noted otherwise.

### **C. GRATING AND STAIR TREADS**

Fabricate with bearing bars placed edgewise and joined by straight cross bars. Do not notch, slot or cut bearing bars to receive cross bars. Cross bars shall be secured to the main bearing bars to prevent turning, twisting,

or coming loose. Each of the cross bars shall be trimmed flush with outside face of bearing bars. Grating shall be fully banded at ends and at all openings. Provide anchorage as indicated on the Drawings.

**D. ACCESSORIES**

Provide necessary accessories as required for complete installation of products. Provide anchors, anchor bolts, plates, angles, hangers, struts, and other items required for connecting stairs to structure.

**E. ANCHORAGE TO SUPPORTING STRUCTURES**

For anchorage to supporting structures, provide 316 stainless steel fasteners for all aluminum items. Provide tapered washers where required to avoid point loading of structural members.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

Verify that field conditions are acceptable and are ready to receive the work.

**3.2 PREPARATION**

Clean and strip primed steel items to bare metal where site welding is required. Supply items required to be cast into concrete or embedded in masonry with setting templates.

Paint embedded aluminum items in accordance with Section 09900.

**3.3 INSTALLATION**

**A. TOLERANCES**

Install items plumb and level, accurately fitted, free from distortion or defects. Comply with the following tolerances:

Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-accumulative.

Maximum Offset From True Alignment: 1/4 inch (6 mm).

Allow for erection loads, and provide sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments. Handrail installation shall be sturdy and without play.

**B. BOLTING AND WELDING**

Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Field weld components as indicated on the Drawings. Perform field welding in accordance with AWS D1.1 or AWS D1.2.

Obtain Owner's approval prior to field cutting or making adjustments not scheduled on the shop drawings.

**C. COATINGS**

After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete complying with Section 09900. Field galvanizing shall be done by the hot-stick method utilizing Galv-bar, or equal. Spray-on zinc paint is not acceptable.

**D. DISSIMILAR MATERIALS**

Avoid direct fastening of dissimilar metals to one another. Connections shall include means as required to isolate dissimilar metals from one another. Possible methods of isolation include, but are not limited to, non-metallic bushings/washers at bolts, and epoxy paint coating of contact surfaces. Intended means of isolation shall be noted on the submitted shop drawings. See Section 09900 for epoxy paint requirements.

**E. ANCHORING GRATING**

All grating shall be mechanically fastened into place. Provide plate fasteners or F-9 fasteners as recommended by the manufacturer. Where removable grating is specified on the Plans, fasteners shall be provided and installed to allow for easy removal of the grating.

**\*\*\* END OF SECTION \*\*\***

**DIVISION 6**

**WOOD AND PLASTICS**

## SECTION 06100

### ROUGH CARPENTRY

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section shows the extent of rough carpentry work on the Plans, including, but not limited to, the following: wood framing, timber posts and beams, rooftop equipment bases and support curbs, wood nailers and blocking, wood furring, fascia, soffits, and sheathing.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
06190	Prefabricated Wood Trusses

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ALSC PS 20	American Lumber Standards Committee (ALSC): American Softwood Lumber Standard
APA PRP-108	American Plywood Association (APA): Performance Standards and Qualification Policy for Structural-Use Panels
APA PS 1	American Plywood Association (APA): Product Standard for Construction and Industrial Plywood
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
AWC NDS	American Wood Council (AWC): National Design Specification for Wood Construction
AWC WFCM	American Wood Council (AWC): Wood Frame Construction Manual for one- and two-family dwellings
AWPA U1	American Wood-Preservers' Association (AWPA) Standard
WCLIB 17	West Coast Lumber Inspection Bureau (WCLIB): Standard Grading and Dressing Rules for Douglas Fir, Western Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber

## **1.4 SUBMITTALS**

Comply with provisions of Section 01300.

Submit a certificate of compliance from the supplier certifying that the materials provided meet or exceed specified requirements. Certificate shall itemize materials provided on the Project and refer to pertinent specifications.

## **1.5 DELIVERY, STORAGE AND HANDLING**

Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and underneath temporary coverings including polyethylene and similar materials. For lumber and plywood that is pressure treated with waterborne chemicals, provide a sticker between each course to provide air circulation.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

Lumber shall comply with ALSC PS 20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Each piece of lumber shall be factory marked with Grade Stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill that produced the product.

Nominal sizes are indicated on the Drawings, except as shown by detailed dimensions. Provide actual sizes as required by ALSC PS 20, with moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

### **2.2 FRAMING LUMBER AND FASCIA BOARDS**

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

## **2.3 TRIM BOARDS**

Unless noted otherwise, provide No. 2 Common Boards or better complying with WWPA rules. Where boards are exposed to finish work, provide 19 percent maximum moisture content. Exterior trim shall be cedar, Grade A or better.

## **2.4 MISCELLANEOUS LUMBER**

Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, wood trim, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown or required. Provide Standard Grade Hem-Fir or better. Provide 19 percent maximum moisture content for lumber items not specified to receive wood preservative treatment.

## **2.5 SHEATHING**

Provide APA-rated Exposure 1 unless noted otherwise, span rating and thickness as noted on the Plans.

Comply with PS 1 “Product Standard for Construction and Industrial Plywood” for plywood panels and for products not manufactured under PS 1 provisions, comply with APA PRP-108. Factory-mark each panel with APA trademark evidencing compliance with grade requirements.

## **2.6 PLYWOOD OTHER THAN SHEATHING**

### **A. BACKING PANELS**

For Plywood Backing Panels (or Boards) used for mounting electrical, telephone or communications system equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated on the Drawings. If not otherwise indicated, provide minimum thickness of 15/32 of an inch.

### **B. MARINE**

APA, A-A exterior thickness as indicated on the Plans. HDO (High Density Overlay) faces are acceptable.

## **2.7 MISCELLANEOUS MATERIALS**

### **A. FASTENERS AND ANCHORAGES**

Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable federal specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended fasteners.

Where rough carpentry work is exposed to the weather, in ground contact, or in an area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating per ASTM A153.

### **B. BUILDING PAPER**

ASTM D226, Type I; asphalt saturated felt, non-perforated, 30-lb. type.

### **C. SILL SEALER GASKETS**

Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1-inch nominal thickness compressible to 1/32 of an inch; selected from manufacturer's standard width to suit width of sill members.

## **2.8 WOOD TREATMENT BY PRESSURE PROCESS**

Where lumber or plywood is indicated as "P.T." or "Treated," or is specified herein to be treated, comply with applicable requirements of American Wood Preserver's Association (AWPA) Standard U1.

Pressure-treat above-ground items with waterborne preservatives to comply with AWPA Standard U1. After treatment, kiln dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Pressure treat items indicated on the Plans and all of the following: wood cants, nailer, curbs, top plates, equipment support bases, equipment curbs, plywood, blocking, stripping, and similar members utilized in connection with roofing, flashing, vapor barriers and waterproofing. All wood items including plywood used for or around roof penetrations shall be pressure treated.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Discard units of material with defects that could impair the quality of the work or with units too small to use in fabricating work with minimum joints or optimum joint arrangement. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, and similar supports to allow attachment of other work.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

### **3.2 WOOD NAILERS AND BLOCKING**

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

### **3.3 WOOD FURRING**

Install plumb and level with closure strips at edges and openings. Shim with wood as required to obtain specified tolerance for finished work.

#### **A. FURRING FOR PLYWOOD PANELING**

Unless otherwise indicated, provide 1-inch x 3-inch furring at 2 feet on center, horizontally and vertically. Select furring for freedom from knots capable of producing bent over nails and resulting damage to paneling.

#### **B. FURRING FOR GYPSUM DRYWALL**

Unless otherwise indicated, provide 1-inch x 2-inch furring at 16-inch on center, vertically.

### C. SUSPENDED FURRING

Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet.

## 3.4 WOOD FRAMING, GENERAL

Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of the AWC WFCM. Do not splice structural members between supports. Anchor and nail as shown, and to comply with the AWC NDS.

Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2—inch-thick lumber of the same width as framing members.

## 3.5 STUD FRAMING

Provide stud framing of size and spacing indicated or, if not otherwise indicated, of the following sizes and spacings. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using 2-inch-thick members with widths equaling that of studs. Nail or anchor plates to supporting construction.

Unless noted otherwise, provide the following minimum framing:

1. For exterior walls provide 2" x 6" wood studs spaced 24-inches on center.
2. For interior partitions and walls provide 2" x 4" wood studs spaced 16-inches on center.

Construct corners and intersections with not less than three studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.

Provide continuous horizontal blocking row at mid-height of walls and partitions 8 feet high and greater, using 2-inch-thick members of same width of wall or partitions.

Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

For non-bearing partitions, provide double-jamb studs and headers not less than 4-inches deep for openings 3 feet or smaller in width, and not less than 6-inches deep for wider openings.

For load-bearing partitions, provide double-jamb studs for openings 6 feet or smaller in width, and triple-jamb studs for wider openings. Provide headers of depth shown.

Provide diagonal bracing in stud framing of exterior walls, except as otherwise indicated. Brace both walls at each external corner, full story height, at a 45-degree angle, using either a let-in 1" x 4" or 2" x 4" blocking or metal diagonal bracing. Omit bracing where plywood sheathing, siding and/or gypsum wallboard are indicated to be provided.

### **3.6 INSTALLATION OF SHEATHING**

#### **A. GENERAL**

Comply with applicable recommendations contained in the APA "Engineered Wood Construction Guide," for types of construction panels and applications indicated.

#### **B. FASTENING METHODS**

Fasten panels as indicated on the Plans. Include metal H clips between sheathing panels.

#### **C. PLYWOOD BACKING PANELS**

Nail to supports with minimum 10d at 6-inches on center edge nailing and 12-inches on center at intermediate framing.

**\*\*\* END OF SECTION \*\*\***

## SECTION 06190

### PREFABRICATED WOOD TRUSSES

#### PART 1 GENERAL

##### 1.1 SCOPE

The extent of Prefabricated Wood Trusses work is shown on the drawings and shall include all labor and materials for the fabrication and installation of the type and configuration of prefabricated wood trusses shown on the Drawings.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
<b>01300</b>	<b>SUBMITTALS</b>
<b>01310</b>	<b>PROJECT MEETINGS</b>
<b>01400</b>	<b>QUALITY CONTROL</b>
<b>04200</b>	<b>MASONRY</b>

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879	Steel Sheet, Zinc-Coated by the Electrolytic Process
ASTM A924	General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
TPI	Truss Plate Institute
ANSI/TPI 1	National Design Standard for Metal Plate Connected Wood Trusses Construction
WCLIB	West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber
WWPA	Western Wood Products Association

##### 1.4 SUBMITTALS

Comply with provisions of Section 01300.

###### A. PRODUCT DATA

Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling, and erection.

Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

**B. SHOP DRAWINGS**

Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design values, location of metal connector plates; and bearing and anchorage details.

Provide calculations, which have been signed and stamped by a Structural Engineer licensed in the State of Washington.

**C. SINGLE SOURCE RESPONSIBILITY FOR CONNECTOR PLATES**

Provide metal connector plates from a single manufacturer.

**1.5 QUALITY ASSURANCE**

**A. TPI STANDARDS**

Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:

“National Design Standard for Metal Plate Connected Wood Truss Construction.”

“BCSI B1 – Guide for Handling, Installing, Restraining and Bracing Trusses.”

“Commentary for Permanent Bracing of Metal Plate Connected Wood Trusses.”

**B. WOOD STRUCTURAL DESIGN STANDARD**

Comply with applicable requirements of “National Design Specification for Wood Construction” published by American Wood Council (AWC).

## C. MANUFACTURER’S QUALIFICATIONS

Trusses shall be manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI “National Design Standard for Metal Plate Connected Wood Truss Construction.” Trusses shall be designed to support all superimposed dead and live loads indicated, with design approved and certified by a structural engineer licensed in the State of Washington.

Provide trusses by a manufacturer, which has a record of successfully fabricating trusses similar to type, indicated and which complies with the following requirements for quality control:

Fabricator participates in TPI “Quality Assurance Inspection Program” as a licensee authorized to apply TPI marks to trusses.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Handle and store trusses with care, and in accordance with manufacturer’s instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.

Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

Subject to compliance with requirements, manufacturers which may be incorporated in the work include, but are not limited to, the following:

Alpine Engineered Products, Inc.  
Truss Span  
Tacoma Truss Systems, Inc.

### 2.2 LUMBER

Lumber to comply with PS 20 “American Softwood Lumber Standard” and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee’s (ALSC) Board of Review.

Inspection agencies and the abbreviations used to reference lumber grades and species include the following:

NLGA - National Lumber Grades Authority (Canadian).  
SPIB - Southern Pine Inspection Bureau.  
WCLIB - West Coast Lumber Inspection Bureau.  
WWPA - Western Wood Products Association.

Provide lumber to actual sizes required by PS 20 to comply with requirements indicated below:

Dressed, S4S, unless otherwise indicated.

Seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inch or less in nominal thickness, unless otherwise indicated.

Factory mark each piece of lumber with type, grade, mill and grading agency.

## **2.3 FRAMING LUMBER**

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

## **2.4 METAL CONNECTOR PLATES, FASTENERS, AND ANCHORAGES**

Fabricate connector plates from metal complying with the following requirements:

### **A. HOT-DIP GALVANIZED STEEL SHEET**

Structural (physical) quality steel sheet complying with ASTM A653, Grade 33; zinc coated by hot-dip process to comply with ASTM A924, Designation G60; minimum coated metal thickness indicated but not less than 0.036 inch.

### **B. ELECTROLYTIC ZINC-COATED STEEL SHEET**

Structural (physical) quality steel sheet complying with ASTM A879 Designation 30Z, and, for structural properties, with ASTM A653, Grade 33; zinc-coated by electro-deposition; with minimum coated metal thickness indicated but not less than 0.047 inch.

## **2.5 FASTENERS AND ANCHORAGES**

Provide size, type, material, and finish indicated for nails, screws, bolts, nuts, washers and other anchoring devices.

## **2.6 FABRICATION**

Cut truss members to accurate lengths, angles, and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.

Fabricate metal connector plates to size, configuration, thickness, and anchorage details required for types of joint designs indicated.

Assemble truss member in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.

Fabricated wood trusses within manufacturing tolerances of ANSI/TPI 1.

Connect truss members by means of metal connector plates accurately located and securely fastened to each side of wood members by means indicated or approved.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute.

Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.

Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

Anchor trusses securely at all bearing points to comply with methods and details indicated.

Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

Do not cut or remove truss members.

**\*\*\* END OF SECTION \*\*\***

## SECTION 06520

### STRUCTURAL FIBERGLASS REINFORCED PLASTICS (FRP) GRATING

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section shall consist of all structural fiberglass reinforced plastic (FRP) items, with all appurtenances, accessories, and incidentals necessary to produce a complete, operable, and serviceable installation as shown on the Plans and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03300	Cast-In-Place Concrete

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM D635	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E84	Surface Burning Characteristics of Building Materials

##### 1.4 SUBMITTALS

Submit under provisions of Section 01300.

###### A. GRATING

Submit shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.

###### B. CONNECTIONS

Submit manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths,

type and sizes of fasteners, clip angles, member sizes, and connection details.

**C. TEST REPORTS**

Submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

**D. SAMPLES**

Submit sample pieces of each item specified herein for acceptance by the Engineer as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

**1.5 QUALITY ASSURANCE**

All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of five previous, separate, and similar successful installations completed within the last 5 years.

**1.6 DELIVERY, STORAGE, AND HANDLING**

Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required. Any material which has become damaged, as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

Subject to compliance with requirements, manufacturers, which may be incorporated in the work include, but are not limited to, the following:

Fibergrate Composite Structures, Inc., Addison, Texas  
McNichols Company, Tampa, Florida  
IKG Industries, Clark, New Jersey

### **2.2 GENERAL**

All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

Resin shall be Type 1 Isophthalic Polyester, with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties as required.

All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids, and without dry spots, cracks, crazes, or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

All grating products shall have a tested flame spread rating of 25 or less per ASTM E84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

### **2.3 FRP GRATING**

Provide FRP grating of the type and size as indicated on the Plans.

Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84. Grating shall also have tested burn time of

less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635. Certifications shall be made available to the Engineer when requested and shall be dated within the past 2 years. Test data performed only on the resin shall not be acceptable.

Unless noted otherwise on the Plans, grating color shall be Light Grey. The cover plate shall have a gritted surface, integrally molded into the plate prior to bonding to the grating. The color of the cover plate shall match the color of the grating.

#### A. MOLDED FRP GRATING

Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement in the grating panel shall be no more than 3/16 inch below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35 percent so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements specified herein.

After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

Grating load/deflection requirements at the required span (shown below) shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Load/deflection not to exceed the following:

Uniform distributed load over a 48-inch span: 150 pounds per square foot, with a maximum deflection of 0.28 inch.

Unless noted otherwise on the Plans, provide grating with non-slip surfacing. Grating shall be manufactured with a concave profile on the top of each bar providing maximum slip resistance. Secondarily applied grit shall be allowed as long as the top surface does not exceed 1/16 inch.

Provide non-slip grating cover plate as indicated on the Plans. The grating cover plate shall be attached to the completed panel of grating by chemical means (epoxy) to ensure integral action of the panel and plate. The panel and grating shall be vacuum assisted to ensure that all contact surface

remain in contact throughout the curing process.

## **B. PULTRUDED FRP GRATING**

Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70 percent and a minimum of 60 percent glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two-piece cross rod system to provide a mechanical and chemical lock. Cross rods shall be flush with the top surface bearing bars for maximum bearing bar stability and maximum slip resistance.

Unless noted otherwise on the Plans, the minimum overall depth shall be 1-5/8 inches with a tolerance of plus or minus 1/16 of an inch. Maximum spacing of bars shall be 1-1/2 inches with maximum cross rods spacing of 6-inches on center.

Grating load/deflection requirements at the required span (shown below) shall be less than the manufacturer's published maximum recommended loads. Load/deflection shall not exceed the following:

Uniform distributed load of 125 pounds per square foot (PSF) on grating with a clear span of 60 inches with a maximum deflection of 0.38 inches.

Unless noted otherwise on the Plans, provide grating with non-slip surfacing. Grating shall be manufactured with a quartz grit slip resistant surface on the top of each bar. The embedded grit shall not penetrate beyond 3/16 of an inch.

Provide non-slip grating cover plate as indicated on the Plans. The grating cover plate shall be attached to the completed panel of grating by chemical means (epoxy) to ensure integral action of the panel and plate. The panel and grating shall be vacuum assisted to ensure that all contact surface remain in contact throughout the curing process.

## **2.4 GRATING FABRICATION**

Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to

complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

Each covered grating section shall be tied down with appropriate anchors or clips. Manufacturer to provide openings and holes where located on the contract Plans. Grating openings, which fit around protrusions (pipes, cables, machinery, etc.), shall be field cut or, when shop fabricated, discontinuous at approximately the centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.

All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.

Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of 4-feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Contractor shall install gratings in accordance with manufacturers' assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 7**

### **THERMAL AND MOISTURE PROTECTION**

## SECTION 07110

### BITUMINOUS DAMPPROOFING

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install bituminous dampproofing on all backfill wall surfaces, or as shown on the Plans, and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

##### 1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM D41	Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
ASTM D449	Standard Specification for Asphalt Used in Dampproofing and Waterproofing
ASTM D1187	Standard Specification for Asphalt Base Emulsions for Use as Protective Coatings
ASTM D1227	Standard Specification for Emulsified Asphalt Used as a Protective Coating

#### PART 2 PRODUCTS

##### 2.1 APPROVED MANUFACTURERS

Bituminous dampproofing shall be W.R. Meadows or equal product foundation coating.

## **2.2 COLD ASPHALTIC MATERIALS**

Cold asphaltic materials shall be in accordance with the following reference standards:

<b><u>Material</u></b>	<b><u>Reference Standard</u></b>
Sealmastic Emulsion Type II	ASTM D1227, Type II

## **PART 3 EXECUTION**

### **3.1 GENERAL**

All surface preparation, primer and finish coat applications shall be in accordance with these specifications and with the manufacturer's recommendations.

### **3.2 EXAMINATION**

The Contractor shall verify that surfaces are durable, and free of matter detrimental to adhesion of dampproofing. The Contractor shall verify items which penetrate surfaces to receive dampproofing are securely installed.

### **3.3 PREPARATION**

The Contractor shall protect adjacent surfaces not designated to receive dampproofing. The Contractor shall clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions. The Contractor shall not apply dampproofing to surfaces unacceptable to manufacturer or applicator. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate. The Contractor shall maintain ambient temperatures above 40 degrees F for 24 hours before and continuously during application until dampproofing membrane has cured.

### **3.4 APPLICATION**

The Contractor shall prime surfaces in accordance with manufacturer's instructions. The Contractor shall apply two coats of dampproofing with roller at a maximum coverage rate of 40 square feet per gallon. Dampproofing shall be applied on all foundation walls from 2 inches below finish grade elevation to the outside top edge of footings. The Contractor shall seal items projecting through dampproofed surfaces with mastic.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 07210**

### **BATT AND RIGID INSULATION**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install batt and rigid insulation, as indicated on the Plans and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals

##### **1.3 REFERENCES**

This Section references the latest revisions of the following document:

<u>Reference</u>	<u>Title</u>
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C1289	Standard Specification for Faced Rigid, Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1320	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

##### **1.4 PERFORMANCE REQUIREMENTS**

Materials of this Section shall provide continuity of thermal and vapor and air barriers at building enclosure elements.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

Owens Corning, Johns Manville, CertainTeed, DOW, or approved equal.

### **2.2 MATERIALS**

#### **A. BATT INSULATION**

Type III preformed, foil-faced, glass fiber batt or roll conforming to ASTM C665, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

#### **B. RIGID BELOW-GRADE INSULATION**

Type IV rigid, closed cell extruded polystyrene foam board insulation conforming to ASTM C578, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

#### **C. VAPOR BARRIER**

Polyamide (nylon) vapor retarding, 2 mil, sheeting with a variable permeance ranging from 1 perm, or less, up to 10 perms, or greater, based on varying levels of ambient humidity; MemBrain Continuous Air Barrier & Smart Vapor Retarder by CertainTeed, or equal.

#### **D. TAPE**

Pressure sensitive, aluminum foil tape; Specialty Tape #425 by 3M, or equal.

#### **E. INSULATION FASTENERS**

Galvanized steel impale spindles and clips on 2-inch square flat bases with self adhering backing and length to suit insulation thickness. Include galvanized steel retaining washer(s) of not less than 1-1/2-inches in diameter capable of securely and rigidly fastening insulation in place; by Gemco, or equal.

#### **F. BUILDING WRAP**

Mechanically attached water-resistive, vapor permeable air barrier membrane system including primary sheet membrane, self-adhered

flashing tape, and flashing primer (as needed). Entire system shall be provided by a single manufacturer. Tyvek CommercialWrap by DuPont, WrapShield IT by VaproShield, or equal.

**G. INSULATION BAFFLES**

Rigid polystyrene or PVC insulation baffles; Raft-R-Mate by Owens-Corning, AccuVent by Brentwood, or equal.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

Verify site conditions before beginning installation. Verify that substrate and adjacent materials are ready to receive insulation, and free of all projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

**3.2 GENERAL**

Comply with insulation manufacturer's written instructions applicable to products and applications.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated with vapor barriers placed to face the interior (warm) side of the envelope. Fill all voids with insulation, fit tightly around all obstructions and tight to the exterior side of mechanical and electrical services within the plane of the insulation. Remove projections that interfere with placement. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values.

All miscellaneous voids shall have insulation installed to prevent gaps in insulation using either fiberglass batt compacted to approximately 75 percent of normal maximum volume, or spray polyurethane foam applied according to the manufacturer's written instructions.

Prior to installation of finished surfaces, all vapor-retarder joints and ruptures shall be taped and sealed in each continuous area of insulation to ensure an airtight installation.

### **3.3 INSTALLATION BELOW GRADE**

On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions.

Stagger all joints and butt all panels together for tight fit.

### **3.4 INSTALLATION IN FRAMED CONSTRUCTION**

Install blanket insulation in all cavities formed by framing members. Use insulation widths and lengths that fully fill the cavities. If more than one length is required to fill cavities, provide lengths that will produce a snug fit between ends. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members, and lap all ends and side flanges of facings over framing members.

Prior to installation of attic insulation, install eave insulation baffles between roof framing members on the underside of roof sheathing in insulated attic spaces at vented eaves.

For metal-framed wall cavities, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs. For unfaced blankets, located vapor barrier joints over member faces and extend vapor barrier tight to the full perimeter of adjacent window and door frames, as well as other items interrupting the plane of membrane. Fully tape seal in place. Provide airspace at exterior plane of insulation for ventilation as recommended by manufacturer.

For wood-framed wall cavities, install blankets according to ASTM C1320 and as specified herein. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

**\*\*\* END OF SECTION \*\*\***

## SECTION 07410

### METAL ROOF AND WALL PANELS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes, but is not necessarily limited to, furnishing and installing of all metal roofing, siding, metal flashing and fascia, and accessories as indicated on the Plans and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
06100	Rough Carpentry
06190	Prefabricated Wood Trusses

##### 1.3 SUBMITTALS

Submit in accordance with Section 01300 and as specified herein.

###### A. PRODUCT DATA

Submit manufacturer's technical product data, installation instructions, and recommendations for Metal Roof and Wall Panels used. Include data substantiating that materials comply with requirements.

###### B. SAMPLES

Prior to ordering products, submit manufacturer's standard color samples for Owner's selection.

###### C. SHOP DRAWINGS

Show panel layout, trim installation, and panel attachment, including gutters and downspouts.

###### D. WARRANTY

###### 1. Manufacturer's Product Warranty

Manufacturer's standard coating performance warranty, as available for specified installation and environmental conditions.

## 2. Contractor's Warranty

Warrant panels, flashings, sealants, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for 2 years following project substantial completion date.

### 1.4 QUALITY ASSURANCE

#### A. INSTALLER'S QUALIFICATIONS

Installation of panels and accessories by installers with a minimum of 5-years documented experience in metal panel projects of this nature.

#### B. MANUFACTURER'S QUALIFICATIONS

Manufacturer shall have a minimum of 10-years experience supplying metal roofing/siding to the region where the work is to be done.

#### C. REGULATORY AGENCY REQUIREMENTS

Comply with IBC and local Building Code requirements if more stringent than those specified.

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Protect panels against damage and discoloration. Handle panels with non-marring slings and do not bend panels. Store panels above ground, with one end elevated for drainage. Protect panels against standing water and condensation between adjacent surfaces. If panels become wet, immediately separate sheets, wipe dry and allow to air dry. Remove any strippable film prior to installation and do not allow too remain on panels in extreme cold, heat or in direct sunlight.

## PART 2 PRODUCTS

### 2.1 APPROVED MANUFACTURERS

AEP Span, The Bryer Company, Metal Sales, or approved equal.

Panel Designations:

Roof: Interlocking standing seam panels with concealed clips, a net coverage of 16 inches, and panel surface striations. AEP Span "Design Span HP", or equal.

Walls: Corrugated exposed fastener vertical panels with a net coverage of 34-2/3-inches, a rib depth of 7/8-inch. AEP Span “Nu-Wave”, or equal.

## **2.2 PANEL MATERIALS**

### **A. PANELS**

#### **1. Base Metal**

Steel conforming to ASTM A924/ASTM A792 Grade 40 or ASTM A446 Grade C, thickness 22 gauge.

#### **2. Coatings**

Protective zinc coating conforming to ASTM A653, Class G-90.

#### **3. Finish**

Exterior finish includes a 0.2 mil thick corrosion-resistant primer and a 0.8 mil thick finish coat of Polyvinylidene Fluoride (PVF<sub>2</sub>), full 70 percent Kynar 500®/Hylar 5000® for a total 1.0 mil dry film thickness.

#### **4. Color**

Manufacturer’s standard selection of not less than 20 colors.

#### **5. Sidelap Sealant**

Factory applied butyl sealant at all panel-to-panel sealing surfaces.

### **B. ACCESSORIES**

#### **1. Concealed Clips**

Galvanized steel conforming to ASTM A653, Class G-90, 16-gauge clips designed to allow thermal movement of panel and configured to secure panel per design conditions.

2. Fasteners

Self-tapping screws, bolts, nuts, and other acceptable fasteners per manufacturer's requirements. Exposed fasteners shall be corrosion-resistant, color-matched with neoprene gasket.

3. Sealants (Field Applied)

Gunnable caulk and tape sealants per Specification Section 07900.

4. Profile Closures

Neoprene or polyethylene foam, die-cut or formed to panel configuration.

5. Trim and Flashing

Material, gauge, and finish to match panels. Profiles shall be as indicated in the Plans and as required to weather seal the structure. Lead or copper flashing is not acceptable for use.

6. Underlayment

Self-adhered ice and water shield conforming to ASTM D1970.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

Contractor shall inspect installed work of other trades and verify that such work is complete to a point where this work may continue. Verify that installation can be performed in accordance with approved shop drawings and manufacturer's instructions.

### **3.2 PREPARATION**

#### **A. FIELD MEASUREMENTS**

Verify prior to installation. If field measurements differ from Plan dimensions, notify Engineer prior to fabrication.

#### **B. PROTECTION**

Treat, or isolate with protective material, any contacting surfaces of dissimilar materials to prevent electrolytic corrosion, comply with

Section 09900. Require workmen who will be walking on roofing panels to wear clean, soft-soled shoes that will not pick up stones or other abrasive material, which could cause damage and discoloration.

C. SURFACE PREPARATION

Clean and dry surfaces prior to applying sealant.

**3.3 INSTALLATION**

A. GENERAL

Unless otherwise shown on the Plans or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

B. PANELS

1. Follow metal panel manufacturer's directions and printed instructions.
2. Install roof panel seams vertically.
3. Install wall panel seams: vertically.
4. Lap panels away from prevailing wind direction.
5. Do not stretch or compress panel side-lap interlocks.
6. Secure panels without warp or deflection.

C. ALLOWABLE ERECTION TOLERANCE

Maximum Alignment Variation: 1/4 inch in 40 feet.

D. FLASHING

1. Follow manufacturer's directions and Engineer-approved shop drawings.
2. Overlap roof panels at least 6 inches.

3. Install flashings to allow for thermal movement.
4. Remove any strippable protective film, if used, immediately preceding flashing installation.

E. CUTTING AND FITTING

1. Provide neat, square and true. Torch cutting is prohibited where cut is exposed to final view.
2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
3. Where necessary to saw cut panels, debur and treat with galvanic paint coating to match factory color.

**3.4 CLEANUP AND CLOSEOUT**

A. PANEL DAMAGE AND FINISH SCRATCHES

Do not apply touch-up paint to damaged paint areas that involve minor scratches. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Engineer.

B. CLEANING AND REPAIRING

At completion of each day's work and at work completion, sweep panels, flashing and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate. Remove debris from project site upon work completion, or sooner, if directed by the Owner.

**\*\*\* END OF SECTION \*\*\***

## SECTION 07900

### CAULKING AND SEALANTS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install caulking and sealants, as indicated on the Plans and as specified herein.

All exterior wall joints and interior and exterior joints between all differing or dissimilar materials and at windows, doors, roof penetrations, louvers and similar types of openings shall receive sealants to make the joint air and watertight. This includes concrete to CMU, concrete to wood, CMU to wood, concrete to sheet metal, CMU to sheet metal, etc.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast-in-Place Concrete
04200	Masonry
07410	Metal Roof and Wall Panels
08110	Hollow Metal Doors and Frames
08560	Vinyl Windows

##### 1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
AAMA 800	Sealant Manual, Specifications and Test Methods for Sealants
ASTM C834	Standard Specification for Latex Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1193	Standard Guide for Joint Sealants
ASTM C1311	Standard Specification for Solvent Release Sealants

ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D7174	Standard Specification for Preformed Closed-Cell Polyolefin Expansion Joint Fillers for Concrete Paving and Structural Construction
NSF/ANSI 61	Drinking Water System Components – Health Effects

## **PART 2 PRODUCTS**

### **2.1 POLYURETHANE SEALANTS**

Provide a one-component, gunnable grade, non-sag, solvent-free polyurethane sealant. The sealant shall cure under the influence of atmospheric moisture. Sealant shall meet ASTM C920, Type S, Grade NS, Class 35, under uses NT, T, M, G, I, A, and O. Performance characteristics shall include a 175 psi 21-day tensile strength, a minimum 500-percent ultimate elongation, and a maximum Shore “A” Hardness of 45.

Polyurethane sealants shall be Sikaflex-1a, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

### **2.2 SILICONE SEALANTS**

Provide a one-component, gunnable grade, neutral cure, silicone sealant. Sealant shall meet ASTM C920, Type S, Grade NS, Class 50, under uses NT, M, G, A and O. Performance characteristics shall include a 200 psi 21-day tensile strength, a minimum 700-percent ultimate elongation, and a maximum Shore “A” Hardness of 25.

Silicone sealants shall be Sikasil WS-295, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

### **2.3 ACRYLIC LATEX CAULK**

Provide a one-component, gunnable grade, pure acrylic latex sealant. Sealant shall meet ASTM C834, Type OP, Grade -18 °C. Performance characteristics shall include a maximum 25-percent shrinkage, and a movement capability of plus/minus 12.5-percent.

Acrylic latex sealants shall be Tremflex 834, as manufactured by the Tremco, Inc. or equal by BASF Corporation.

## **2.4 TAPE SEALANT**

Provide a 100-percent solid, isobutylene preformed sealant tape. Tape sealant shall meet the American Architectural Manufacturer's Association AAMA 807.3 standard. Performance characteristics shall include a density of 1.5 and a minimum peel adhesion of 8 pounds per inch.

Tape sealant shall be Sikalastomer-95, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

## **2.5 PREFORMED FLEXIBLE JOINT MATERIAL**

Provide a closed-cell, polyolefin preformed foam joint material. Foam joint material shall meet ASTM D7174. Performance characteristics shall include an expansion recovery greater than 99-percent, a maximum 50-percent compression strength of 15 psi, and a maximum water absorption of 0.25-percent by volume.

Foam joint material shall be Ceramar, as manufactured by W.R. Meadows, or equal.

## **2.6 PREFORMED FLEXIBLE JOINT BACKER MATERIAL**

Provide a closed-cell, polyolefin preformed foam backer rod material. Backer rod material shall meet ASTM D5249 and shall be compatible with the proposed cold-applied sealant.

Backer rod material shall be Kool-Rod, as manufactured by W.R. Meadows, or equal.

## **2.7 PRIMERS**

Provide primer materials made by or recommended by the sealant manufacturer for the conditions of the application, including the materials to be sealed at the joints and the type of sealant or caulking material to be used.

# **PART 3 EXECUTION**

## **3.1 GENERAL**

All sealant and primer work shall comply with ASTM C1193 and with the manufacturer's written instructions.

The Contractor shall confirm that the proposed sealant and primer materials are compatible with any concrete curing compound used, or the Contractor shall lightly sandblast and thoroughly clean concrete joint surfaces prior to application of sealant materials.

All priming and sealant work shall be done under temperature and moisture conditions that are within the requirements of the manufacturer's written instructions.

All exterior dissimilar materials shall be sealed with elastomeric sealants at the joints between the different materials.

## **3.2 APPLICATION OF SEALANTS**

### **A. PREPARATION OF JOINTS**

Inspect profiles and surfaces of all joints prior to application. Verify joint dimensions are adequate for development of the sealant movement capability. All joints shall be solvent cleaned, dry, and free of dust, oils and grease before receiving backing materials and sealant. Floor joints shall be wire brushed, free of laitance or other residues. Aluminum or other metal surfaces to be in contact with sealants shall be wiped clean with xylol or an MEK solvent to remove any coatings or contamination. Joint sealants shall be installed before other surface finishes are applied. Proceed with joint sealant work only once conditions meet the manufacturer's requirements.

### **B. BACKINGS**

Install filler and backer materials in as long of lengths as practicable. Stretch and force into joints with tool designed for that purpose, to a uniform depth, as indicated on the Plans or as required by the manufacturer, allowing for installation of sealant and caulking. Provide filler material in slab shapes for joints 1/2 inch or more in depth, and in 3/4 inch or more wide joints to receive sealing material. Provide extruded rod backer material in all other joints to receive sealant. Filler or backer material shall be of a depth as required to bring the top surface to within 1/2 inch of the slab surface, or as indicated on the Plans. All joints shall include a suitable bond breaker between backing materials and sealant.

### **C. MASKING**

Both sides of joints shall be masked with tape to prevent soiling floor, slab, or wall beyond limits of the joint.



D. PRIMING

Apply primer to all surfaces of joints in contact with sealant materials. Apply full strength and undiluted in a uniform coating of surface. Allow to set or cure prior to proceeding. Do not prime surfaces at back of joint.

E. APPLICATION

Sealant shall be gun applied, giving the joint a full bead of sealant. Skin beads are not acceptable. Tool the bead immediately after application to ensure a firm and full contact with the inner faces of the joint. Joints in sills and other wash surfaces shall be filled slightly convex to obtain a flush joint when dry. Entire perimeter of openings in concrete surfaces shall be sealed. Do not apply sealants to wet or damp surfaces nor in temperatures below 50 degrees F, and as required by the manufacturer. Strike off excess sealant with tooling stick or a knife so that finished bead is slightly below surface. Remove excess sealant as work progresses. Sealants in masonry wall joints are to be a maximum of 1/2-inch deep and not less than 1/4 inch in each dimension. When applying sealant, do not permit thickness of sealant to exceed 1/2 of the width of the joint. Any joints over 1/2-inch wide shall be reported to the Owner and instructions for correcting the applications will be given.

**3.3 CLEANUP**

Upon completion, the Contractor shall remove and dispose of masking materials. Remove any excess materials and clean adjacent surfaces free from any soiling or staining resulting from the sealing and caulking operations.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 8**

### **DOORS AND WINDOWS**

## **SECTION 08110**

### **HOLLOW METAL DOORS AND FRAMES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section covers furnishing and installing hollow metal doors, frames, and glazing as indicated on the Plans and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01300	Submittals
04200	Masonry
07900	Caulking and Sealants
08700	Finish Hardware
09900	Painting

##### **1.3 REFERENCES**

This Section references the latest revisions of the following documents:

<b><u>Reference</u></b>	<b><u>Title</u></b>
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
ANSI Z97.1	Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
HMMA 840	Guide Specification for Installation and Storage of Hollow Metal Doors and Frames

##### **1.4 QUALITY ASSURANCE**

Hollow metal doors and frames shall conform to applicable requirements of ANSI/SDI A250.8.

## **1.5 SUBMITTALS**

Submit shop drawings and product data under provisions of Section 01300.

Indicate frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, and finish.

Indicate door elevations and internal reinforcement.

## **1.6 REGULATORY REQUIREMENTS**

Conform to applicable Building Code for fire rated frame and door requirements.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

The hollow metal doors and frames shall be as manufactured by Curries, Ceco, Republic, Steelcraft, or any other SDI member.

### **2.2 DOORS AND FRAMES**

<b><u>Location</u></b>	<b><u>Material</u></b>
Exterior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2
Interior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2

Provide door and frame types and sizes as shown on the Plans.

### **2.3 DOOR CORE CONSTRUCTION**

Insulated doors shall contain a polyurethane core. Minimum U-value shall be as shown on the Plans.

Non-insulated doors shall contain a honeycomb core.

### **2.4 FABRICATION**

Provide fully welded frames for all new construction. Provide fabricated frames of knock down field assembly type for retrofit applications or for existing door openings.

Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

Prepare frame for silencers, where required. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

Close top edge of exterior doors flush with inverted steel channel closure. Seal weld all door joints watertight. Caulking of door seams is not acceptable.

## **2.5 FINISH**

Both interior and exterior doors and frames shall be made from galvanealed zinc coating per ASTM A653 or A60 material, with a minimum application rate of 0.60 oz/ft<sup>2</sup>. Finish painting shall be in accordance with Section 09900 of these Specifications.

The inside of the metal frame profile shall be coated per Section 09900 of these Specifications. Provide dissimilar metals system. Coating may be shop or field applied.

## **2.6 GLAZING**

Doors with glass relites shall be furnished with formed steel glazing strip frame with attachment screws allowed only on the non-secure side. Glazing for insulated doors shall consist of insulated glass units preassembled with two glass panels separated by a dehydrated interspace with a nominal 1/2-inch overall thickness. Insulated glass panels shall be manufactured in accordance with ASTM E773 and ASTM E774. Glazing for non-insulated doors shall be nominally 1/4-inch thick. All glazing shall be fully-tempered in accordance with ASTM C1048 and shall meet the requirements of ANSI 297.1.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Frames shall be installed plumb, level, and rigid in accordance with ANSI/SDI A250.11 and with HMMA 840. Doors shall be installed in accordance with HMMA 840.

Coordinate with all wall construction types for proper anchor placement. All door frames installed in masonry construction shall be completely filled with the masonry mortar utilized to install the masonry units or be fully grouted with non-shrink grout after installation of the frame. All door frames installed in cast-in-

place concrete structures shall be fully grouted with non-shrink grout.

Door hardware shall be installed per Section 08700 of these Specifications.

Contractor shall protect doors and frames as necessary during construction of the Project.

### **3.2 CLEARANCES AND TOLERANCES**

Clearances between the door and frame head and jambs shall be 1/8 of an inch. Clearance between the meeting edges of pairs of doors shall be 3/16 of an inch plus or minus 1/16. Maximum diagonal distortion shall be 1/8 of an inch, measured with straight edge, from corner to corner. Clearance between the face of the door and the door frame stops shall be 1/16 to 1/8 of an inch.

### **3.3 ADJUSTING DOORS**

Adjust hardware for smooth and balanced door movement.

**\*\*\* END OF SECTION \*\*\***

## SECTION 08530

### ALUMINUM FIRE RATED WINDOW ASSEMBLY

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section consists of furnishing and installing 1-hour fire rated window assemblies complete with related components as shown on the Plans and as specified herein.

##### 1.2 RELATED SECTIONS

<u>Section</u>	<u>Item</u>
04200	Masonry
07900	Caulking and Sealants

##### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

###### A. STANDARDS

Provide 1-hour fire rated framing and glazing bearing the AAMA label certifying compliance with requirements of AAMA Publication 101 for the type of window unit indicated on the Plans.

Laminated glass units shall be certified to ASTM E119 per the Associated Laboratories Incorporated (ALI) guidelines.

###### B. TESTING

Provide test reports from an independent testing laboratory certifying performance of framing system for rate of air infiltration (ASTM E283), water resistance (ASTM E331) and structural performance (ASTM E330) indicated in AAMA Publication 101. Test samples shall comply with requirements in AAMA 101 for test samples size and methods.

Provide test reports from an independent testing laboratory certifying performance of framing system for fire resistance rating (UL 263).

###### C. STRUCTURAL PERFORMANCE

No glass breakage, damage to hardware, permanent deformation that would impair operation of the unit, or residual deflection at a positive

(inward) and negative (outward) test pressure of 37.5 psf. Limit deflection of edge of glass normal to the plane of glass to lesser of 1/175 or 3/4".

#### **1.4 SUBMITTALS**

##### **A. PRODUCT DATA**

Provide product data for each type of product required.

##### **B. SHOP DRAWINGS**

Submit shop drawings that include plans, window schedule, sections, and details. Identify and label all proposed components, including those that are not supplied by the window manufacturer.

##### **C. TEST REPORTS**

Test reports that show compliance with specified performance requirements.

#### **1.5 STORAGE AND HANDLING**

Store materials and accessories away from exposure to environmental conditions that may be harmful to materials.

Store products off ground and in an upright position. Provide cover from weather and construction activity.

#### **1.6 WARRANTIES**

The Contractor shall submit a written warranty, executed by the window framing manufacturer, agreeing to repair or replace units that fail in materials or workmanship for a period of 10 years. Materials and labor are to be covered in full by the manufacturer.

### **PART 2 PRODUCTS**

#### **2.1 APPROVED MANUFACTURERS**

##### **A. 1-HOUR FIRE RATED ALUMINUM FRAMING**

Technical Glass Products, or approved equal.

**B. 1-HOUR FIRE RATED GLASS**

Pilkington Group, or approved equal.

**2.2 MATERIALS**

**A. ALUMINUM FRAMING SYSTEM**

Framing shall be two steel halves with lengths cut according to glazing size. Dual aluminum cover caps shall be square in style and attach to the steel sleeves as trim pieces. Mullions shall be connected with stainless steel braces on each side with intermediate standoffs between braces.

**B. FINISH**

All exposed areas of aluminum windows and components shall be finished with electrolytically deposited color in accordance with Aluminum Designation AA-M12-C22-A42/44. Color shall be clear anodized.

**C. GLASS AND GLAZING MATERIALS**

Provide the manufacturer's high visible light transmission glass laminated with an intumescent interlayer that complies with ASTM E119 and UL 263. Overall thickness shall be at minimum 7/8". Glazing gaskets to be black EPDM and comply with ASTM C864. Setting blocks shall be provided as 1/4" thick and composed of calcium silicate.

**D. INTUMESCENT GLAZING TAPE AND SEALANT**

Provide closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides. Tape shall be designed for compression of 25 percent. Intumescent caulk to be single component, latex-based, and designed to stop passage of fire, smoke, and fumes through fire-rated separations.

**2.3 FABRICATION**

Fabricate fire-rated assembly to comply with specified standards. Framing members shall ship from factory as knock-down and ready for installation.

Field glaze frame assembly in accordance with reviewed shop drawings.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

#### **A. GENERAL**

Comply with manufacturer's specifications and recommendations for installation of framing assembly, hardware, accessories, and other window components.

Install assemblies in framed walls in accordance with AAMA 2400 and/or AAMA 2410.

Fire-rated assembly must be installed level, plumb, and square.

#### **B. INSTALLATION IN MASONRY**

Framing members shall be factory sized in accordance with glazing size and rough opening. Prepare each steel half of mullion with gaskets, appropriate connecting braces, and standoffs. Locate and secure manufacturer provided head and sill anchors within opening.

Attach one half of mullion members to pre-set anchors in the opening and prepare glazing setting blocks. Do not proceed with installing glass if the second half of mullion cannot be installed simultaneously, as temporary clamping strips are not to be used for holding glass while unattended. Apply intumescent glazing tape to perimeter of glass and place on setting blocks. Attach remaining half of mullion to connecting braces and apply snap-on aluminum cover caps.

Firmly pack intumescent sealant continuously between frame assembly and wall construction after installation. Do not paint sealant.

### **3.2 CLEANING**

Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.

Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 08560**

### **VINYL WINDOWS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section consists of furnishing and installing polyvinyl chloride (PVC) window units complete with hardware and related components as shown on the Plans and as specified herein.

##### **1.2 RELATED SECTIONS**

<u>Section</u>	<u>Item</u>
01300	Submittals
07900	Caulking and Sealants

##### **1.3 SYSTEM PERFORMANCE REQUIREMENTS**

###### **A. STANDARDS**

Testing standards and methods for structural performance, air infiltration and water penetration for vinyl windows are those specified in AAMA Publication 101 for the type of window unit indicated on the Plans.

Provide vinyl windows bearing the AAMA label certifying compliance with requirements of AAMA publication 101 for the type of window unit indicated on the Plans. Windows shall be NFRC certified with a temporary U-factor label applied to the glass and an NFRC tab added to the permanent AAMA frame label.

Insulated glass units shall be certified to ASTM E2188/E2190 per the Associated Laboratories Incorporated (ALI) guidelines.

###### **B. TESTING**

Provide test reports from an independent testing laboratory certifying performance of window units for rate of air infiltration (ASTM E283), water resistance (ASTM E547) and structural performance (ASTM E330) indicated in AAMA publication 101. Test samples shall comply with requirements in AAMA 101 for test samples size and methods.

C. AIR INFILTRATION

Air Infiltration shall not exceed 0.15 cfm per square foot of overall frame area at an inward test pressure of 1.57 psf.

D. WATER PENETRATION

No water penetration as defined in the test method at an inward test pressure of 3.0 psf.

E. STRUCTURAL PERFORMANCE

No glass breakage, damage to hardware, permanent deformation that would impair operation of the unit, or residual deflection at a positive (inward) and negative (outward) test pressure of 37.5 psf.

**1.4 WARRANTIES**

The Contractor shall submit a written warranty, executed by the window manufacturer, agreeing to repair or replace units that fail in materials or workmanship for a period of 10 years. Materials and labor are to be covered in full by the manufacturer.

**PART 2 PRODUCTS**

**2.1 APPROVED MANUFACTURERS**

Andersen Windows, Milgard Windows, or approved equal.

**2.2 MATERIALS**

A. PVC

Windows shall be extruded, high impact resistant, rigid polyvinyl chloride (PVC). Windows shall be constructed in a neat workmanlike manner. All corners of the frame and sash shall be mitered and fusion welded. All welds are to be dressed and finished to match the surrounding frame area.

B. FINISH

Any color applications are to be solid (homogenous) frame color, or rigid PVC co-extruded cap-stock to prevent contrasting scratches or scars.

C. GLASS AND GLAZING MATERIALS

Provide the manufacturer's standard low E coating sealed, insulated glazing material that complies with ASTM E2188 and E2190, and is at least 1 inch in overall thickness. Under no circumstances will a double glazing system incorporating a removable storm sash be allowed. Sash shall be factory glazed from the interior by use of applied PVC glazing beads with EPDM glazing gaskets. The size of the bead shall accommodate the glass thickness. Provide safety glazing where required by code or industry safety standards.

D. WEATHER-STRIPPING

All operating sash members shall be double weather-stripped with extruded EPDM.

E. HARDWARE

Provide the manufacturer's standard hardware fabricated from a non-corrosive material and of sufficient strength to perform its intended function. For application of hardware, use fasteners that match the finish of the hardware being fastened.

F. GLAZING STOPS

Provide screw applied or snap-on glazing stops (beads) coordinated with glass section indicated. Finish glazing stops to match exterior window finish.

G. INSECT SCREENS

Provide removable insect screen panel for each operable sash, with 18 x 14 replaceable mesh and vinyl retainer spline.

## **2.3 FABRICATION**

Fabricate window units to comply with specified standards. Units shall be reglazable without dismantling sash framing.

Preglaze units at the factory. All units shall be inside glazed for easy replacement and service from the interior of the building.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

#### **A. GENERAL**

Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, accessories, and other window components.

Operable panels must be closed and locked during installation. Windows must be installed level, plumb, and square with weep holes on the bottom. Provide clearances as noted below.

Adjust operating sash and hardware to provide tight fit at contact points and weather-stripping. Lubricate hardware and moving parts.

#### **B. INSTALLATION IN WOOD**

Headers must not be nailed. Nail through fin into framing along sides and base. At head, nail 1/2-inch above fin and bend nails over fin to allow for header deflection. Full support is required along entire length of sill.

Apply flashing tape over installation flanges at sill, sides, and head. Head flashing shall overlap side flashing. Side flashing shall overlap sill flashing. Use non-reflective flashing.

Apply elastomeric sealant around interior and exterior perimeter of window after installation of siding or other finish. Comply with Section 07900, Caulking and Sealants. Do not paint sealant.

#### **C. INSTALLATION IN MASONRY**

Window shall be factory sized in each frame opening to allow for 1/4-inch clearance on the top and sides of the window. Provide a minimum clearance of 1/2 inch from the top of masonry to the bottom of any portion of the sill.

Cut and remove installation flanges from the window unit. Secure unit to masonry rough opening using masonry screws or anchors through side jamb, spaced 12-inches o.c. starting 6 inches from corners.

Apply elastomeric sealant around interior and exterior perimeter of window after installation. Comply with Section 07900, Caulking and Sealants. Do not paint sealant.

Masonry cleaners may damage vinyl windows, care should be taken to protect windows during the masonry cleaning process.

### **3.2 CLEANING**

Clean windows in accordance with manufacturer's recommendations. Clean interior and exterior frame, sash members, glass, and insect screens using a mild detergent-and-water solution and a soft cloth immediately after installation.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 08700**

### **FINISH HARDWARE**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section specifies that the Contractor shall provide complete finish hardware and suitable fastenings for the project. Quantities listed in any instance are for supplier convenience only and are not guaranteed.

Finish hardware includes items known commercially as “builders’ hardware” required, for swinging doors. Hardware specified in the same section as the door and/or doorframe will be furnished by the supplier of that Section.

All hardware furnished in this Section shall comply with the requirements of all applicable codes. All items specified in this Section shall be furnished by a factory-authorized distributor maintaining parts, stocks, and services for standard specified items.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01300	Submittals
08110	Hollow Metal Doors and Frames

##### **1.3 REFERENCES**

This Section references the latest revisions of the following documents:

<b><u>Reference</u></b>	<b><u>Title</u></b>
ANSI/NFPA 80	Fire Doors and Windows
ANSI/NFPA 101	Code for Safety to Life from Fire in Buildings and Structures
UL	Building Materials List

##### **1.4 SUBMITTALS**

Submit hardware under the provisions of Section 01300. Indicate product number and finish for all hardware.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURER'S**

Finish hardware shall be as manufactured by the suppliers listed in the following sections.

### **2.2 FINISHES**

Finishes for hardware items specified shall be as follows:

<b><u>Hardware</u></b>	<b><u>Finish</u></b>
Butts	US26D/US32D
Locksets	US32D (630)
Closers	689
O.H. Stops	US26D
Thresholds	As listed
Misc.	US26D/US32D

### **2.3 BUTTS**

Butts shall be 4-1/2" x 4-1/2" (minimum 1.4 lbs each) for 3'-0" and under, and 5" x 4-1/2" (minimum 1.67 lbs each) for over 3'-0", except as required for 180-degree swing and shall be of the type listed. Doors up to and including 90 inches in height shall have 1-1/2 pair and doors over 90 inches in height shall have two pair. For unusual size or weight doors, furnish type, size, and quantity recommended by the butt manufacturer. All exterior-outswinging doors shall have non-removable pins. Concealed bearing hinges shall have bearing designs that eliminate metal-to-metal contact between knuckles and between the pin and barrel. Butts shall be as manufactured by Stanley, or equal.

### **2.4 LOCKSETS**

Locksets shall be Grade 1 mortise locksets with 2-3/4-inch backsets and 3/4-inch antifriction latch bolt, as manufactured by Corbin Russwin, or equal. All locksets and latchsets shall be the product of one manufacturer and shall be UL approved. Functions as indicated in the hardware groups. Provide curved lip strikes. Deadbolt functions shall be 1-inch projection.

Locksets and latchsets shall be furnished with sufficient strike lip to protect trim. (note: 3/4-inch latch bolts require 3/4-inch minimum clearance for trim, otherwise extended lip strikes must be furnished).

All locks shall have wrought box strikes.

## **2.5 MANUAL FLUSH BOLTS**

Manual flush bolts shall be as manufactured by Ives, or equal. Refer to hardware groups for sizes and types.

## **2.6 DOOR CLOSERS, SURFACE**

Door closers shall be as manufactured by Norton, Corbin Russwin, or equal. Drop plates shall be furnished where required. Hex nuts and bolts shall be furnished for all doors.

Closers shall be provided as specified in hardware groups and shall have a 10-year guarantee.

## **2.7 STOPS**

All interior doors are to have a wall or floor stop unless otherwise specified. Where wall stops are specified but cannot be used, substitute a floor stop. If wall stop or floor stop cannot be used, advise the Owner of the specific door during submittal process. Provide proper height floor stops to suit conditions. Contractor to provide solid backing for all wall mounted stops. Stops shall be as manufactured by Trimco, or equal.

## **2.8 GASKET, THRESHOLD AND RAIN DRIPS**

Gaskets and thresholds shall be as specified in the hardware groups and shall be as manufactured by Pemko, or equal.

Provide rain drips at header of all exterior doors. Rain drips shall be extruded aluminum not less than 0.07 in thick, clear anodized or painted to match door frame color. Rain drips shall be approximately 1-1/2 high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

## **2.9 DOOR SILENCERS**

Door silencers shall be Glynn Johnson Type 64 or 65, or equal. The Contractor shall furnish three door silencers for each single doorframe, and four door silencers for each pair of doorframes.

## **2.10 KEYING**

All cylinder items shall be furnished with visual key control with key code stamped on the face of the keys and marked on the back or side of the cylinders. All standard cylinder items shall be furnished with construction-keyed cylinders.

The Contractor shall coordinate the keying for door locks with the Owner.

## 2.11 KEY QUANTITIES

Keys shall be furnished in the following quantities:

<u>Type</u>	<u>Quantity</u>
MKs	6 each
Construction Keys	6 each
Change keys per keyed cylinder	2 each
Control keys	2 each

## 2.12 HARDWARE GROUPS

### A. MANUFACTURER'S LIST

<u>Manufacturer</u>	<u>Abbreviation</u>
Stanley	ST
Corbin Russwin	CO
Pemko	PE
Ives	IV
Trimco	TR

### B. Refer to door schedule and related information concerning the following hardware groups:

#### HW1 (exterior single door)

	Butts CB 199, 32D	ST
1 ea.	Lockset ML2051 LWA, 630	CO
1 ea.	ED 8200 689	CO
1 ea.	7-Pin IC Cylinder 1080-112-AO2, 630	CO
1 ea.	Door Closer 8210, A12, M71, M73, M75	CO
1 ea.	Threshold 1715	PE
1 ea.	Door bottom 210 DPK	PE
1 set	Gaskets 2891, 290 DPK	PE

#### HW2 (privacy door)

	Butts CB179	ST
1 ea.	Privacy lockset ML2010 LWA, 630	CO
1 ea.	Wall stop 1270WV, 626	TR
3 ea.	Silencers	GJ

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Refer to A.S.A.H.C., B.H.M.A., and S.D.I. for mounting heights.

Unless a conflict arises, the following are standard mounting heights on some products. If a question or conflict should arise, the hardware supplier, if requested, shall assist the Contractor and Owner in determining mounting heights. All measurements are from finish floor except top butt.

#### **A. BUTTS**

Top 11-3/4-inch center of butt to top of door. Intermediate equal distance between top and bottom butts. Bottom 13-inch center of butt.

#### **B. KNOB LOCKS**

40-5/16 inch to center of strike DEADLOCKS: 60 inch to center of strike.

#### **C. EXIT DEVICES**

40-5/16 inch to center of strike PUSH PLATES: 45 inch to center.

#### **D. PULL PLATES**

42 inch to center DOOR CLOSERS: as per manufacturer's instructions.

#### **E. RAIN DRIPS**

Align rain drips with bottom edge of doorframe rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

### **3.2 ADJUSTING**

Hardware shall be adjusted for correct operation.

After installation of hardware and before the building is accepted, Contractor shall inspect the installation and certify that the hardware is correctly installed in accordance with the manufacturer's recommendations. Hardware installer shall make any necessary adjustments.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 9**

### **FINISHES**

## **SECTION 09250**

### **GYPSUM WALLBOARD**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section consists of all labor, materials, and equipment for all gypsum wallboard, zinc-coated trim, taping, spackling, and texturing necessary to complete all the work indicated on the Plans and as specified. The work shall include installation of gypsum board, exterior and interior grounds, corner beads, taping, spackling, sanding, and texturing of all joints and screw heads to obtain finished walls ready for painting.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01300	Submittals
06100	Rough Carpentry
06190	Prefabricated Wood Trusses
09900	Painting

##### **1.3 REFERENCES**

This Section references the latest revisions of the following documents:

<b><u>Reference</u></b>	<b><u>Title</u></b>
ASTM C36	Specification for Gypsum Wallboard
ASTM C79	Test Method for Gypsum Wallboard
ASTM C514	Specification for Nails for the Application of Gypsum Wallboard
ASTM C630	Specification for Water-Resistant Gypsum Backing Board
ASTM C840	Specification for Application and Finishing of Gypsum Wallboard
ASTM C1002	Specification for Steel Drill Screws for the Application of Gypsum Wallboard
ASTM C1047	Specification for Accessories for Gypsum Wallboard

##### **1.4 QUALITY ASSURANCE**

All gypsum wallboard products and joint treatment products shall be obtained from a single manufacturer.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

Gypsum wallboard products and joint treatment products shall be as manufactured by the National Gypsum Company, Georgia Pacific, the USG Group, or approved equal.

### **2.2 GYPSUM WALLBOARD**

Gypsum wallboard shall be heavy duty, moisture and abuse resistant wallboard with reinforcing layers at each face, conforming to ASTM C1629 and ASTM C1396, Type X. Thickness shall be 5/8 inch.

### **2.3 TRIM ACCESSORIES**

Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for fastening and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, and one-piece control joint beads. Unless specifically noted as "exposed," all trim accessories shall be beaded type to be concealed with joint compound.

### **2.4 JOINT TREATMENT MATERIALS**

Provide materials complying with ASTM C475, ASTM C840 and recommendations from the Manufacturer for the applications indicated. Provide 2-1/2-inches wide, perforated tape for joints. Provide two separate grades of ready-mixed, vinyl-type joint compound. One type shall be for bedding tapes and filling depressions. The second type shall be for taping and sanding.

### **2.5 FASTENERS**

Screws shall conform to ASTM C1002 with heads, threads, points, and finish as recommended by the manufacturer.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

All workmanship and materials shall be of the best quality and any defective work shall be removed and replaced by the Contractor at no additional expense to the Owner. Keep the premises free of accumulations of debris and dust connected

with this work and protect adjacent finished surfaces from damage by this work. The Contractor shall establish and maintain application and finishing environment in accordance with ASTM C840. For non-adhesive attachment of gypsum wallboard to framing, maintain not less than 40 degrees F.

### **3.2 INSTALLATION**

All drywall sheets shall be set with staggered joints and screws set deep enough to receive a cover of spackle, spaced in accordance with Wallboard Manufacturer's standard specifications. Install approved zinc-coated corner molds at openings and terminations of wallboards. Cut all wallboard close to and around wall penetrations and electrical outlets. Provide a complete, covered installation in all areas where gypsum wallboard is to be installed.

### **3.3 FINISHING**

After the wallboard has been installed, it shall be finished. Apply joint compound or bedding compound and embed tape leaving uniform thickness of materials underneath tape. Cover screw heads smooth with finished surface of board after each application of joint material. After initial application has been complete, it shall be allowed to dry and then sanded smooth. Additional coats of joint compound shall be applied and finish sanded until a Level 5 finish has been achieved in accordance with ASTM C840 and left in condition to receive paint. Obtain Owner's approval prior to applying paint.

### **3.4 ESCUTCHEONS**

Provide escutcheons around all pipe, conduit, and similar types of penetrations through gypsum wallboard walls and ceiling.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 09653**

### **RESILIENT WALL BASE**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes the resilient base material and accessories as shown on the Plans and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01300	Submittals
09250	Gypsum Wall Board

##### **1.3 SUBMITTALS**

###### **A. PRODUCT DATA**

Rubber Wall Base.

###### **B. SAMPLES FOR INITIAL SELECTION**

Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

##### **1.4 QUALITY ASSURANCE**

###### **A. INSTALLER QUALIFICATIONS**

Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

###### **B. SOURCE LIMITATIONS**

Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 degrees F (10 and 32 degrees C).
- C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

## **1.6 PROJECT CONDITIONS**

- A. Maintain a temperature of not less than 70 degrees F (21 degrees C) or more than 95 degrees F (35 degrees C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).
- B. Do not install products until they are at the same temperature as the space where they are to be installed.

## **PART 2 PRODUCTS**

### **2.1 RESILIENT WALL BASE**

Products shall comply with ASTM F-1861, Type TV.

### **2.2 MANUFACTURERS**

#### **A. AVAILABLE PRODUCTS**

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

- 1. Products
  - a. Roppee Corporation

- b. Mercer Products Company
  - c. Johnsonite
- 2. Color and Pattern

As selected by Owner from manufacturer's full range of colors and patterns produced for rubber wall base complying with requirements indicated.

  - a. Allow one color.
- 3. Style: Cove with top-set toe.
- 4. Minimum Thickness: 1/8 inch (3.2 mm).
- 5. Height: 4 inches (101.6 mm).
- 6. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet (29.26 m).
- 7. Outside Corners: Formed on job.
- 8. Inside Corners: Formed on job.
- 9. Ends: Premolded.
- 10. Surface: Smooth.

## **2.3 RESILIENT ACCESSORIES**

Provide necessary accessories as required per manufacturer's recommendations.

## **2.4 INSTALLATION ACCESSORIES**

### **A. TROWELABLE LEVELING AND PATCHING COMPOUNDS**

Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

### **B. ADHESIVES**

Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

#### **A. GENERAL**

Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

- B.** Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C.** Remove coatings, including curing compounds and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D.** Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.3 INSTALLATION**

#### **A. GENERAL**

Install resilient products according to manufacturer's written installation instructions.

- B.** Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas as scheduled.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
  2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
  3. Do not stretch base during installation.
  4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
  5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

### **3.4 CLEANING AND PROTECTING**

- A. Perform the following operations immediately after installing resilient products:
1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
  2. Sweep or vacuum horizontal surfaces thoroughly.
  3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
  4. Damp-mop or sponge resilient products to remove marks and soil.

- B. Protect resilient products against mars, marks, indentations and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by resilient product manufacturer.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

**\*\*\* END OF SECTION \*\*\***

## SECTION 09900

### PAINTING

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section covers the furnishing and installation of protective coatings, complete-in-place. Special shop coatings and/or factory-applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of paint coats previously applied, at least two field coats of paint shall be applied to all surfaces unless otherwise specified herein. Field painting is not required for factory prefinished equipment items such as pumps, blowers, motors, etc. Touchup of the factory applied coatings may be required.

The word “paint” as used herein shall be taken to include all protective coatings and incidental materials as required with the exception that anodized aluminum or zinc galvanized coatings shall not be considered as paint.

Unless specifically noted otherwise in these Specifications or on the Plans, all work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If an existing wall or ceiling (or similar surface) is modified in some way, the entire wall or ceiling surface is to be painted.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Concrete
04200	Masonry
07900	Caulking and Sealant
08100	Hollow Metal Doors and Frames
Division 11	Equipment
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

### **1.3 REFERENCED STANDARDS**

The following standards are referenced and shall be considered a part of these Specifications:

American National Standards Institute (ANSI):

A159.1, Surface Preparation Specifications;

Z53.1, Safety Color Code for Marking Physical Hazards

American Society for Testing and Materials (ASTM):

D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

E84, Standard Test Method for Surface Burning Characteristics of Building Materials

National Fire Protection Association (NFPA):

101, Life Safety Code

Steel Structures Painting Council (SSPC):

SP-1, Solvent Cleaning

SP-2, Hand Tool Cleaning

SP-3, Power Tool Cleaning

SP-5, White Metal Blast Cleaning

SP-6, Commercial Blast Cleaning

SP-7, Brush-off Blast Cleaning

SP-10, Near-White Blast Cleaning

SP-11, Power Tool Cleaning

SP-13 Surface Preparation for Concrete Surfaces

VIS-89, Visual Standard

### **1.4 DEFINITIONS**

#### **A. PAINT**

Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, urethanes, shellacs, varnishes and any other applied coating specified within these Specifications or shown on the Plans.

#### **B. FINISHED ROOM OR SPACE**

One that has a finish called for on Room Finish Schedule, or is indicated on the Plans, or is specified herein, to be painted.

## C. PAINTING COVERAGE RATE

Coverage's expressed in SF/GAL/coat are the manufacturer's published theoretical coverage's in square feet per gallon per coat.

### 1.5 SUBMITTALS

In addition to the general submittal requirements listed in Section 01300, the following shall be submitted:

1. Written acknowledgment and certification that products submitted meet requirements of standards referenced in this Section.
2. Manufacturer's application instructions for primer and finish coats.
3. Manufacturer's surface preparation instructions.
4. Manufacturer's full line of color samples for color selection by Owner.
5. If products being used are manufactured by a company other than the specified reference standard, the Contractor must provide a complete comparison of the proposed products with the specified reference products per Part 2.1 requirements, including application procedure, coverage rates, and verification that product is designed for intended use. Information must be provided that demonstrates that manufacturer's products are equal to the performance standards of products manufactured by the Tnemec Company, which is the reference standard.
6. Manufacturer's approval of protective coating systems applicator.
7. List of Applicator's experience and qualifications. A minimum of 5-years of experience in the painting of wastewater treatment plant facilities required.

## PART 2 PRODUCTS

### 2.1 APPROVED MANUFACTURERS

The following is an approved coating systems manufacturers list subject to compliance with the Specifications contained herein:

1. Ameron Protective Coatings Division.
2. Sherwin Williams.
3. Tnemec Company.
4. Or equal.

The specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the coatings proposed are equivalent to those named. Proposed coatings shall be submitted for review in accordance with these Specifications. Requests for review of equivalency will not be accepted from anyone except the Contractor, and such requests shall not be considered until after the Contract has been awarded.

No substitutions shall be allowed that change the number of coats, thickness or generic type of paint required. All materials shall be brought to the jobsite in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

No coating materials other than those specified shall be brought to the jobsite. Thinners, driers and oils brought to the jobsite shall be only those recommended and approved by the paint manufacturer.

All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products which will be in contact with each other or which will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

All paint used for intermediate and finish coats shall be guaranteed by the paint manufacturer to be fumeproof and suitable for wastewater plant atmospheres containing hydrogen sulfide. Any paint that cannot be so guaranteed shall not be used. Paint shall be lead-free and mercury-free if available, but in no case shall the lead or mercury content cause discoloration in a wastewater plant atmosphere.

Tnemec Company products are the reference standard and Tnemec designations for product type are used herein. Requirements for an approved equal product are listed below:

1. For approval of an equal manufacturer. The Contractor shall provide to the Owner in writing a detailed side-by-side comparison of the proposed equal Products Characteristics, Performance Characteristics, and Application Conditions for each Tnemec coating specified in this specification. For consideration for approval this written comparison shall be certified and notarized by an officer of the proposed manufacturer as true and correct.
2. For Products Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Volume Solids, Weight Solids, VOC, Mix Ratio, Zinc Content in Dry Film (by Weight), Spreading Rate per coat, Drying Schedule, Shelf Life and Flash Point.
3. For Performance Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Abrasion Resistance, Corrosion Weathering, Direct Impact Resistance, Dry Heat Resistance, Flexibility, Moisture Condensation Resistance, Pencil Hardness, Salt Fog Resistance, Slip Coefficient and Wet Heat Resistance
4. In addition to the detailed side-by-side comparison for approval of an equal manufacturer, The Contractor shall provide to the Owner in writing five similar installations that have had the proposed or equal coating system and date coating system was put into service. In addition the installations names, locations, and owner's name with contact person and telephone number shall be provided.
5. For consideration for approval as an equal coating system the detailed side-by-side comparison shall be submit, with successful bidder's Shop Drawing at the time of the Preconstruction Conference, along with any proposed monetary adjustments to the contract price. As with all shop drawings, final approval rests with the Owner.
6. As a minimum standard any equal coating system shall have a 5-year service history on its coating system.

## **2.2 PAINT SYSTEMS**

### **A. COATING OF FACTORY NON-APPROVED FINISHES**

#### **1. Scope**

This Section shall apply to all interior and exterior steel windows and frames and other similar type of items which have a factory finish which is not an approved corrosion resistant finish.

2. Surface Preparation

Factory coating is to remain. Provide clean surfaces, lightly sand 100 percent of the surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Primer System:

Coat One

Product: Typoxy Tnemec Series N27

MDFT: 2 to 3 mils

Finish System:

Coat One

Product: Endura-Shield III Tnemec Series 73

MDFT: 3 to 5 mils

Total MDFT: 5.0 mils

B. STRUCTURAL STEEL - MILD CONDITIONS

1. Scope

This Section shall apply to all interior structural steel. Items which are interior but may be exposed to splashing of liquids or corrosives shall be coated for severe conditions.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Coat Two  
Product: Hi-Build Epoxoline Tnemec Series N69  
MDFT: 4 to 6 mils

Total Field applied MDFT: 11.0 mils

C. STRUCTURAL STEEL - SEVERE CONDITIONS

1. Scope

This Section shall apply to all exterior structural steel components and structural steel items which are interior but may be exposed to splashing of liquids or corrosives.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Primer System:

Coat One  
Product: Series 1 Omnithane  
MDFT: 2.5 to 3.5 mils

Finish System:

Coat One  
Product: Hi-Build Epoxoline Tnemec Series N69  
MDFT: 4 to 6 mils

Coat Two  
Product: Endura-Shield III Tnemec Series 73  
MDFT: 3 to 5 mils

Total MDFT: 10.0 mils

D. DUCTILE IRON PIPE AND FITTING MATERIALS  
(NON-IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are not continuously or intermittently submerged.

Continuously or intermittently submerged items are covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Coat Two

Product: Endura-Shield III Tnemec Series 73

MDFT: 3 to 5 mils

Total MDFT: 10.0 mils

E. GALVANIZED SURFACE TOUCHUP

1. Scope

This Section shall apply to all galvanized surfaces, which have received minor damage to the galvanized surface during construction.

2. Surface Preparation

Power tool cleaning, SSPC-SP-3.

3. Coatings

Paint System:

Product: Tnemec-Zinc Tnemec Series 90-97

MDFT: 3 to 5 mils

Total MDFT: 3.5 mils

F. ALUMINUM BURIED IN CONCRETE - DISSIMILAR METALS

1. Scope

This Section shall apply to all surfaces, which are conducive to corrosion due to interactions between dissimilar metals, or to chemical reactions, to include embedments in cast-in-place or precast concrete or masonry grout. This Section applies to aluminum, hot-dipped galvanized steel, and any other metals that have a dissimilar metals or chemical reaction concern when installed or embedded in concrete, or against concrete, mortar or grout.

2. Surface Preparation

Lightly sand with 150 grit sandpaper to degloss and roughen surfaces. Solvent cleaning, SSPC-SP-1.

3. Coatings

Finish Coat

Product: Hi-Build Epoxoline Tnemec Series N69  
MDFT: 4 to 6 mils

Total MDFT: 4.0 mils

G. GYPSUM WALLBOARD

1. Scope

This Section shall apply to all exposed gypsum wallboard surfaces.

2. Surface Preparation

Sandpaper smooth, dust and contaminant free.

3. Coatings

Primer System:

Coat One

Product: Elasto-Grip FC, Tnemec Series 151-1051  
MDFT: 1.5 to 2.5 mils

Finish System:

Coat One

Product: Endura-Tone, Tnemec Series 1029

MDFT: 2 to 4 mils

Coat Two

Product: Endura-Tone, Tnemec Series 1029

MDFT: 2 to 4 mils

Total MDFT: 5.5 mils

H. METAL DOORS AND FRAME

1. Scope

This Section shall apply to all interior and exterior hollow metal doors and frames.

2. Surface Preparation

All hollow metal doors and frames shall be bonderized, pickled or phosphatized, which will serve as the primer for and shall be compatible with the finish coats to be applied in the field. Prior to field coat application, the surface shall be solvent cleaned SSPC-SP-1, and shall be clean, dry and free of all dirt, oil, grease and any other contaminants.

3. Coatings

Primer System:

Coat One

Product: Typoxy, Tnemec Series 27

MDFT: 3 to 5 mils

Finish System:

Coat One

Product: Endurashield, Tnemec Series 73

MDFT: 3 to 5 mils

Total MDFT: 6.0 mils

I. CONCRETE BLOCK MASONRY (INTERIOR)

1. Scope

This Section shall apply to all interior concrete block masonry (CMU) surfaces unless otherwise specified in these Specifications.

2. Surface Preparation

Clean, dry, and free of contaminants.

3. Coatings

Primer System:

Product: EpoxyBlock WB (Masonry Filler),  
Tnemec Series 1254  
MDFT: 80 to 100 sf/gal/coat application rate. Need  
to provide a smooth, continuous, pinhole  
free, void-free film, prior to application of  
finish coating system.

Finish System:

Coat One

Product: Hi-Build Epoxoline II, Tnemec Series N69  
MDFT: 4 to 6 mils

Coat Two

Product: Hi-Build Epoxoline II, Tnemec Series N69  
MDFT: 4 to 6 mils

Total MDFT: 8.0 mils (for finish system only)

## 2.3 COLORS

A. GENERAL

Paint colors used for the finish coatings on process equipment, piping and building surfaces shall conform to the following schedules. All finishes shall be glossy unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform with this color schedule wherever possible. Factory coatings which are damaged during shipment or installation, or which are not of suitable color, as determined by the Engineer, shall be recoated in the field in accordance with these Specifications. Color samples shall be submitted to the Engineer for approval prior to application of any field coatings.

## B. PIPING COLOR SCHEDULE

Piping Identification: Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, shall have flow directional arrows, and shall be color coded as scheduled below.

Piping scheduled to be color coded shall be completely painted with the indicated colors, except surfaces specified to be unpainted shall have segments painted with the specified coding color long enough to accommodate the required lettering and arrows. All other piping specified to be painted shall match adjacent surfaces, unless otherwise approved by the Engineer.

Location: Lettering and flow direction arrows shall be provided near equipment served, adjacent to valves, on both sides of walls and floors where pipe passes through, at each branch or tee, and at intervals of not more than 50 feet in straight runs of pipe. If, in the opinion of the Engineer, the foregoing requirements will result in an excessive number of labels or arrows on a run of pipe, the number required can be reduced.

Metal Tags: Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, metal tags shall be provided instead of lettering. Tags shall have the specified identifying lettering stamped in, and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel. Where tags are used, pipe shall be color coded as specified.

Lettering: Lettering on piping shall be painted, stenciled, or snap-on markers. Snap-on markers shall be plastic sleeves as manufactured by Brady "Brady snap-on B-915," Seton "Setmark," or equal. Letter sizes shall be as follows:

<u>Outside Diameter of Pipe or Covering</u>	<u>Minimum Height of Letters</u>
5/8 inch and smaller	Metal tags - 1/4 inch
3/4 inch through 4 inch	3/4 inch
5 inch and larger	2 inches

Color Coding and Lettering Schedule: All piping for the following services shall be color coded and identified using the process names given below. Where scheduled, bands shall be 6-inches-wide spaced along the pipe at 5-foot intervals.

### **For Wastewater Projects:**

<b><u>Process</u></b>	<b><u>Abbreviation</u></b>	<b><u>Color of Pipe</u></b>	<b><u>Color of Letters</u></b>
Air Low Pressure	ALP	Not Painted	Black
Air High Pressure	AHP	Not Painted	Black
Hot Water	HW	Light Blue	Black
Potable Water	W	Light Blue	Black
Return Activated Sludge	RAS	Light Brown	White
Waste Activated Sludge	WAS	Light Brown	White

All exposed piping shall be color coded and lettered. Pipes not tabulated above shall be color coded and lettered as determined by the Engineer.

Electrical conduit shall be painted to match adjacent ceiling or wall surfaces as approved by the Engineer. Vent lines shall be painted to match surfaces they adjoin, otherwise gray.

All valves shall be identified with a valve identification number. Contractor shall provide a computer file (Excel spreadsheet) with this information to the Engineer.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

It is the intent of these Specifications that materials and workmanship be provided such that the highest quality job is obtained. The completed work, prior to acceptance, must be free from runs, skips, mars and any other disfiguring mark due to faulty workmanship or care of the completed work.

It is the responsibility of the Contractor to ensure that all surfaces are prepared in accordance with the written recommendations and directions of the paint manufacturer whose paint is applied.

Approval of conditions shall be obtained from the Engineer prior to applying any or all coats of paint; however, such approval shall not relieve the Contractor of their responsibility of conformance with these Specifications and conformance with the manufacturer's recommendations.

It shall be the responsibility of the Contractor to prevent settling of dust or the occurrence of other conditions detrimental to the finished quality of the job and to repair any damaged paint at no additional cost to the Owner.

Materials or equipment delivered with prime coats shall be touched up as required prior to the application of additional coating(s).

The Contractor shall apply each coating at the rate and in the manner specified by the paint manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built-up to the same thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Film thickness shall be determined when dry by the Engineer with a magnetic dry film thickness gauge. The thickness gauge shall be calibrated with test shims.

Where thinning is necessary, only the products of the manufacturer furnishing the paint and for the particular purpose shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees F. No paint shall be applied when the temperature of the surface to be painted is below 35 degrees F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity exceeds 85 percent. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40 degrees F within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until conditions improve to be certain that the surfaces are dry prior to application of paint. No paint shall be applied when the ambient temperature is less than 5 percent F. above the dewpoint. Further, the day's painting shall be completed well within advance of the probable time of day when condensation will occur, in order to permit the paint film an appreciable drying time prior to the formation of moisture.

Manufacturer's recommended drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times shall be necessary. The manufacturer's recommendations for recoating time intervals shall be strictly adhered to.

Adequate ventilation, which will effectively remove solvents, shall be provided for proper drying of paints on interior surfaces. A minimum of 7-consecutive calendar days at 70 degrees F following the application of the final coat on submerged surfaces shall be required before submergence. Longer periods shall be allowed prior to submergence if recommended by the paint manufacturer or if weather conditions require a longer curing time.

### 3.2 MIXING AND THINNING

Paint shall be thoroughly mixed each time any is withdrawn from the container. Paint containers shall be kept tightly closed except while paint is being withdrawn.

Paint shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. Only thinners approved by the paint manufacturer shall be used. In no case shall the wet film thickness of applied paint be reduced, by addition of paint thinner or otherwise, below the thickness recommended by the paint manufacturer.

### 3.3 SURFACE PREPARATION

#### A. GENERAL

Surfaces shall be dry and thoroughly cleaned of foreign materials with all defects filled or removed. All trades employed shall leave the surfaces of their work in such a condition that only minor cleaning, sanding and filling is required of the painting trade for surface preparation.

Hardware, switchplates, machined surfaces, nameplates, lighting fixtures and all other surfaces not to be painted shall be removed or otherwise protected. Drop cloths shall be provided, where necessary, to avoid spotting of surfaces adjacent to the item being painted. Working parts of electrical equipment shall be protected from damage during surface preparation and painting operations.

Ferrous metal cleaning shall be in accordance with Steel Structures Painting Council Specifications (SSPC).

<u>Description</u>	<u>SSPC</u>
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10
Preparation of Concrete	SP-13

The words “blast cleaning” or equivalent phrases of equal intent shall be taken to refer to the applicable SSPC specification when used in the paint manufacturer’s recommendations or these Specifications.

Hand tool cleaning shall be used when power tool cleaning is not possible. Hand and power tool cleaning shall be in accordance with SSPC Specifications SP-2, SP-3 or SP-11, respectively.

The blast cleaning profile depth shall be not less than 1 mil or greater than 2 mils. In the case of equipment to which the manufacturer applies a primer coating in the shop after fabrication, the blast profile depth needs to be as noted above.

**B. WOOD**

The Contractor shall sandpaper smooth, then remove dust. After prime coat has dried, seal all knots, pitch and resinous sapwood. The Contractor shall putty nail holes and minor defects prior to painting.

**C. FERROUS METAL, GALVANIZED METAL AND HOLLOW METAL SURFACES**

The Contractor shall assure that fabrication, welding or burning is completed prior to the sandblasting operation. The Contractor shall chip or grind off flux, splatter, slag or other laminations left from welding. The Contractor shall remove all mill scale. The Contractor shall grind smooth rough welds and other sharp projections.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10, submerged surfaces and surfaces to 12 inches above highest liquid level, and areas subject to splash or spillage.

The Contractor shall commercial blast clean, in accordance with SSPC SP-6, all interior and exterior structural steel surfaces, surfaces located 12 inches above submerged areas, and surfaces located in areas not subject to splash or spillage where exposed to open bodies of liquids.

The Engineer reserves the right to accept preparation of these surfaces in accordance with SSPC SP-3 for areas not practical or possible to sandblast to SSPC SP-6 requirements.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10 surfaces, subject to heat in excess of 600 degrees F. The Contractor shall power tool or hand clean in accordance with SSPC SP-2 or SSPC SP-3. The Contractor shall apply prime coat on cleaned surfaces within 2 hours of cleaning. The Contractor shall solvent clean galvanized surfaces in accordance with SSPC SP-1.

D. EQUIPMENT

The Contractor shall sandblast the following equipment items or surfaces in accordance with applicable SSPC standards whether prime coated or not:

Shop primed surfaces, which have 2 percent or more of the primed surface damaged.

If catalyzed epoxy prime coat has been exposed to sunlight for longer than 60 days.

E. GYPSUM WALLBOARD

The Contractor shall repair minor irregularities left by finishers, avoid raising the nap of the paper and verify that the moisture content is less than 8 percent before painting. Contractor shall install sealant as required at edges of wallboard where it abuts different materials prior to painting.

F. CONCRETE AND CONCRETE BLOCK MASONRY

The Contractor shall allow new concrete and concrete block masonry to cure for a minimum of 28 days and shall verify that the moisture content contained in the concrete is stable and not in motion. The Contractor shall verify by performance of a Wet Matt Test per ASTM D4263. The Contractor shall fill concrete surface cracks and irregularities with Portland cement grout to provide a uniform surface texture and shall fill concrete block masonry surface with an epoxy block filler as specified. As a minimum, the Contractor shall brush off blast clean surfaces. The Contractor shall prepare the surface as specified elsewhere in these Specifications.

C. CONCRETE BLOCK MASONRY

The Contractor shall verify that the moisture content is acceptable as noted above, shall remove existing paint that has a tendency to powder, peel or shatter when scraped with a knife, shall hydroblast or sandblast the surfaces of any previous coatings, shall fill cracks and irregularities with portland cement grout to provide a uniform surface texture compatible with new concrete and shall fill concrete block masonry surfaces with a block filler.

## **G. PREPARATION BY SANDBLASTING**

The Contractor shall not sandblast surfaces that will be wet after blasting and before painting. The Contractor shall apply primer to sandblasted surfaces the same day that the surface is blasted and before rusting occurs. The Contractor shall reblast surfaces allowed to set overnight prior to priming or surfaces that show rust bloom.

The sand shall be clean, water washed, with controlled particle size and high silica content. The sand shall have sharp, angular surfaces and contain no clay particles or other extraneous matter.

The profile depth of sandblasted surfaces shall be not less than 1 mil or greater than 2 mils, unless required otherwise by the coating manufacturer.

Compressed air for blasting shall be free of water and oil. The Contractor shall provide accessible separators and traps, shall confine sandblast sand to the area being blasted, shall provide shields of polyethylene sheeting or other such barriers to confine sand and shall plug pipes, holes or openings before sandblasting and keep them plugged until the sandblasting operation is complete and the sand is removed.

The Contractor shall protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from sandblasting. The Contractor shall reblast surfaces not meeting the requirements of these Specifications.

## **3.4 APPLICATION**

### **A. GENERAL**

The Contractor shall mix and apply coatings by brush, roller or spray in accordance with the manufacturer's installation instructions. Spraying equipment shall be inspected and approved in writing by the coating manufacturer. The Contractor shall provide complete coverage's to the mil thickness specified. The thickness specified shall be dry film mil thickness. All paint systems are "to cover." In situations of discrepancy between the manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern. When color or undercoats show through, the Contractor shall apply additional coats until paint film is of uniform finish and color. The Contractor shall not apply consecutive coats until the Engineer has had an opportunity to observe and approve previous coats.

The Contractor shall apply materials under adequate illumination, shall evenly spread and flow on to provide full, smooth coverage, shall work each application of material into corners, crevices, joints and other difficult to work areas, shall avoid degradation and contamination of blasted surfaces and avoid intercoat contamination, shall clean contaminated surfaces before applying next coat and shall immediately smooth out runs or sags, or remove and recoat entire surfaces. The Contractor shall assure that preceding coats are dry before recoating, shall recoat within the time limits specified by the coating manufacturer and shall allow coated surfaces to cure prior to allowing traffic or other work to proceed.

The Contractor shall coat all aluminum surfaces in contact with dissimilar materials. All fabricated and structural steel shall have prime coat(s) applied in the shop and finish coat(s) applied in the field.

During application of either prime or finish coats, brush coat all weld seams, edges, angles, fasteners and other irregular surfaces to insure a monolithic film, pinhole free surface. Finish coats of paint shall be uniform in color and sheen without streaks, laps, runs, drips, sags or missed areas.

All submerged or intermittently submerged materials shall have surface preparation and coatings applied prior to installation unless otherwise approved by the Engineer. All pipe, pipe supports, and pipe hangers that will be painted shall have surface preparation and coatings applied prior to installation.

#### B. PRIME COAT INSTALLATION

The Contractor shall prime all surfaces indicated to be painted, shall touch-up damaged primer coats prior to finish coats and shall assure field-applied coatings are compatible with factory-applied coatings. If coatings are not compatible, and if approved in writing by the Engineer, the Contractor shall apply a 2-mil-thick universal barrier coat recommended by the paint manufacturer prior to applying field coats or completely remove factory coatings and reprime.

The Contractor shall prime ferrous metals bedded in concrete to a minimum of 1 inch below exposed surfaces. The Contractor shall backroll all primer coats applied to existing or new CMU block. The Contractor shall assure sandblasting operations do not result in the embedment of sand particles in paint film. The Contractor shall brush or spray bolts,

welds, edges and difficult access areas with primer prior to primer application over the entire surface being coated. The Contractor shall backroll concrete, masonry, gypsum board and plaster surfaces with a roller if the primer has been spray applied.

#### C. FINISH SCHEDULE

All work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If the finish schedule requires wall surfaces to be painted in a particular space, the Contractor shall paint all appurtenant surfaces unless specifically noted not to be painted on the Plans. These items to be painted shall include:

1. Pipe supports, and equipment supports.
2. Insulated or wrapped piping, valves, fittings, hydrants and appurtenances except where covered by lagging.
3. Insulated or wrapped ductwork and appurtenances.
4. Conduit and appurtenances.
5. Ferrous metals.
6. Exposed woodwork.
7. Copper and brass surfaces.
8. Inside and/or outside of ferrous metal tankage.
9. New machinery and equipment except:
  - a. Electrical panels;
  - b. Switchboards;
  - c. Switchgear;
  - d. Safety switches;
  - e. Motor starter equipment;
  - f. Busways;

g. Raceways.

The Contractor shall paint the following surfaces in areas not considered as finished areas:

1. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances.
2. Insulated or wrapped ductwork and appurtenances.
3. Exposed wood.
4. New machinery and equipment.
5. Machinery and equipment in sumps, pits, boxes, channels, wetwells and structures.

The Contractor shall paint all exposed interior and exterior surfaces including:

1. Soffits.
2. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances except when covered by lagging.
3. Insulated or wrapped ductwork and appurtenances except when covered by lagging.
4. Conduit and appurtenances.
5. Exterior and interior surfaces of ferrous metal tankage.
6. Ferrous metals.
7. Exposed wood.
8. Plaster surfaces.
9. Concrete block to be sealed, paint interior surfaces only.

The Contractor shall not paint the following elements unless specifically noted on the Plans to be painted:

1. Stainless steel surfaces except as required to identify piping.

2. Exposed to view aluminum surfaces.
3. Galvanized metal surfaces.
4. Fiberglass surfaces except fiberglass piping and piping appurtenances.
5. FRP ductwork unless gel coat color is not acceptable to the Owner.
6. Interior of pipe, ductwork, and conduits.
7. Moving parts of mechanical and electrical units.
8. Code labels and equipment identification and rating plates.
9. Piping, ductwork, or pipe conduit when enclosed between suspended ceiling and overhead slabs or located in pipe chases or surfaces to be lagged.
10. Factory-finished furniture, laboratory casework, metal toilet partitions, kitchen units, lockers, shop and storage equipment or miscellaneous items that have preapproved factory applied finishes.
11. Prefaced masonry, burnished masonry units, or glass masonry.
12. Structural steel or steel deck required to be fireproofed.
13. Contact surfaces of friction-type connections.
14. Pipe and/or duct lagging.

### **3.5 FIELD QUALITY CONTROL**

The Contractor shall be responsible for performing, testing and assuring conformance with all requirements of these Specifications.

The Contractor shall maintain daily records showing:

- Start date of work in each area.
- Date of application for each following coat.

- Moisture content and surface temperature of substrate. Also record weather conditions, ambient air temperature and dew point.
- Provisions utilized to maintain temperature and humidity of work area within paint manufacturer's recommended ranges.

The Contractor shall measure the surface temperature of items to be painted with surface temperature gauges specifically designed for such use. The Contractor shall measure substrate humidity with humidity gauges specifically designed for such use. The Contractor shall measure wet paint with wet film thickness gauges. The Contractor shall measure paint dry film thickness with a Mikrotest gauge calibrated against the National Bureau of Standards "Certified Coating Thickness Calibration Standards." The Engineer may direct measurement of paint thickness at any time during the project to ensure conformance with these Specifications. A sufficient number of dry film thickness measurements shall be made so that there is approximately one measurement for each 100 square feet of surface area painted.

Where a wall or ceiling or other type of surface is disturbed and patched, the Contractor shall repaint entire wall or ceiling. The Contractor shall provide wet paint signs as necessary. The Contractor shall touch up damaged finish coats using the same material as specified for the finish coat.

At the conclusion of all painting activities, Contractor shall submit a painting field test report to the Engineer showing the above information plus results of wet film and dry film thickness tests. Provide four copies of final test report.

### **3.6 PAINTING SITE**

Either shop painting or field painting and surface preparation shall be acceptable when painting work is performed in conformance with this Section, unless the painting is activity specified elsewhere in these Specifications.

### **3.7 PAINT THICKNESS**

All paint thicknesses specified herein are minimum dry film thickness (MDFT). The thickness of paint over metallic surfaces shall be measured with a magnetic thickness gauge; paint thickness over wood or masonry shall vary in accordance with surface texture, but in no case shall the manufacturer's recommended coverage rate be exceeded. The minimum thicknesses given are total coating thickness for the coating specified, including multiple coats of the same material, where applicable.

**\*\*\* END OF SECTION \*\*\***

**DIVISION 10**  
**SPECIALTIES**

## **SECTION 10300**

### **SAFETY EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The Contractor shall furnish and install safety equipment items including fire extinguishers, ear protectors, and emergency shower.

One fire extinguisher shall be furnished and installed in each of the following locations.

- A. Operations Building Lab/Office.
- B. Operations Building Electrical Room.
- C. Operations Building Chlorine Gas Room.
- D. Operations Building Sludge Pump Room.
- E. Operations Building Basement.

One ear protector shall be furnished and installed in each of the following locations.

- A. Operations Building Sludge Pump Room

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals

#### **PART 2 PRODUCTS**

##### **2.1 FIRE EXTINGUISHERS**

The fire extinguishers shall be 5-pound monoammonium phosphate, dry chemical, nitrogen pressurized, Underwriter's Laboratories listed. The chemical shall be suitable for Class A, B, and C fires. Fire extinguishers shall have metal valve pressure gauges and corrosion resistant handles and wall hooks.

##### **2.2 EAR PROTECTORS**

Ear protectors shall be of the over-the-ear design with adjustable suspension bands. The suspension bands shall pivot on the ear cups to allow the band to rotate through 360 degrees and be worn over the head, behind the head or under

the chin. Ear cup mounting shall be adjustable so that the angle of the ear cups may be adjusted to the wearer's head. Minimum noise reduction shall be 15 DB above 200 Hz.

### **PART 3 EXECUTION**

Safety equipment shall be installed in the general areas specified.

Specific locations shall be determined by a Safety Inspector with the Washington State Department of Labor and Industries. The Safety Inspector's visit shall be arranged by the Contractor. Any costs associated with the Safety Inspector's site visit shall be included in the Contractor's cost for the project.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 10500**

### **METAL LOCKERS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes furnishing and installing metal lockers as shown on the Plans, and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals

#### **PART 2 PRODUCTS**

##### **2.1 APPROVED MANUFACTURERS**

Republic Storage Systems, or equal.

##### **2.2 LOCKERS**

Republic "Standard," 15-inches wide by 72-inches tall by 18-inches deep, with single prong back wall hook and two single prong side wall hooks, latching door handle, rubber door silencers, five knuckle hinges, baked enamel finish.

##### **2.3 MATERIALS**

###### **A. FRAME AND CROSS FRAME MEMBERS**

16-gauge cold rolled steel.

###### **B. DOORS**

18-gauge cold rolled steel.

###### **C. BODY**

24-gauge sheet steel.

## **2.4 FINISH**

Baked enamel finish. Color to be selected from the manufacturer's full line of standard colors.

## **PART 3 EXECUTION**

The Contractor shall provide a pressure treated wood platform for mounting the lockers. All lockers shall be installed plumb and level and shall be securely and rigidly anchored to the substrate.

**\*\*\* END OF SECTION \*\*\***

## SECTION 10800

### TOILET AND BATH ACCESSORIES

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing all toilet, bath, and restroom accessories as shown on the Plans, and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

##### 1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ANSI A117	Accessible and Usable Buildings and Facilities
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality

#### PART 2 PRODUCTS

##### 2.1 APPROVED MANUFACTURERS

All toilet and bath accessories shall be as manufactured by Bobrick Washroom Equipment Inc., or equal.

##### 2.2 FIXTURE SCHEDULE

<u>Fixture</u>	<u>Type</u>	<u>Location</u>
Toilet Tissue Dispenser	B-3888	Provide one at each water closet; recessed mount
Toilet Seat Cover Dispenser	B-221	Provide one at each water closet; surface mount

<b><u>Fixture</u></b>	<b><u>Type</u></b>	<b><u>Location</u></b>
Sanitary Receptacle	B-353	Provide one at each water closet; recessed mount
Shower Ct. Rod	B-6047	Provide one at each shower
Shower Curtain	B-204	Provide one at each shower
Shower Ct. Hooks	B-204	Provide complete set for each curtain
Hook Strip	B-232x24	Provide one at each locker room
Hooks	B-6827	Provide one at each shower
Hand Towel Dispenser/Receptacle	B-3699	Provide one at each lavatory
Soap Dispenser	B-2111	Provide one at each lavatory
Mirror w/Shelf	B-166, 24x36	Provide one at each lavatory

## **2.3 MATERIALS**

### **A. SHEET STEEL**

ASTM A366.

### **B. STAINLESS STEEL SHEET**

ASTM A167, Type 304.

### **C. TUBING**

ASTM A269, stainless steel.

### **D. ADHESIVE**

Contact type, waterproof.

### **E. FASTENERS, SCREWS, AND BOLTS**

Hot dip galvanized, tamper-proof, and security type.

## **2.4 FABRICATION**

Weld and grind joints of fabricated components, smooth. Exposed surfaces shall be formed from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

Grab bars shall be fabricated of tubing, free of visible joints and shall return to wall with end attachment flanges.

Components shall be shop assembled and packaged, complete with anchors and fittings.

Provide steel anchor plates, adapters, and anchor components as required for installation.

## **2.5 FINISHES**

All stainless steel shall have a No. 4 satin luster finish. All components in contact with building finishes shall receive back paint to prevent electrolysis.

## **PART 3 EXECUTION**

The Contractor shall install all accessories in accordance with the manufacturer's instructions and ANSI A117. All toilet and bath accessories shall be installed plumb and level and shall be securely and rigidly anchored to the substrate.

**\*\*\* END OF SECTION \*\*\***

## **DIVISION 11**

## **EQUIPMENT**

## **SECTION 11000**

### **EQUIPMENT GENERAL PROVISIONS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The provisions of this Section apply to all Sections of Divisions 11, 13, 14, 15, and 16, unless specifically revised therein.

The Contractor shall direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Provisions wherever they may occur.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
03300	Cast-in-Place Concrete
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

##### **1.3 STANDARDS FOR THE WORK**

Pipe, fittings, wiring and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor. In order to meet

these requirements with equipment as furnished, minor deviation from the Plans may be made as authorized by the Engineer. All such minor deviations from the Plans that may include extending oil and lubrication fittings for accessibility and safety shall be executed at no additional cost to the Owner.

#### **1.4 MANUFACTURER'S INSTRUCTIONS**

The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

#### **1.5 SUBMITTALS**

##### **A. GENERAL**

Product Submittals shall be provided to the Engineer for all equipment specified in Divisions 11, 13, 14, 15, and 16, in accordance with Specification 01300, this Section and the respective equipment specification section. Submittals shall be dated and signed as certified for use in construction of this project.

##### **B. MANUFACTURER'S LITERATURE**

Manufacturer's literature shall be submitted for equipment, including, as applicable, performance characteristics, fan curves and pump curves, motor data sheets and methods of assembly.

The following minimum requirements shall accompany all manufacturers' literature submittals:

1. Description of materials.
2. Rating data - Mechanical and Electrical as applicable.
3. Motor Data including bearing and enclosure information.
4. List of any special tools and/or spare parts required and to be furnished, if any.
5. Exceptions taken to the specification and detailed explanation why the exception is being taken.
6. Additional specific information that is specified in the equipment sections.

7. For motor driven equipment served by variable frequency drives (VFDs), provide vibration and critical speed requirements of the equipment, minimum speed requirements of motor and driven machinery, acceleration and deceleration requirements of the equipment, and torque and speed information as per Part 1.6 of this Section.

#### C. SHOP DRAWINGS

Shop Drawings shall be submitted showing sizes and arrangement of equipment, foundations and anchor bolts required, control diagrams, wiring diagrams, pipe hanging details, ductwork layouts and connections to other work. The arrangement of mechanical equipment and appurtenant piping shown on the Plans may be varied as necessary to fit the certified manufacturer's installation drawings. However, the manufacturer's drawings shall not deviate from the Plans and Specifications as to location, size, type and design of equipment.

The following minimum requirements shall accompany all shop drawing submittals:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Connection sizes and orientation.
4. Capacity and location of lifting eyes.
5. Motor arrangement showing location of electrical connections.
6. Detail electrical wiring diagrams, showing component designation and rating, and the connection points and associated terminals and cable identification for connection to the process control system.
7. The Contractor shall ascertain the location of all electrical (power and control) connections in order to properly orient electrical conduits.

D. DESIGN CALCULATIONS

Seismic design calculations shall be submitted for equipment and for supports and anchorage for equipment.

Special seismic certification shall be submitted for all active mechanical and electrical equipment that must remain operable following an earthquake in compliance with ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components.

E. FACTORY TEST REPORTS

Factory tests shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard shall make that requirement a part of these Specifications. Conduct factory tests at the same speeds at which the equipment will operate in the field except as noted.

Where specifically noted, the Engineer may witness performance test. The Contractor shall inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified results shall be supplied by the Contractor to the Engineer.

Factory testing of pumps shall be done in accordance with the requirements and standards of the Hydraulic Institute. Tests of other equipment shall conform to the requirements set forth in these Specifications.

F. IDENTIFICATION OF DELIVERED EQUIPMENT

Each piece of equipment delivered to the project site shall be accompanied by a completed form which will contain at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.

5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number).
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure, insulation type, NEMA Code letter, dimensions, service factor, serial number.
7. Date and signature of person certifying performance.

G. MANUFACTURER'S AFFIDAVITS

Equipment manufacturers, or their authorized representatives, shall each submit a signed and dated written report with respect to their equipment certifying the following:

1. The equipment has been properly installed and lubricated
2. The equipment is in accurate alignment
3. The manufacturer was present when the equipment was placed into operation
4. The manufacturer has checked, inspected, and adjusted the equipment as necessary
5. The equipment is free from any undue stress imposed by connecting piping or anchor bolts
6. The equipment is not imposing any undue stress on any connecting members
7. The equipment has been operated satisfactorily under full load conditions
8. The manufacturer has inspected their equipment during the operational demonstrations and system validation tests to the extent specified
9. The equipment is fully covered under the terms of the guarantee

## **PART 2 PRODUCTS**

### **2.1 DESIGN**

All equipment shall be designed for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation, shall be adequately stayed, braced and anchored, and shall be installed in a neat and workmanlike manner. Appearance, safety, and utility shall be given consideration in the design of equipment. Materials of construction shall be cathodically compatible.

### **2.2 STANDARD REQUIREMENTS**

#### **A. MATERIALS**

Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

#### **B. UNIFORMITY**

Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

#### **C. SEISMIC REQUIREMENTS**

Supports and anchorage of equipment(s) shall comply with the requirements of the 2018 *International Building Code* (IBC) Section 1613 and ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components, as referenced and amended by the IBC. For the following design parameters:

- Risk Category III
- Site Class D
- The component Importance Factor:  $I_p = 1.0$
- Design response acceleration coefficients:

$$S_{DS} = 0.426g$$

$$S_{D1} = 0.254g$$

- Seismic Design Category D

#### **D. STANDARDS**

Provide equipment and materials suitable for service conditions and meeting standard requirements of ANSI, ASME, AWWA, ASTM, NEMA, IBC, NPC, UL and OSHA.

### **2.3 LUBRICATION**

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for a minimum of 1-year's consumption prior to completion, testing and final acceptance.

### **2.4 EQUIPMENT BASES AND BEDPLATES**

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate on a grout or concrete base unless otherwise shown or specified. Provide bases and bedplates with machined support pads, vibration pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide leveling screws in equipment bases and bedplates to aid in leveling prior to grouting.

### **2.5 ANCHORS AND FASTENERS**

Each equipment manufacturer shall furnish the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified. The manufacturer shall submit to the Engineer design calculations regarding recommended sizing and type of anchor bolts, nuts, and washers for securing the equipment, in accordance with the project seismic requirements.

Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All nuts, bolts and washers shall be Type 316 stainless steel. All leveling nuts shall be Type 316 stainless steel.

All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment, or equipment or piping subject to vibration.

Expansion type anchors are not to be used for any submerged applications unless specifically noted on the Plans.

Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Plans, expansion type anchors may be used.

## **2.6 SAFETY GUARDS**

Cover belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all applicable Federal, State, and local codes and regulations; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring loaded hinged doors with latch for service and lubrication access.

All pipes, manifolds, heaters, and other surfaces, which have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or otherwise guarded against contact.

Guards shall comply with the requirements of these Specifications, WISHA Standards, and "The Principles and Techniques of Mechanical Guarding" (OSHA 2057, 1973), whichever is more stringent.

## **2.7 LIFTING EYES**

All equipment weighing over 100 pounds shall be supplied with lifting eyes. Parts of equipment assemblies, which are normally serviced separately, such as motors, shall have individual lifting eyes.

## **2.8 ELECTRICAL COMPONENTS**

Equipment shall be manufactured, fabricated and installed in a manner which permits conduit connection to electrical power and control equipment from below the connection point, terminal box, or connection box without offsets or bends such that the conduit will drain away from the equipment.

Electric motors, control panels, accessories, etc., shall conform to the requirements of Divisions 11, 12, 13, 14, 15 (Equipment items) and Division 16, Electrical.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

All electrical components shall be recognized or labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the Project.

## **2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION**

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This list shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum speed, acceleration, etc. The list shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the motor information for the submitted equipment

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

## **2.10 NAMEPLATES/DATA PLATES/IDENTIFICATION**

Each piece of equipment and its driver shall be furnished with a stainless steel metal nameplate fastened to the item in an accessible position. This nameplate shall contain the manufacturer's name, equipment rating, capacity, size, model, serial number and speed. Data for motors shall be NEMA standard. All information written or printed shall be in English. Each item of equipment shall bear a different serial number. Measurement units shall be given for ratings and capacity.

Nameplates for tanks and pressure vessels shall give working pressure, test pressure, vessel plate thickness and ASME Code data.

Each piece of rotating equipment shall have a direction of rotation arrow.

Each piece of equipment shall be labeled using a plastic laminate label with the functional name and number of the equipment shown on the Plans or provided by the Engineer. Name and number shall correspond to those used on Motor Control Centers and Panels.

Labels shall be fastened to the equipment base or other acceptable location. The letters shall be at least ½-inch high with a border trim on all sides not less than ¼-inch. Color shall be green background with white letters. Fasteners shall be brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

Units of measure shall be shown on the indicating and totalizing dials of all meters, gauges and other measuring devices.

## **2.11 PROTECTION AGAINST ELECTROLYSIS**

Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

## **2.12 PAINTING**

Painting of all equipment shall be in accordance with Section 09900 of these Specifications.

## **2.13 NOISE**

Mechanical and electrical equipment shall not create sound levels that are in excess of that permitted by WISHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved.

## **2.14 PRESSURE GAUGE CONNECTIONS**

Provide tapped and plugged suction and discharge gauge connections on the pump nozzles or flanges. Where this is not possible, provide gauge connections on the piping immediately adjacent to the pump.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for new equipment installation.

### **3.2 PREPARATION**

Prior to installing equipment, ensure that the areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service the equipment in accordance with the Operation and Maintenance Instruction Manuals and specific requirements included in applicable Sections of these Specifications.

### **3.3 SPARE AND LOOSE PARTS**

Prior to equipment startup provide an inventory of spare and loose parts supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

### **3.4 INSTALLATION**

#### **A. EQUIPMENT**

Equipment shall conform to the approved submittals and Operation and Maintenance Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

#### **B. ANCHOR BOLTS**

Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed. Prior to assembly, the

Contractor shall coat all stainless steel bolts and nut threads with anti-seizing compound.

**C. BASE AND BEDPLATE GROUTING**

Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except around exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 consecutive days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform corrective work as required to conform to the tolerances given in the applicable Operation and Maintenance Instruction Manual.

The Contractor shall make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Plans. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the complete work. Unless otherwise authorized, all grout shall be a non-shrink, non-metallic grout as stated in Section 03300.

Where practicable, the grout shall be placed through the grout holes in the equipment base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

**D. PRESSURE GAUGES**

Pressure gauges shall be installed on all pump discharge piping at a location where the gauges can be easily read. The gauges shall be located upstream of the isolation valves, if possible. Gauges shall be installed on other equipment items as specified. The gauges are specified in Division 13 and shall be installed as detailed on the Plans.

**3.5 EQUIPMENT STARTUP AND ADJUSTMENT**

The Contractor, at their own expense, shall arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to:

- Supervise the equipment installation in accordance with the Operation and Maintenance Instruction Manual.
- Be present when the equipment is first put into operation.
- Inspect, check, adjust as necessary, and approve the installation.
- Repeat the inspection, check and adjust until all trouble or defects are corrected and the equipment installation and operation are acceptable.
- Witness and supervise operational demonstrations and system validation tests to the extent specified.
- Prepare and submit the specified Manufacturer's Affidavit.

The representative shall be experienced and knowledgeable regarding the equipment being tested.

The Contractor shall give initial lubrication to all equipment in accordance with the manufacturer's recommendations.

The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

All equipment shall be field tested and demonstrated to the Engineer that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Current draw and voltage on the motor for each phase shall be measured for each pumping rate measurement. For two-speed pumps, such tests shall be conducted at both speeds. For variable speed pumps, blowers or fans, these tests shall be conducted at minimum and maximum speeds and at the specified duty point.

The Contractor shall furnish and test equipment or measuring devices (including portable flow meters) required that are not part of the permanent installation. Tests for variable speed pumps, blowers, and other equipment shall be performed at 60 Hz and at the initial anticipated flow or capacity levels.

The field test shall demonstrate under all conditions of operation that the equipment:

- Has not been damaged by transportation or installation.

- Has been properly installed.
- Has no mechanical defects.
- Is in proper alignment.
- Has been properly connected.
- Is free of overheating of any parts.
- Is free of excessive noise.
- Is free of overloading of any parts.
- Shall operate as specified with the specified control system.

In addition, the entire facilities shall be demonstrated to be in full operating order prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the Contractor's expense.

Equipment start-up and adjustment shall take place before instruction of the Owner's personnel is performed.

### **3.6 INSTRUCTION OF OWNER'S PERSONNEL**

Conduct an instruction program for up to six operations personnel designated by the Owner in accordance with Specification Section 01800. Furnish the services of qualified instructors from the various equipment manufacturers for the duration specified in each specific Section. Include instruction covering basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment.

Provide the instruction program at the Owner's convenience before contract closeout. The Contractor shall audio- and video-record all training sessions, and also provide the Owner with any audio-visual training materials the manufacturer utilizes (i.e., DVDs, PowerPoint presentations, videocassettes etc.). Cost of instruction and audio-visual training materials shall be included in the bid price for the equipment.

### **3.7 SOUND LEVEL TESTING**

Measure the sound level developed by all mechanical and electrical equipment provided under the Contract Provisions. Perform testing in all rooms and spaces

containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instruments and record the highest sound levels developed when measured according to OSHA standards in each room and space. Deliver a certified copy of records to the Engineer.

**\*\*\* END OF SECTION \*\*\***

## SECTION 11200

### NON-POTABLE WATER SUPPLY SYSTEM

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing one complete, workable non-potable water supply system in the mechanical room of the operations building, to include two non-potable water supply pumps and a water storage tank with float valve, as shown on the Plans and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
09900	Painting
11000	Equipment General Provisions
15050	Piping Systems
15100	Valves
15400	Plumbing

##### 1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Vertical Multistage Booster Pump No. 1	01 BP 01
Vertical Multistage Booster Pump No. 2	01 BP 02

##### 1.4 PERFORMANCE REQUIREMENTS

Each pump in the supply system shall be capable of meeting the following performance requirements:

<b>Parameter</b>	<b>Performance Requirement</b>
Shutoff Head, 0 gpm	~104 psi
Design Operating Point, 50 gpm	85 psi
Maximum Pump Motor Size, each	5 hp

## **PART 2 PRODUCTS**

### **2.1 APPROVED PUMP MANUFACTURERS**

The pumps shall be Grundfos Model CR 10-5, or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Grundfos. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

### **2.2 PUMPS**

#### **A. GENERAL**

The pumps shall be close-coupled, with pump and motor built together as a complete unit and kept in permanent alignment. The pumps shall be vertical, multistage, inline, centrifugal pumps with suction and discharge ports for 2-in. flanged pipe connection on the same level. Each pump shall meet the performance requirements listed herein.

#### **B. CASING**

Casing shall be cast iron ASTM A48-30 B. Suction and discharge connections shall be Class 250 ANSI flanges, flat-faced. Casing shall be provided with renewable bronze wear rings to maintain proper running clearance and minimize leakage between suction and discharge side of casing.

#### **C. IMPELLER**

The impellers shall be of stainless steel AISI 304. The impeller shall be enclosed, single suction, one piece. All impellers shall be statically balanced; and where required, dynamically balanced. Impellers shall be mounted directly on the exposed motor shaft via a splined shaft arrangement.

#### **D. MOTOR**

The motor shall be standard, vertical, TEFC, electrical induction motors designed for continuous duty operation, meeting NEMA design B with a

1.15 SF and other applicable NEMA, ANSI, and IEEE standards. Motor shall be constructed with Class F insulation. The motors shall have drive end bearings adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate of the pump.

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

## **2.3 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION**

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

## **2.4 WATER STORAGE TANK**

The Contractor shall provide one water storage tank as shown on the Plans. The tank and lid shall be constructed of welded 1/4 in. steel in accordance with Section 05500 of these Specifications. The tank and lid shall be hot dip

galvanized after fabrication. The tank shall have a nominal volume of 200 gallons and have connections and openings as shown on the Plans.

## **2.5 FLOAT VALVE**

Float valve shall modulate to maintain a constant liquid level in the storage tank by controlling the flow into the tank via “Valve Closing” on rising level. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern, 2 in. size with flanged connection. Construction shall be cast iron body with removable cover. Internal components shall include 303 stainless steel stem, synthetic rubber disc, and flexible diaphragm. Flexible diaphragm shall be nylon fabric with synthetic rubber. The float valve shall be Cla-Val Model 428-01, or equal.

## **2.6 REMOTE FLOAT ASSEMBLY**

Remote float assembly shall include 304 stainless steel float, stainless steel float rod, and enameled steel base plate. Assembly shall be mounted above a PVC or HDPE fabricated pipe stilling well. Connect pilot lines to main valve per manufacturer’s instructions. The float assembly shall be Cla-Val Model CFM9 Remote Float Control, or equal.

## **2.7 PRESSURE RELIEF VALVE**

Pressure relief valve shall maintain a constant upstream pressure by bypassing excess pressure. Upstream pressure less than the spring setting shall close the valve. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern, 1 in. size with threaded connection. Construction shall be cast iron body with removable cover. Internal components shall include 303 stainless steel stem, synthetic rubber disc, and flexible diaphragm. Flexible diaphragm shall be nylon fabric with synthetic rubber. The pressure relief valve shall be Cla-Val Model 50-01, or equal.

## **2.8 PRESSURE SWITCHES**

Provide two pressure switches on the discharge line that is common to both pumps. The pressure switches shall be rated for 120 volt AC, 15 ampere pilot duty, in NEMA 4X enclosures, with adjustable setpoint and deadband. The pressure switches shall be used to control the lag pump and to provide a low pressure alarm. The pressure switches shall be Omega PSW-100 Series, or equal.

## **2.9 PIPING, VALVES AND APPURTENANCES**

All other piping, valves and appurtenances shall be in accordance with Sections 15050 and 15400 of these Technical Specifications.

## **2.10 SPARE PARTS**

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

All applicable gaskets.....	1 set
Wear ring .....	1
Impeller screw.....	1
Impeller key .....	1
Bearings .....	1 set
Shaft sleeve .....	1

## **2.11 PAINTING**

Piping, valves and accessories shall be painted in accordance with Section 09900 of these Technical Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

## **2.12 FACTORY TESTING**

The pumps shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

The Contractor shall install the non-potable water pumps and associated components as specified herein, as shown on the Plans, and in strict accordance with the manufacturer's instruction and recommendations.

### **3.2 FIELD TESTING**

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

### **3.3 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the pump manufacturer and the control valve manufacturer shall be provided separately. Services shall include 1 day (one visit) onsite for the supervision of installation, startup, and testing of each piece of equipment, and instruction of the Owner's personnel in the operation and maintenance of the equipment after the equipment is fully operational. The cost of these services shall be included in the bid price.

The representative shall provide for one additional service call during the initial 2 years of equipment operation.

**\*\*\* END OF SECTION \*\*\***

## SECTION 11261

### CHLORINE GAS LEAK DETECTOR

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing a chlorine gas leak detector with sensor module and receiver module as shown on the Plans and as specified herein. The detector shall be furnished and installed with all associated control, wiring and accessories required for a complete and operable chlorine gas detector as shown on the Plans and as specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
11260	Gas Chlorination Equipment
11264	Gas Shutoff System
11265	Chlorine Emergency Scrubber
Division 16	Electrical

##### 1.3 EQUIPMENT LIST

The gas detector equipment shall include the following:

- A. Receiver module
- B. Sensor/transmitter

##### 1.4 PERFORMANCE REQUIREMENTS

The chlorine detector shall detect chlorine in the following ranges:

Standard Range	0-10 ppm
Minimum Range	0-5 ppm
Maximum Range	0-50 ppm

## **1.5 DELIVERY, HANDLING, AND STORAGE**

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

## **1.6 WARRANTY**

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide a warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

The chlorine gas detector shall be Wallace & Tiernan Model Acutec A35 gas detection system or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Wallace & Tiernan. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

### **2.2 RECEIVER MODULE**

Each gas receiver module shall contain 4 separate LED indicators for operational and alarm status (Warning, Alarm, Sensor Failure, and Power). There shall be three separate alarm relays that can be assigned to the 2 alarm set points and configurable for normal/fail-safe, latching/non-latching, and fast/slow operation.

Relay contacts shall be rated 10A at 120 VAC, 5A at 250 VAC resistive, SPT. A fourth relay shall be provided to indicate a sensor failure in the event the transmitter cable is disconnected or the sensor fails the automatic integral autotest. A 4 digit sunlight readable LED to display gas concentration in PPM shall be provided in addition to a 4-20 mA output signal proportional to gas concentration. The operating range of the Sensor shall be field adjustable through DIP switches

in the receiver module. An acknowledge/reset button shall provide for: silencing the audible alarm, resetting the alarm circuit, LED indicator testing (on-demand activation of the sensor autotest), and alarm relay inhibition for servicing

### **2.3 SENSOR/TRANSMITTER**

The sensor/transmitter unit shall contain electrochemical gas sensor and a digital transmitter that sends a signal to the receiver module up to 1,000 feet away. The receiver shall be a detector type which shall provide two selectable levels of alarm. The receiver shall be provided with a power supply module accepting 120VAC input and transforming the supply to a 12VDC output for the receiver module. The sensor/transmitter shall be housed in a NEMA 4X enclosure suitable for wall mounting. It shall be an electrochemical type, specific for the gas being monitored, and be provided with an operating life of two years.

The sensor shall not require the addition of chemicals.

The transmitter shall be powered from the Receiver through a 2-conductor cable up to 1,000 ft. long. This same cable shall transmit a current pulse position signal, for improved noise immunity, representative of gas concentration back to the Receiver. The Sensor shall be fitted with an integral electrochemical gas generator that automatically produces a specific gas sample to test the Sensor response daily.

### **2.4 POWER SUPPLY MODULE**

The Power Supply Module should be provided to accept any AC input between 85 and 255 volts, 50/60 HZ and automatically convert this into a 13.7 VDC output for powering 1 Receiver Module(s).

Loss of input power shall be indicated by a built-in power failure relay.

A battery back-up system shall be provided. The battery pack shall consist of a sealed lead-acid battery mounted in a separate enclosure. The battery back-up shall maintain all gas detection system functions for a minimum of 12 hours in the event of a power failure. The Power Supply Module shall continuously and automatically recharge the battery.

The module shall be rail-mounted for flexibility in a NEMA 4X polystyrene enclosure suitable for wall mounting. A clear, hinged polycarbonate window with push-button latches shall be included to provide easy access to the control modules.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The gas chlorine detection equipment shall be installed as specified herein and as shown on the Plans and in accordance with the manufacturer's recommendations. The sensor/transmitter shall be mounted 12 inches above the floor surface.

### **3.2 FIELD TESTING**

The Contractor shall perform the field testing described in Sections 01800 and 11000. Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor. The gas detection equipment shall be tested with small quantities of chlorine gas. The system shall be demonstrated to work in conjunction with the gas shutoff equipment specified in Section 11264 shall shut the valve to the chlorine gas cylinders.

### **3.3 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the chlorination equipment manufacturer shall be provided. Services shall include four hours onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. The cost of these services shall be included in the bid price.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 11264**

### **GAS SHUTOFF SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this section includes automatic closing fail safe chlorine gas cutoff systems for 150 lb. cylinders as shown on the Plans and specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
11261	Chlorine Gas Leak Detector
11265	Chlorine Emergency Scrubber
Division 16	Electrical

##### **1.3 EQUIPMENT LIST**

The gas shutoff system shall include the following:

- A. Actuator
- B. Controller
- C. Wall Mount Stowage Bracket
- D. Emergency Shutoff Switch

##### **1.4 PERFORMANCE REQUIREMENTS**

The emergency chlorine shutoff system is intended to automatically and rapidly stop the flow of chlorine from a cylinder in the case of a feed system leak or emergency.

##### **1.5 EXPERIENCE REQUIREMENTS**

The manufacturer of the emergency chlorine shutoff system shall have a minimum of 20 years of experience in the manufacture of equipment of similar type and size as that specified herein.

## **1.6 DELIVERY, HANDLING, AND STORAGE**

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

## **1.7 WARRANTY**

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide a warranty covering defects in material and workmanship for 3 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

The gas shut off system shall be the Halogen Terminator Actuator with Gemini Controller Model 8001.14 or approved equal system.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Halogen. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

### **2.2 ACTUATOR**

The electric actuator shall mount upon the chlorine cylinder valve stem by means of a bronze drive bushing and two parallel rods that straddle the gas valve body. No clamping mechanisms or mounting tools of any kind shall be required for ease of installation and for rapid access to valve in the event of an emergency. The installed actuator shall not restrict access to the valve packing nut and yoke or clamp in the event they require tightening.

The actuator shall have the following capabilities:

- Integral leak detection with automatic shutdown.

- Remote control by leak detector, panic button, or other digital signals such as PLC or computer.

The actuator shall have a 12-volt DC electric motor acting through a direct drive ratchet assembly that applies proper closing torque. Actuator power shall be provided by the controller. The actuator shall be powered only in the closing direction to eliminate unintended or accidental opening of the cylinder valve. The valve stem for each cylinder shall be opened manually by means of a wrench prior to mounting the actuator.

The actuator shall allow installation on a valve using a yoke style process connection. The actuator shall be compatible with all direct mount vacuum regulators commonly used in the industry without the need for adapters, installation brackets, or modification.

All external metal components shall be epoxy powder coated for corrosion resistance. Shaft entrances to the actuator mechanism shall be sealed with O-ring seals of Viton or Teflon. The motor canister and main enclosure shall be sealed with static Viton O-rings. The enclosure shall be NEMA 4X.

The element that couples the driven shaft to the valve stem shall be designed to accommodate slight misalignment of the actuator shaft with the axis of the valve stem without restricting rotation.

The actuator can be mounted along with vacuum regulator systems commonly used in the industry.

## **2.3 CONTROLLER**

The controller shall be contained within a single electrical enclosure of NEMA 4X rating. All cables, connectors, switches and fittings shall be of a similar rating to resist the chemical environment. The controller shall have an internal 12 VDC gel cell lead acid type battery rated at 8 ampere-hours to provide power to the controller and actuator. An internal battery charging circuit shall provide a variable controlled charge current that is temperature compensated to optimize battery performance and service life. In the event of a loss of AC charging power, the battery shall provide 24 hours of backup time. During a sustained loss of AC charging power, the microprocessor shall detect a declining battery charge and initiate an emergency close sequence while sufficient power remains to apply the specified closing torque to the valve stem.

The controller shall use flexible cable suitable for direct placement in the chlorine room environment to deliver DC electric power to the actuator.

The controller shall contain a microprocessor programmed to precisely control the valve closing cycle time and apply the required torque to the valve stem. The microprocessor shall also monitor and display the status of the battery, charging power and system readiness as well as provide a diagnostic system check during the test cycle. Electro-mechanical relays or contacts, which are susceptible to corrosion failure, shall not be used in the control circuitry. The entire control system shall be comprised of encapsulated solid state devices.

The controller shall have a membrane control panel with system status LED lights. Light conditions shall indicate ARMED/READY status, BATTERY status and BATTERY CHARGER status. The membrane control panel shall have an actuator test key to allow a full cycle test of the actuator. The test cycle shall include a microprocessor self-test, cable/motor continuity test, and battery load test. Test procedures as outlined on the control panel label shall provide the operator with go/no go criteria. Test results shall be confirmed by operator observation and by the tactile force required to reopen the valve.

The controller shall accept multiple incoming signals from sources such as gas detectors, remote station alarms, seismic or fire sensors and manual panic switches to activate an emergency chlorine shutoff. External signals shall be of the normally open dry contact closure type. Input shall be configurable by moving a jumper on the controller mainboard to allow for a normally closed circuit.

A standard low voltage relay output rated at a maximum of 1 amp @ 24V shall be provided. After the completion of an emergency shutoff, the relay shall momentarily activate. The relay shall have the ability to be wired as normally open or normally closed.

Power for the controller battery charging circuit shall be 115 / 230 volts AC, 60 Hz, single phase. Maximum current consumption shall be 0.9 amp at 115 VAC (110 watts).

## **2.4 ACCESSORIES**

Standard accessories for each actuator system shall include one wall mounted stowage bracket for temporary placement of the actuator during cylinder changes and one remote mount emergency shutoff switch.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The gas chlorine detection equipment shall be installed as specified herein and as shown on the Plans and in accordance with the manufacturer's recommendations. Install emergency shutoff switch at location as determined by the Engineer.

### **3.2 FIELD TESTING**

The Contractor shall perform the field testing described in Sections 01800 and 11000. Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor. The gas detection equipment shall be tested with small quantities of chlorine gas. The system shall be demonstrated to work in conjunction with the gas detector specified in Section 11261 to shut the valve to the chlorine gas cylinders when chlorine gas is detected.

### **3.3 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the gas shutoff system manufacturer shall be provided. Services shall include 1 day (one visit) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. The cost of these services shall be included in the bid price.

**\*\*\* END OF SECTION \*\*\***

## SECTION 11265

### CHLORINE EMERGENCY SCRUBBER

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing a Chlorine Emergency Scrubber as shown on the Plans and as specified herein. The system shall include a gas chlorine scrubber vessel, blower assembly, differential pressure gauge, dry media sample ports, electrical equipment, and appurtenances for a complete and workable installation.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
11261	Chlorine Gas Leak Detector
11264	Gas Shutoff System
13417	Pressure Gauge
Division 16	Electrical

##### 1.3 EQUIPMENT LIST

The chlorine emergency scrubber equipment shall include the following:

1. Scrubber vessel
2. Dry media
3. Differential pressure gauge
4. Blower/motor assembly
5. Control/motor starter panel

##### 1.4 PERFORMANCE REQUIREMENTS

The Chlorine Emergency Scrubber shall consist of a chlorine gas dry scrubber vessel, which shall utilize dry media to adsorb chlorine gas during a leakage event, and shall be capable of detecting when the chlorine gas level in the chlorine room is above one half the Immediately Dangerous to Life or Health (IDLH) concentration for chlorine gas, which is 10 parts per million (ppm) as defined by the US National Institute for Occupational Safety and Health (NIOSH).

The treatment system shall be capable of neutralizing the contents of the largest single vessel, which is a 150-lb cylinder.

## **1.5 EXPERIENCE REQUIREMENTS**

The Chlorine Emergency Scrubber assemblies, motors, and all accessories and controls shall be supplied by a single Supplier who is fully experienced, reputable, and qualified in supply of the equipment to be furnished.

The Supplier shall have a minimum of 5-years' experience in supplying emergency chlorine gas scrubbing equipment that is effective in converting chlorine to non-toxic solids.

The Supplier shall have a minimum of five installations of emergency chlorine gas scrubbing equipment. A reference list for full scale operating installations, not pilot or demonstration facilities, shall be supplied with equipment submittals. This list shall include the names and telephone numbers of contacts. Reference installations shall be equal or greater in capacity than the equipment required for this Project.

## **1.6 DELIVERY, STORAGE AND HANDLING**

All equipment shall be skid-mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

Finished surfaces of all exposed flanges shall be protected by wooden or fiberboard blank flanges strongly built and securely bolted thereto.

No shipment shall be made until the equipment submittals are approved by the Engineer in writing. Shipment is not to be made until the manufacturer coordinates shipment to the jobsite with the Contractor, assuring that the equipment will be properly received and stored. Upon receipt, store equipment in strict accordance with the manufacturer's instructions, connect and energize motor space heaters and any other protective devices, as required.

## **1.7 WARRANTY**

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

The Chlorine Emergency Scrubber shall be as manufactured by De Nora Water Technologies, Inc., PureAir Filtration, or equal.

The structural, mechanical, electrical and instrumentation designs for the Chlorine Emergency Scrubber are specific to the equipment manufactured by PureAir Filtration, as specified herein. Any structural, mechanical, electrical or instrumentation modifications required to utilize the equipment actually furnished shall be made by the Contractor at no additional cost to the Owner. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

### **2.2 SCRUBBER VESSEL**

The entire system shall be a skid mounted, packaged system. The chlorine emergency scrubber vessel shall be configured to allow discrete sampling of the media beds to determine the extent of spent media in the direction of airflow, and to allow replacement of the spent media without removing and replacing the entire media column/bed. Discrete beds may be preferred for ease of operations and maintenance.

The scrubber vessel shall be a vertical, PureAir ECGS-150, 4-foot diameter, fabricated of FRP (Hetron 922, or Derakane 41 1 Vinyl Ester Resin with an MEKP cure system). The vessel shall be skid mounted complete with an FRP blower. Media shall be supported by a chlorine resistant perforated screen. The perforated screen shall be supported along the internal walls of the vessel by FRP angles integrally bonded to the vessel walls. In addition, the span of the perforated screen shall be supported by three uniformly spaced rectangular beams. The beams shall be integrally bonded to-the vessel sidewall for maximum support.

The resin used shall be suitable for continuous exposure to a wet chlorine/air mixture with maximum operating temperature of 200°F. A certified letter of suitability for all resins must be submitted with the bids. A corrosion barrier on the inner surface shall be a Hetron 922 vinyl ester resin measuring a minimum of 10-20 millimeters. The resin shall be composed of reinforced non-continuous glass fiber strands applied in two plies of chopped strand mat equivalent to three oz/ft. The inner resin layer shall not exceed 10% + 15% "C" glass by weight. Filament wound laminates shall have an average glass concentration of 50-55% by weight. Hand Layup laminates when used on the vessels and equipment shall be fabricated to meet the physical properties in accordance with PS 15-69 product

standard. Press molded, or compression mold flanged nozzles are acceptable up to and including 6-inch nominal size.

All access doors and hatches shall use closed cell neoprene gasketing to prevent any air leakage.

All gasket material shall be ¼-inch thick by 0.75-inch wide open cell neoprene foam.

Service doors and all unit access shall be oriented to suit field conditions or requirements.

Each bed shall have one (1) 1-inch diameter sample port which shall extend into the bed a minimum of twelve inches. The sample probes shall be blocked off with a cap constructed of CPVC.

The system shall be provided with a straight outlet with rain cap, to prevent rain water from entering into the system.

Scrubber housing and all components which will hold a chlorine release shall be fabricated without caulked, screwed or riveted joints, but rather seamless materials, welded construction, or gasketed joints (gasket material must be compatible with chlorine).

## **2.3 DRY MEDIA**

The chlorine scrubber shall contain a minimum 2,350 pounds of Safetysorb media to scrub one (1) overfilled 150-lb bottle of chlorine gas cylinder (176 pounds).

The chlorine removing media must have been tested for conformance with the specifications and removal requirements and installed in at least five prior and similar applications. Test results and qualifications shall be submitted. If a separate or subcontract media supplier is utilized, the bids shall include technical qualifications for the media supplier, and the bid shall be submitted as a partnership.

Media shall have an alumina oxide substrate and be spherical in shape, porous, non-flammable and capable of removing chlorine throughout the entire media bed. Impregnants shall be applied during pellet formation, such that the impregnate is uniformly distributed throughout the pellet volume. Only media components which are compatible with chlorine shall be used. No ingredient listed on the MSDS for chlorine as incompatible shall be used including activated carbon. Media shall be capable of absorbing and removing chlorine throughout the entire pellet volume and shall be totally nonflammable and shall be UL Classified, Class 1. Media with carbon in the substrate will not be acceptable.

**A. DRY MEDIA CONTAINMENT SECTIONS**

The media containment section(s) shall be designed for bulk placement of new media into the unit through latched access hatches; and removal from the unit by vacuuming or manual handling, through media unload doors. The media containment section(s) shall be separated to assure filling and removal of individual beds as required. Specially designed fill chutes shall allow for media settling but shall preclude bypass of contaminated air.

**2.4 DIFFERENTIAL PRESSURE GAUGE**

A Series 2000 differential pressure gauge as manufactured by Dwyer Instruments shall be provided to continuously monitor the pressure drop across the media beds. The differential pressure gauge shall be mounted on the vessel and provide a local read-out of pressure drop through the media stage(s).

**2.5 BLOWER/MOTOR ASSEMBLY**

One (1) Fan shall be supplied and shall be fiberglass reinforced plastic, centrifugal type with backward inclined or radial blade, industrial fiberglass fan. Fan wheel shall be statically and dynamically balanced. Fiberglass construction shall conform to PS 15-69 product standards. Fan resin shall be suitable for exposure to the specific service conditions. Fans shall be Verantis or equal.

Fan housing shall be constructed of fiberglass and reinforced with rigid bracing to increase structural integrity. Bearing support brackets shall be positioned to directly oppose belt tension forces.

Fan housing shall be a curved scroll design with a 1-inch NPT drain connection at the bottom of the fan scroll. Fan outlets shall have flanged nozzles. Fan shaft shall be 316 stainless steel. Fan shall have self-aligning grease-packed bearings, with neoprene shaft seals and OSHA approved weather proof motor/drive cover. The airflow rate of the fan shall be a minimum 500 CFM at 8-inch W.C. static pressure.

Fan shall have a 5HP/60 Hz 230/460-volt Mill & CHEM motor with a 1.15 service factor. Fan shall be as manufactured by Verantis or equal. The scrubber manufacturer shall determine the motor horsepower.

The fans shall be mounted alongside the scrubber gas outlet. The interconnecting ducting between the scrubber tank outlet and fan inlet is to be supplied by the scrubber manufacturer.

Provide two (2) spare V-belts.

The contractor shall supply all room gas inlet ducting and connect to the scrubber gas inlet connection. The contractor will also supply all exhaust ducting as shown in the contract drawings.

## 2.6 MOTOR/CONTROL STARTER PANEL

### A. APPROVED MANUFACTURERS

Motors shall be by Baldor, US Motors, Reliance, Vernatis or equal. No other manufacturers shall be accepted.

### B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
<b>Blower</b>	
Motor Size	5 hp
Operating Voltage	480 VAC
Phase	3
Frequency	60 Hz
Synchronous Speed	1,800 rpm
<b>Parameter</b>	<b>Specification</b>
Inverter Duty?	No (Non-VFD)
Motor Overload Protection?	Yes
Classified Environment?	No

### C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal/vertical, WP-1 drip proof/TEFC/TENV premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper. Motor design shall be Type B (Standard), C (High Starting Torque)

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor

and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

## **2.7 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION**

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

## **2.8 SPARE PARTS**

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Blower Drive Belts .....two

## **2.9 FACTORY TESTING**

Contractor shall provide test results showing that the media that will be supplied can maintain a continuous air discharge containing less than 1 ppm Cl<sub>2</sub> concentration throughout the test. The test is meant to simulate the release and subsequent chlorine removal from a catastrophic tank failure. During the test, the same total flow rate of gas is maintained through the bed. However, the chlorine concentration, in air, for the first minute is approximately 40% then drops to approximately 10% for the remainder of the test. The first minute simulates the initial flash of 400 lbs of chlorine, then the remaining time simulates the subsequent evaporation of the remaining chlorine at a rate of 80 lbs per minute.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The Chlorine Emergency Scrubber shall be manufactured in accordance with the best applicable trade practices and in compliance with state, OSHA, and other governing code requirements.

The equipment shall be installed to provide a complete working system. Installation shall follow the manufacturer's recommendation and as shown on the Plans.

### **3.2 FIELD TESTING**

Submit a Detailed Performance Testing Plan which includes:

1. Test equipment and apparatus.
2. Calibration and setup procedures.
3. The specific testing methodology to be used.
4. The sampling and analysis procedures.

Submit a final report that provides a narrative of the sampling activities, a copy of the original sample log, tabular summary of the data, calculated results, and conclusions of these results.

Field performance tests shall be conducted by the gas scrubber manufacturer and performed for 4 hours. The gas scrubber shall be tested for compliance with the specifications to demonstrate that all components function properly and that the unit produces the required airflow rate. The gas scrubber system will be tested

using the automatic method of control. All control work shall be completed prior to the field tests. The field tests will not require leaking of chlorine, except to activate the gas detectors. Field testing shall include measurement of at least the following:

1. Airflow rate from chemical storage room
2. Pressure drop through the scrubber

### **3.3 MANUFACTURER'S SERVICES**

Upon completion of the installation and as part of the manufacturer's field services, a total of 2 consecutive days (8-hour days) shall be provided to instruct the owner's staff on system operation, maintenance, and media sampling.

Such service shall be provided at the manufacturer's expense for a period of ten years.

**\*\*\* END OF SECTION \*\*\***

## SECTION 11305

### ROTARY LOBE PUMPS

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing new rotary lobe positive-displacement pumps as shown on the Plans and specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
Division 16	Electrical

##### 1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Sludge Pump No. 1	11 SP 01
Sludge Pump No. 2	11 SP 02

##### 1.4 PERFORMANCE REQUIREMENTS

A. Rotary lobe pumps shall meet the following performance requirements:

Parameter	Performance Requirement
Flow (gpm)	27
Operating Pressure (TDH, psi)	14 ft
Solids Concentration Range (percent)	2%
Pump Rotor Operating Speed (rpm)	421

##### 1.5 WARRANTY

In addition to the warranty required in the General Conditions, the pump manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The

warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

## **1.6 SUBMITTALS**

Submittals shall be in accordance with Sections 01300 and 11000. In addition, if a pin joint pump is provided, the Design Calculation submittals shall include the following:

- A. Certification that the pin joint pressure capability is adequate for each pump supplied.
- B. Certification that the pin joint thrust loads are adequate for each pump supplied.
- C. Calculations showing determination of the pin joint thrust loads and proposed safety factor.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

All pumps in this section shall be supplied by the same manufacturer.

The digested sludge transfer pumps shall be a Vogelsang VX100-45Q, with a piggy back mounted integral motor or an equivalent pump manufactured by Borger.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Vogelsang. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

In order to assure uniform quality, product functionality, and ease of maintenance; all of the equipment specified in this Section shall be supplied by a single manufacturer. The Contractor shall be responsible for ensuring a complete and workable installation.

## **2.2 PUMPS**

The pumps shall be of the positive displacement, rotary lobe type, designed to pump aerobically-digested waste activated sludge and scum. All fluid-wetted parts including the mechanical seal shall be replaceable through the quick release front cover without disassembly of coupling, drive unit or the pipe system.

The pumps shall be designed to temporarily run dry and to operate in either direction. Oil-quench for protection of the mechanical seal is mandatory. Seal water flush systems are not acceptable.

The pumps shall be constructed with an oil-filled intermediate chamber between the pump casing and the gearbox with the following functions:

- A. Oil-quench (lubrication and cooling) of the mechanical seals
- B. Visual detection of seal failures
- C. Buffer zone to the sealed timing gear

Oil drain of gearbox and intermediate chamber shall be easily accessible with side mounted drain screw. Oil drain under the pump is not acceptable. The rotor/shaft connection shall be oil-lubricated fed by an intermediate chamber and shall not come in contact with the pumped fluid.

## **2.3 CASING**

The pump casing shall be manufactured in a single block construction, cast iron ASTM A48 grade 40, Brinell hardness 264 Brinell. Multiple piece design pump casings held together by screw connections are not acceptable.

The rear of the pump casing and the front cover and radial surfaces shall be protected with replaceable wear plates with a hardness of 550 Brinell. The front cover protection plate shall be reversible. Pump casings without radial liners are not acceptable.

The quick release cover shall be held in place by four eye nuts. The stationary threaded studs shall keep the front cover on the same level as the pump casing in the process of opening the pump for easy handling.

## **2.4 ROTORS**

Rotors shall be dual lobe screw rotor design and shall consist of a non-sludge-wetted cast iron core entirely coated with abrasion-resistant Buna-N. Stacking of lobes is not acceptable. Rotors shall be keyed to the shaft with one central screw

to a cylindrical thread inside the shaft. The cast iron core of the rotor shall be equipped with a female thread to enable the removal of the rotor from the shaft with ease. Rotor/shaft designs with a cover disc and/or spring washers are not acceptable.

## **2.5 SHAFTS AND SLEEVES**

The shafts shall be non-sludge-wetted; the rotor/shaft connection shall be lubricated with quench fluid of the intermediate chamber. They shall be timed in their rotation by straight cut timing gears running in a separate oil chamber, which also contains the ball and roller bearings for each shaft. Sludge wetted rotor/shaft connections are not acceptable. The shafts shall be constructed from carbon steel AISI 4140.

## **2.6 MECHANICAL SEALS**

The pumps shall be fitted with maintenance free, quenched mechanical seals with duronit seal faces. The seals shall be operating in a common oil-filled intermediate chamber. Purge systems for the seals are not acceptable. The rotating holding bush shall be locked in a fixed radial position by a keyway that also holds the rotor in the correct location. Seal designs that open during rotor replacement are not acceptable. No sleeves shall be necessary for the mechanical seal setup. Design of the pump shall allow removal and replacement of the seal via the front cover.

## **2.7 MOUNTING**

Pump and drive shall be fitted on common base, made from galvanized steel complete with all necessary guards and mounting hardware. The pumps shall be vertical, close-couple, mounted. All pump bases shall be suitable for installation as shown on the Plans.

## **2.8 BEARINGS**

Bearings and timing gear shall be located in a common oil-filled cast iron gearbox, fitted with a built in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors. Bearing life shall be designed for L-10 bearing life rating of 100,000 hours at design conditions.

## **2.9 GEARBOXES**

The pumps shall be driven by an integral, parallel, vertical, helical gearmotor. Connection to the pumps shall be direct coupled with integral gearmotor. Speed reducer design and rating shall be equal or exceed AGMA requirements, thrust bearing life shall be L10, and be selected for AGMA Class 2 service. Helical

garmotors shall be Nord Gear Corp., or approved equal. The pumps, gear reducers and motors shall be on a steel base plate complete with necessary couplings, guards, and mounting hardware.

## 2.10 MOTOR

### A. APPROVED MANUFACTURERS

Motors shall be by Baldor, US Motors, Reliance, Nidec, or Toshiba/Houston. No other manufacturers shall be accepted.

### B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
<b>Sludge Transfer Pumps</b>	
Motor Size	3 hp
Operating Voltage	230/460 V
Phase	3
Frequency	60 Hz
Synchronous Speed	1,180 rpm
Inverter Duty?	Yes
Motor Overtemperature Protection?	Yes
Classified Environment?	Yes

### C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal, TEFC premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class H insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper. Motor design shall be Type B.

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

**D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES**

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical, and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

**E. MOTOR OVERTEMPERATURE DETECTION**

Motor over temperature shall be provided. The method of motor over temperature detection shall be as follows.

**1. Thermal switches**

Where selected, thermal switches shall be Normally Closed (NC) and shall be sized by the motor manufacturer to open 10 degrees C below the maximum allowed operating temperature for the insulation class and ambient ratings specified herein. These switches shall be internally series connected by the manufacturer with two insulated leads brought to the motor junction box for user connection. These switches shall be suitable for 120 VAC or 24 VDC control circuit applications at 5 Amps.

**2.11 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION**

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

## **2.12 HARDWARE**

All machine bolts, nuts, and cap screws shall be the hex head type and shall be Type 316 stainless steel. Hardware (or parts) requiring special tools or wrenches shall not be used.

## **2.13 SPARE PARTS**

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Rotary lobes and o-rings .....	1 set per pump
Axial protection plates.....	1 set per pump
Radial protection plates .....	1 set per pump
Mechanical seals and o-rings .....	1 set per pump

## **2.14 PAINTING**

Pumps and motors shall be painted in accordance with Section 09900-2.2.C of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

## **2.15 FACTORY TESTING**

The pumps shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The

Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's recommendations. Pump bases shall be securely anchored to the concrete equipment pad using Type 316 stainless steel bolts.

### **3.2 FIELD TESTING**

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

### **1.3 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the pump manufacturer shall be provided by the Contractor. Services shall include two days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 11600**

### **LABORATORY EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes furnishing and installing laboratory equipment, as shown on the Plans and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals
15400	Plumbing
Division 16	Electrical

##### **1.3 DELIVERY, HANDLING, AND STORAGE**

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

##### **1.4 WARRANTY**

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

#### **PART 2 PRODUCTS**

##### **2.1 GENERAL**

All electrical equipment shall be equipped with proper electrical #12 AWG SO cords and NEMA 5-15P or NEMA 5-20P plugs. All electrical equipment shall be suitable for 120 volts AC, single-phase, 60 Hz electrical power, unless otherwise noted in the Plans.

## 2.2 SCHEDULE OF EQUIPMENT

The following items are referenced to VWR and Hach catalog numbers to indicate the required type and quantity.

VWR	Quantity		Description
89238-616	1	each	Undercounter BOD Refrigerated Incubator
10805-316	1	each	Precision 19L Coliform Water Bath
54908-037	1	each	Vacuum/Pressure Pump
10014-938	1	kit	Orion Dual Star pH/ISE Dual Channel Benchtop Meter Ammonia & pH Kit w/ Accessories
76122-406	1	each	Professional Plus Phase Trinocular Microscope
10204-966	1	each	A-Series Precision Balance w/ Draft Shield
11277-542	1	each	Balance Dampening Marble Slab
58619-000	1	each	Autoclave / Sterilizer
75871-664	1	each	Glass Desiccator
30631-232	1	each	Muffle Furnace
97007-124	1	each	Drying Oven
470012-298	1	each	Vantage Pro2 Wireless Weather Station
89090-216	2	each	Digital Stirrer/Hot Plate

Hach Catalog No.	Quantity		Description
9624700	1	each	DR1900 Portable Spectrophotometer
HQ440D	1	each	Laboratory BOD Meter with Optical Sensor

## 2.3 EQUIPMENT SAFETY

The Contractor shall supply Material Safety Data Sheets (MSDS) for all applicable pieces of equipment. At a minimum, this shall include all chemicals and standards, (wet or dry), and all equipment that poses a potential health hazard to laboratory personnel. MSDSs shall be placed neatly into a three ring binder that shall remain with the Owner.

The Contractor shall also provide operations manuals for all electronic or measuring equipment as specified in Section 11000. These manuals shall be placed neatly into a three-ring binder that shall remain with the Owner.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Coordinate delivery and installation of equipment with the Engineer.

All laboratory equipment items shall be delivered in original containers. The Contractor shall check for shipping damage and verify that all items have been received before turning the equipment over to the Owner who will verify that all items have been received and are in an acceptable condition.

Laboratory equipment shall not be delivered to the job site until the Operations Building is sufficiently completed to provide for proper storage in a heated, clean, and dry location and the Owner agrees with the proposed delivery time.

Where apparatus and appliances, which require electrical service, are supplied without line cords, the Contractor shall furnish a line cord and plug which is compatible with the service required and/or available outlets.

Unless specifically directed otherwise, remove all crates and other packing material from jobsite.

### **3.2 MANUFACTURER'S SERVICES**

The services of factory-trained representatives of equipment manufacturers shall be provided by the Contractor, for laboratory equipment items requiring assembly, calibration, or other procedures for proper operation and maintenance. For each piece of such equipment services shall include 1 day (4 hours) onsite for instruction of the Owner's personnel in the operation and maintenance of the equipment. Instruction and training of the Owner's personnel shall not take place until the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

**\*\*\* END OF SECTION \*\*\***

**DIVISION 12**  
**FURNISHINGS**

## **SECTION 12356**

### **PLASTIC LAMINATE FACED CASEWORK**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes furnishing and installing plastic laminate faced casework and accessories as shown on the Plans, and as specified herein.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals
12452	Appliances

##### **1.3 SUMMARY**

A This Section includes the following:

1. Plastic-laminate-faced cabinets.
2. Plastic-laminate-faced countertops and worktops.
3. Plastic-laminate-faced windowsills.
4. Plastic-laminate-faced shelves.
5. Hardware.
6. All accessory items noted on details or specified in manufacturer's latest specifications to provide a complete assembly.
7. Chemically resistant resin countertops.

##### **1.4 DEFINITIONS**

A EXPOSED SURFACES OF CABINETS

Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

**B SEMI-EXPOSED SURFACES OF CABINETS**

Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as “semi-exposed.”

**C CONCEALED SURFACES OF CABINETS**

Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as “concealed.”

**1.5 SUBMITTALS**

**A PRODUCT DATA**

For the following:

1. Casework.
2. Plastic laminate countertops, worktops, shelves, sills.
3. Hardware.

**B SHOP DRAWINGS**

For all plastic laminate fabrications, include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, grommets, and cutouts for plumbing fixtures.

**C SAMPLES FOR INITIAL SELECTION**

Manufacturer’s color charts consisting of units or section of units showing the full range of colors. Textures and patterns available for each type of material exposed to view.

**1.6 QUALITY ASSURANCE**

**A SOURCE LIMITATIONS FOR CABINETS**

Obtain cabinets through one source from a single manufacturer.

## **1.7 PROJECT CONDITIONS**

### **A ENVIRONMENTAL LIMITATIONS**

Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

### **B ESTABLISHED DIMENSIONS**

Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

## **1.8 COORDINATION**

Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

#### **A MANUFACTURERS**

Subject to compliance with requirements, provide products by one of the following:

1. Plastic Laminate Surfacing Material for Countertops
  - a. Formica Corp.
  - b. Wilsonart.
  - c. Nevamar Corp.
2. Cabinets
  - a. Pacific Cabinets.
  - b. Northwest Woodworks.
  - c. Genothern Casework.

- d. Valley Cabinets, Inc.
- e. Fremont Millwork Co.
- f. Approved equal.

## **2.2 COLORS, TEXTURES AND PATTERNS**

- A Colors, Textures and Patterns: As selected by Engineer from manufacturer's full range of laminates including premium grades.
- B Allow for a selection of up to seven plastic laminates of distinct color, texture and pattern.

## **2.3 CABINET MATERIALS**

### **A EXPOSED MATERIALS**

#### **1. Plastic Laminate**

High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

### **B SEMI-EXPOSED MATERIALS**

Unless otherwise indicated, provide the following:

#### **1. Plastic Laminate**

High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

#### **2. Cabinet Liners**

High pressure melamine laminate .027 thickness.

### **C CONCEALED MATERIALS**

Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility.

**D      EDGE BAND**

High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

**2.4      COUNTERTOP MATERIALS**

**A      PLASTIC LAMINATE**

High-pressure decorative laminate complying with NEMA LD 3, Grade HGS.

**B      PLYWOOD**

Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded.

**C      CHEMICALLY RESISTANT**

1-inch solid, acid resistant finish Modified epoxy resin, with 4-inch applied curb.

**2.5      CABINET HARDWARE**

**A      GENERAL**

Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Engineer from manufacturer's full range.

**B      DRAWER AND DOOR PULLS**

Manufacturer's standard brushed stainless steel wire pull.

**C      HINGES**

Concealed, 170 degree, European-style hinges. Blum #75M5580.

**D      DRAWER GUIDES**

Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers. Accuride #3832, 100 lb rating typical.

**E      HARDWARE**

Concealed where possible.

**F      GROMMETS**

One-inch-diameter vinyl with removable cap. Color as selected from manufacturer's standard colors.

**G      SHELF PINS**

All shelf pins to be seismic double pin captive shelf support.

**H      SUPPORT BRACKETS**

Extra heavy duty 18"x24" t-bar countertop support brackets. Rakks "EH" Series by the Rangine Corporation or equal. Colors as selected from manufacturer's standard colors.

**2.6    CABINET CONSTRUCTION**

**A      FACE STYLE**

Flush overlay; door and drawer faces cover cabinet body members or face frames with only enough space between faces for operating clearance.

**B      DOOR AND DRAWER FRONTS**

11/16-inch-thick plywood with plastic-laminate faces, backs and 3mm PVC edge banding. Provide same grade, pattern, color and texture of plastic laminate for backs as for faces.

**C      EXPOSED CABINET ENDS**

Plastic-laminate-faced plywood.

**D      CABINET ENDS**

3/4-inch (19-mm) thick plywood.

**E      CABINET TOPS AND BOTTOMS**

3/4-inch- (19-mm-) thick plywood.

**F WALL-HUNG UNIT BACK PANELS**

1/2-inch- (12.8-mm-) thick plywood. Back panel to receive plastic laminate.

**G BASE UNIT BACK PANELS**

1/2-inch- (12.8-mm-) thick plywood. Back panel to receive laminate.

**H DRAWERS**

Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.

1. Bottoms: 1/2-inch- (12.8-mm-) thick plywood.
2. Top of drawer boxes to be 3-mm PVC edge banding.

**I SHELVES**

1. 3/4-inch-thick plywood.
2. All shelves shall have 3-mm PVC edge banding.

**J FACTORY FINISHING**

To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.

**K SEISMIC**

All upper and tall casework construction to meet seismic requirements per WIC (Woodworking Institute of California).

**2.7 PLASTIC LAMINATE COUNTERTOPS**

**A CONFIGURATION**

Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and end-splash style:

1. Front  
  
Rolled edge at lunch room and restroom locations. Premium grade square edge at other locations.

2. Cove

Butt splash typical. Integrally coved splash at lunch room and restroom locations.

3. Backsplash

Butt splash.

4. End Splash

Butt splash.

**B PLASTIC-LAMINATE SUBSTRATE**

Plywood not less than 3/4-inch (19-mm) thick.

1. For countertops at sinks and lavatories, use phenolic-resin plywood or exterior-grade plywood.

**2.8 PLASTIC LAMINATE SILLS**

**A WINDOWSILLS**

Formed plastic laminate sills.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

- D Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24-inches (600-mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
  2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24-inches (600-mm) o.c., with toggle bolts through metal backing behind gypsum board.
- E Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
  2. Seal edges of cutouts by saturating with varnish.
- F WINDOWSILLS
- Anchor securely to framing as required. Caulk space between window/gypsum wallboard and sill/cap ends with laminate.
- G Verify all appliance sizes prior to fabrication.

### **3.2 ADJUSTING AND CLEANING**

- A Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

**\*\*\* END OF SECTION \*\*\***

## SECTION 12400

### FURNISHINGS AND ACCESSORIES

#### PART 1 GENERAL

##### 1.1 SCOPE

The work specified in this Section includes furnishing and installing building furnishings and accessories as shown on the Plans, and as specified herein.

##### 1.2 RELATED SECTIONS

<u>Section</u>	<u>Item</u>
01300	Submittals

#### PART 2 PRODUCTS

##### 2.1 WINDOW BLINDS

Horizontal blinds shall be 1-inch-wide rigid louvers of aluminum with a matching 1-inch-deep valance. The headrail and bottom rail shall be formed steel or extruded aluminum. The blinds shall be mounted on the inside of the window opening and shall have a side draw and tilt. Provide wand for tilt operation, locks for cord to stop blind in any position. Size to fit between jambs, and between head and sill. The Contractor shall submit color samples for approval and selection by the Owner. Bali, or approved equal.

A Provide blinds at buildings as noted below:

1. Operations Building
  - a. All windows.
  - b. Not required at exterior entrance doors. Not required at frosted glass windows.

##### 2.2 BUILDING SIGNAGE

A ROOM IDENTIFICATION SIGNS

Provide ES Plastic (high pressure plastic laminate or polymer with contrasting color core, with 1/32-inch-high raised tactile lettering and

Grade 2 Braille. Plaque shall be 1/8-inch thick. Color to be selected by the Architect. ASI Sign System, or approved.

Letters to be in Helvetica medium Style, all in caps. Letter size shall be 3/4-inch-high, centered in the plate. Length shall be as required but not to exceed 16 inch on one line. Background shall be removed from the medium to expose the contrasting core color.

Provide room identification signs at doors as noted below. Provide an additional ten signs with labels to be determined by Owner upon receipt of identification sign submittal.

1. Operations Building
  - a. “Lab / Office” at doors 1 and 6
  - b. “Locker Room” at door 7
  - c. “Chlorine Gas Room” at door 4
  - d. “Electrical Room” at door 5
  - e. “Sludge Pump Room” at door 2
  - f. “Storage” at door 3

## **2.3 FURNITURE**

Furniture references are to Hon models/part numbers to establish type and quality. Provide furniture as noted below:

1. Work Chair – Hon Ignition Series, mesh mid-back, fully adjustable, caster base
  - a. HON HIWM1
  - b. Provide 1
2. Guest Chair – Hon Ignition Series, stacking, four leg, sliders
  - a. HON HIGS6
  - b. Provide 1

3. Lab Chair – Hon Ignition Series, fully adjustable, swivel stool, counter height
  - a. HON HITSM
  - b. Provide 1

## **PART 3 EXECUTION**

### **3.1 GENERAL**

Mount surface mounted accessories on concealed backplates, except where shown otherwise. Accessory backplates shall have concealed fasteners. Install accessories except if indicated otherwise, with sheet metal screws or wood screws in teflon or neoprene sleeves and expansion shields with toggle bolts, or other approved fasteners. Install on back plates in same manner. All accessories mounted on gypsum board walls without solid backing shall be fastened into metal backplates secured to studs.

Exact locations for fixtures and equipment shall be determined on the job to suit the actual conditions.

Any discrepancies between the Drawings and actual field conditions shall be brought to the attention of the Engineer for a decision. Changes in the work because of failure to do so shall be made by the Contractor at no additional cost to the Owner.

### **3.2 FURNISHINGS**

The furnishings specified herein and shown on the Drawings shall be installed in locations shown, and in accordance with the Manufacturer's recommendations.

### **3.3 SIGNAGE**

Mount on the wall at the latch side of the door, at 5'-0" height above floor level. Use adhesive attachment at interior and screw attachment at exterior wall conditions.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 12452**

### **APPLIANCES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes furnishing and installing appliances as shown on the Plans, and as specified herein.

##### **1.2 RELATED SECTIONS**

<u>Section</u>	<u>Item</u>
01300	Submittals

#### **PART 2 PRODUCTS**

##### **2.1 REFRIGERATORS**

Provide one full-size refrigerator, no-frost, top freezer, 17.5 cubic foot minimum, Energy Star, G.E. model GTE18CCHSA, or approved equal. Power requirements shall be 120 V, 60 Hertz, 15 amp maximum. The color shall be stainless steel. It shall be provided with a cord and attachment plug cap (NEMA 5-15 or 5-20P).

Provide one under-counter refrigerator, 5.6 cubic foot minimum, Energy Star, G.E. model GCE06GSHSB, or approved equal. Power requirements shall be 120 V, 60 Hertz, 15 amp maximum. The color shall be stainless steel. It shall be provided with a cord and attachment plug cap (NEMA 5-15 or 5-20P).

##### **2.2 DISHWASHER**

Provide one dishwasher fully automatic, front-loading type, G.E. model GDT665SSNSS, or approved equal. Power requirements shall be 120 V, 60 Hertz. It shall be provided with a cord and cap (NEMA 5-15 or 5-20P). The color shall be stainless steel.

##### **2.2 HOOD**

Provide one hood, 310 CFM, 4-speed motor, G.E. model JVX5360SJSS, or approved equal. Power requirements shall be 120 V, 60 Hertz. It shall be provided with the power cord kit for field wiring. The color shall be stainless steel.

### **PART 3 EXECUTION**

The furnishings specified herein and shown on the Plans shall be installed in locations shown, and in accordance with the Manufacturer's recommendations.

Mount appliances in locations as shown on the Plans; fully connect to mechanical and electrical services. The accessory manufacturer's mounting details shall be coordinated with other trades as the work progresses. All brackets, plates, anchoring devices and similar items used for mounting in wet areas shall be bedded in a silicone or other sealant as they are set to provide a watertight installation.

Mount surface mounted accessories on concealed backplates, except where shown otherwise. Accessory backplates shall have concealed fasteners. Install accessories except if indicated otherwise, with sheet metal screws or wood screws in teflon or neoprene sleeves and expansion shields with toggle bolts, or other approved fasteners. Install on back plates in same manner. All accessories mounted on gypsum board walls without solid backing shall be fastened into metal backplates secured to studs.

Exact locations for fixtures and equipment shall be determined on the job to suit the actual conditions.

Any discrepancies between the Plans and actual field conditions shall be brought to the attention of the Engineer for a decision. Changes in the work because of failure to do so shall be made by the Contractor at no additional cost to the Owner.

**\*\*\* END OF SECTION \*\*\***

**DIVISION 13**  
**SPECIAL CONSTRUCTION**

## **SECTION 13417**

### **PRESSURE GAUGES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes furnishing and installing new suction and discharge pressure gauges, as shown on the Plans and specified herein. Discharge pressure gauges shall include all necessary connectors and hardware on all process piping for pumps, blowers, fans, and compressors and at the various locations for a complete and workable installation.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions
15050	Process Piping Systems
Division 15	Mechanical

##### **1.3 PERFORMANCE REQUIREMENTS**

Unless otherwise indicated, the discharge pressure gauge scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale. The suction pressure gauges on pumps, blowers, and compressors shall be equivalent to the discharge pressure gauges with a lower range of 30-inch Hg.

Pressure gauges shall be shown on the detailed installation drawings of all piping and connected equipment as specified in Section 15050. Pressure scale range for each pressure gauge shall be in the form of a summary table including all process piping pressure gauges.

##### **1.4 DELIVERY, STORAGE AND HANDLING**

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

## **1.5 WARRANTY**

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MANUFACTURERS**

The pressure gauges shall be Ashcroft Duragage 1279, or approved equal.

The diaphragm seals shall be Ashcroft Type 101, or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Ashcroft. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

### **2.2 GENERAL**

The pressure gauges shall be glycerin filled type and shall have all internal parts immersed. Pressure gauges shall be minimum 4 1/2-inch dial size, with non-metallic case, stainless steel bourdon tube with plastic bushings and pinion, and stainless steel selector. Gauges shall be ANSI grade A or better with an accuracy of  $\pm 0.5$  percent.

Gauges measuring liquids shall be supplied with bronze pressure snubber and diaphragm seal. Diaphragm seals shall have silicone DC200 fluid fill and shall have a Type 316 stainless steel body, with 1/4-inch flushing connection and 1/2-inch process connection.

### **2.3 SPARE PARTS**

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled

boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

## **2.4 FACTORY TESTING**

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The pressure gauges and accessories shall be installed as shown on the Plans and as specified herein and in accordance with the manufacturer's instructions.

### **3.3 FIELD TESTING**

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

### **3.4 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the pressure gauge manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pressure gauges are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

**\*\*\* END OF SECTION \*\*\***

**DIVISION 15**

**MECHANICAL**

## **SECTION 15050**

### **PIPING SYSTEMS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section describes process and utility piping, fittings, supports, and accessories shown on the Plans, described in these Specifications and as required to completely interconnect all equipment with piping for complete and operable systems.

The Contractor shall direct the attention of all subcontractors and suppliers of piping systems and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01300	Submittals
01800	Testing, Commissioning and Training
02300	Earthwork
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

##### **1.3 STANDARDS FOR THE WORK**

Pipe, fittings, and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Piping systems and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. In order to meet these requirements minor deviation from the Plans may be made as approved by the Engineer.

## 1.4 PIPE MATERIALS

The materials to be utilized for the various pipe sizes and applications on the project shall be as follows, unless otherwise noted on the Plans or herein:

<u>Process</u>		<u>Inside</u>	<u>Buried</u>
Potable Water (<3")	W	Copper	Solvent Welded PVC Galvanized Iron Outside Exposed
Waste Activated Sludge	WAS	Ductile Iron, FL	Ductile Iron <sup>(1)</sup>
Chlorine	CL	Solvent Welded PVC	Solvent Welded PVC

- (1) Buried Ductile Iron pipe shall have push on joints while all fittings and valves shall be mechanical joints. All buried ductile iron pipe shall be restrained unless otherwise shown on the Plans.

## 1.5 SUBMITTALS

Submittal data shall be supplied in accordance with Section 01300. Detailed installation drawings of all piping and connected equipment shall be submitted. The drawings shall include all piping, valves, fittings, pipe support locations and types, seismic bracing, and appurtenances.

Submit data to show that the following items conform to the Specification requirements:

- A. Pipe, fittings, and accessories.
- B. Valves.
- C. Couplings and couplers.
- D. Pipe supports and seismic braces as required herein.

Submit certified test reports as required herein and by the referenced standards.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Part 3 Execution of this Section.

All water piping shall be certified under NSF 61 and NSF 372 for potable water use.

### **2.2 DUCTILE IRON PIPE AND FITTINGS**

#### **A. GENERAL**

Ductile iron pipe shall be centrifugal cast pipe conforming to AWWA C151, Class 52, unless otherwise noted, bituminous coated and cement mortar lined in accordance with, AWWA C104. All flanged spools shall be Class 53 as shall all piping where grooved couplings are used. Exposed pipe to be painted shall be primed for preparation and coating per Section 09900 of the Specifications. Approved grooved couplings may be used instead of flanged spools and fittings as approved by Engineer.

All above ground piping shall be flanged or grooved piping unless otherwise specified or indicated.

Below ground piping shall be push on joint or mechanical joints unless otherwise specified or indicated. Mechanical joints shall comply with AWWA C111.

All mechanical joints shall be restrained joints with a retainer. The restrainer shall utilize the full circumference of the pipe for restraining and utilize standard MJ gasket and bolts. The restrainer shall be Grip Ring as manufactured by Romac Industries, Mega-Lug, or equal.

All push on joints shall be restrained with field lock gaskets from US Pipe or equal.

Flanges shall comply with ANSI B16.1, Class 125. Flange gaskets shall be full face. Approved adaptor flanges shall be used instead of flanges where shown on the Plans.

Grooved couplings shall be Victaulic Style 31, or engineer approved equal and shall comply with AWWA C606. Victaulic Style 341 adaptor flanges shall be installed instead of flanges where shown on the Plans.

Fittings shall be ductile iron and shall comply with AWWA C110 or AWWA C153, bituminous-coated exterior and cement mortar lined, 250-psi minimum pressure. Exposed fittings to be painted shall be primed for preparation and coating per Section 09900 of the Specifications. Fittings shall be mechanical joint, flanged, or grooved fittings. Fittings with grooved ends shall comply with AWWA C606 and shall be Victaulic or approved equal. Fittings shall not be "Tyton" or other push-on type joint.

The exterior of ductile iron pipe and fittings that are buried or in contact with concrete shall be coated with an asphaltic coating. The exterior surface of ductile iron pipe inside of buildings, structures, and vaults shall be painted in accordance with Section 09900 of the Specifications.

All bolts, buried and unburied, shall be coated with Armite Anti-Seize Compound No. 609, or equal, prior to installation.

## **2.3 PVC PIPE AND FITTINGS**

### **A. PRESSURE PIPE**

All PVC pipe 3 inch and smaller shall be Schedule 80. Pipe shall be constructed of material that meets or exceeds ASTM D2241 and D1784 and Commercial Standard CS 256. Joints shall be solvent weld with press fit. Fittings shall conform to ASTM D2466 and D2467 for socket type and ASTM D2464 for threaded pipe.

All PVC pipe 4 inch and larger shall be PVC, Cast Iron pipe equivalent O.D., Class 235, conforming to the requirements of AWWA C900. Pipe joints shall be gasketed. Solvent-cement joints will not be acceptable. Fittings for PVC pipe 4 inch and larger shall be ductile iron, as specified in Part 2.2 of this Section.

Provisions for pipe expansion shall be as recommended by the pipe manufacturer.

Bolts for PVC pipe, where required, shall be 316 stainless steel, ASTM A193, Grade B8M, hex head with ASTM A194, Grade 8M hex nuts. Washers of the same material shall be supplied.

## **2.4 HOSE ASSEMBLY**

The Contractor shall furnish and install hoses, nozzles and fittings where shown on the Plans and as described below.

### **A. HOSE ASSEMBLY**

Washdown hoses shall be EDPM, Hosecraft USA RM2 or equal. The hose shall be red in color. The inner diameter shall be equal to the diameter of the thread connection for each yard hydrant and hose bib, as shown on the Plans. The hose and all fittings shall have a pressure rating of at least 150 psi. The inner tube shall be smooth and the outer cover shall be reinforced with braided synthetic cords. Each section of the hose assembly shall be 50-feet long and have male and female brass couplings sized to fit its yard hydrant or hose bib. Threaded female fittings shall swivel until tightened. Each hose assembly shall have a nozzle.

The Contractor shall furnish and install any and all transition or specialized fittings required to connect the hose to the yard hydrant and or hose bib at no additional cost to the Owner.

### **B. NOZZLES, 1-INCH THROUGH 1-1/2-INCH SIZE**

Nozzles to fit 1-inch through 1-1/2-inch hoses shall be industrial fog nozzles with brass body, rubber protective rim, adjustable from fog-stream to straight stream by a twisting action with the ability to shut off flow completely at the nozzle, maximum working pressure of at least 150 psi, and NPSH threads, Dixon model WHFN150 or equal.

### **C. NOZZLES, 3/4-INCH SIZE**

Nozzles to fit 3/4-inch hoses shall be industrial fog nozzles with brass body, rubber protective rim, adjustable from fog-stream to straight stream by a twisting action, maximum working pressure of at least 100 psi, and GH threads, Dixon model WDN75 or equal.

## **2.5 MISCELLANEOUS FITTINGS**

### **A. FLEXIBLE COUPLINGS**

Flexible couplings shall be Romac 501 or approved equal. Middle ring and follower shall have fusion bonded epoxy coating. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

### **B. FLANGED COUPLING ADAPTERS**

Flanged coupling adapters shall be Rockwell (Smith-Blair) Type 912 Dresser Style 127 or equal.

Restrained flange coupling adapters for ductile iron wastewater piping shall comply with AWWA C219, shall be constructed of high strength ductile iron ASTM A536 Grade 64-45-12 and shall be lined and costed with fusion-bonded epoxy. Restraint lugs/wedges shall be heat-treated A536 ductile iron with heads designed to break off at the specified torque. Gaskets shall be compounded for wastewater service and in accordance with ASTM D2000. Provide 316 stainless steel bolts for buried and below-grade applications. Restrained flange coupling adapters shall be Romac RFCA, Smith-Blair Series 911 or equal.

### **C. ADAPTER FLANGES**

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-lb. pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

### **D. FLEXIBLE CONNECTORS AND EXPANSION JOINTS**

Flexible connectors and expansion joints shall be provided where shown on the Plans. The flexible connectors and expansion joints shall be provided with Class 125 ANSI flanges and be single arch-type multiple ply rubber or synthetic elastomers, complete with steel retaining rings, as manufactured by the Red Valve Company, Inc., the Metraflex Company, or equal.

### **E. DIELECTRIC INSULATED UNIONS**

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one

percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

**F. WALL SLEEVES AND SEALS**

Wall and/or floor pipe penetrations shall be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast waterstop of 1/2-inch minimum thickness and 2-1/2-inch minimum height. Wall sleeves shall be omni\*sleeve or equal.

Seals for pipe sleeves shall be bolt-up type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. When bolts are tightened the rubber sealing elements shall expand to result in a watertight seal. Bolts and pressure plate nuts shall be Type 316 stainless steel in below grade or "wet" locations, and of carbon steel at other installations. Rubber links shall be suitable for use in water, moist environments, normal atmospheric conditions, and -40 degrees F to 250 degrees F temperatures for standard service.

In addition to the locations shown on the Plans, stainless steel expansion couplings shall be installed at a maximum spacing of 40 feet on all stainless steel pipe. The locations of the expansion couplings shall be determined by the Contractor prior to pipe fabrication and shall be subject to review and approval by the Engineer.

**PART 3 EXECUTION**

**3.1 PIPING INSTALLATION**

**A. GENERAL HANDLING AND PLACING**

All piping constructed on this project shall be performed in accordance with the Uniform Plumbing Code. These Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as a part of this Section and all costs included in the lump sum bid.

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not

to injure pipe coating. No other pipe or material of any kind shall be placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

The types and sizes of pipes to be used shall be as specified herein and as shown on the Plans. Where sizes of small pipe are omitted from the plans and not mentioned in the Specifications, the sizes to be used shall correspond to plumbing code requirements. In any event, undesignated pipe sizes shall be proper for the function to be performed and as accepted by the Engineer.

All pipe shall be carefully placed and supported at the proper lines and grades and where possible shall be sloped to permit complete drainage. Piping runs shown on the Plans shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are required, they shall be approved by the Engineer.

Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. Unions shall be ground joint, malleable iron type. Where unions connect dissimilar materials, the union shall be protected from reaction with dissimilar metals by installation of insulating materials and dielectric unions at contact points.

The interior of all piping shall be cleaned after assembly and before connecting to equipment.

All piping for which no location dimensions are shown shall be installed in a neat and workmanlike manner in accordance with best trade practice. Wherever possible runs and rises shall be grouped and kept parallel. Properly lay out all miscellaneous piping to clear obstructions such as passageways, equipment, larger sized pipes, ventilation ducts, lights, etc.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All piping to be buried below structures, foundations, or slabs shall be installed with extreme care. When all joints have been made, Contractor shall demonstrate to Engineer's satisfaction that all of piping is watertight and that all lines are clear before proceeding with any work above this piping. It shall be Contractor's responsibility to see that these lines are kept clear until final acceptance of the project, providing suitable tight

wooden bulkheads or plugs for open end pipes. Any blockage of these systems due to earth, debris, cement slurry or anything else shall be rectified at Contractor's expense before project is accepted.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, jointing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. At all times during pipe laying operations keep trench free of water either by pumping, bailing, or drainage. Seal end of line with a tight-fitting plug when pipe is not being laid.

Valves shall have interiors cleaned of all foreign matter and inspected, both in open and closed positions prior to installation.

All pipes running through concrete walls below water surface or where subject to groundwater pressure shall be assembled as shown on the plans. Pipes running through concrete not subject to water pressure may be installed through standard steel sleeves, one or two pipe sizes larger than pipe in question. The pipe shall be free of all dirt and grease and thoroughly cleaned to insure a tight bond with the concrete.

All above ground outside pipe carrying liquids shall be insulated.

All buried, submerged, or intermittently submerged piping that is bolted together or uses bolts to hold materials together shall use 316 stainless steel nuts, bolts, and washers. This requirement applies to a distance of 12 inches above the highest water level in any tank, channel, or structure. Otherwise, bolts, nuts, and washers may be hot-dip galvanized steel.

## **B. GENERAL EXPOSED PIPING INSTALLATION**

Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

Piping shall be installed without springing or forcing.

All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

Flexible couplings shall be provided for all piping connections to motor-driven equipment and where otherwise shown in the Plans. The Contractor may install additional flexible couplings at approved location

to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

Unions or flexible couplings shall be installed where shown on the Plans, and at all non-motor-driven equipment to facilitate removal of the equipment.

Where equipment drain connections are provided, they shall be valved, with the discharge pipe carried to the nearest floor drain, drain trench, or sump. Where no receptacle for drain exists, drain valves shall be piped to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

All exposed or submerged piping shall be painted and color-coded in accordance with Section 09900, unless otherwise specified.

### **3.2 PVC PIPING**

#### **A. GENERAL**

PVC piping socket weld connections shall be made up in accordance with the pipe manufacturer's recommendations and as follows:

Where pipe is cut, remove all burrs and ream inside to provide smooth flow line. Bevel the plain end pipe 1/16 inch to 1/32 inch. Joints shall be first cleaned with cleaner before making up. Apply primer to the female joint. Apply primer to the male joint. Reapply primer to the female joint. Apply glue to the male joint. Apply glue to the female joint. Reapply glue to the male joint. Join pipe quickly with a 1/4 turn. If joint cannot be made up to full depth of socket, cut out and discard. Wipe off excessive cement. Hold for 30 seconds and do not move for 15 minutes after making up joint. Pipe joining below 40 degrees F will not be permitted. Cleaner and cement types shall be as recommended by the manufacturer for the size of pipe being used.

### **3.3 FLANGED PIPING**

Flanged joints shall be made in accordance with best trade practice. Screwed flanges for piping shall be run until pipe projects beyond face and no more than one thread is exposed on backside. All flange faces shall then be machined so as to be perfectly parallel. All flanged pipe shall be accurately dimensioned; no "drawing-up" will be allowed. Gaskets shall be full face, rubber.

### **3.4 MECHANICAL JOINT PIPING**

Mechanical joint piping shall be installed in best trade practice with torque wrenches used to avoid overstressing bolts. Piping shall be installed using recommended procedures outlined in "Handbook of Cast Iron Pipe" as published by Cast Iron Research Association which in part requires that all contact surfaces of rubber seal with pipe be wire brushed, spigot be centrally located in bell. When tightening bolts, it is essential that the gland be brought up toward pipe flange evenly, maintaining approximately same distance between gland and face of flange at all points around socket.

### **3.5 PIPE SUPPORTS**

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans, or as specified in Section 15066.

### **3.6 FLEXIBLE COUPLINGS**

Flexible couplings shall be installed in accordance with recommendations of manufacturer and used where indicated on the Plans. Finished joint shall be airtight or watertight under test pressure of pipeline. Buried flexible couplings shall be coated with asphalt base paint after assembly.

### **3.7 PIPE BEDDING**

All pipe shall be bedded as specified in Section 02300.

### **3.8 TESTING**

#### **A. GENERAL**

All piping shall be tested and inspected in accordance with the provisions of Division 7 APWA/WSDOT, except as modified herein. Where new piping systems are being connected to existing piping systems the existing piping systems shall be tested prior to connecting to the new pipe to the existing piping. Once the new piping system has been connected to the existing piping system the entire system shall be tested again.

All piping systems will be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein, the costs to be included in the lump sum bid price.

Each particular piping system shall be tested as hereinafter specified. All leaks shall be repaired or defective material replaced and the test repeated as directed by the Engineer. After compliance with test requirements and approval of the Engineer, the field painting, where required, may be started. All pressure testing shall be done prior to any finish painting or pipe insulating.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

All thrust blocks shall be in place for at least 7 days to allow concrete to cure before testing. Install adequate blocking or other means of resisting test pressure.

**B. AIR PIPING**

Low pressure air piping shall be pressurized with air to 25 psig and remain leaktight for 1 hour.

High pressure air piping (AHP) shall be pressurized with air to 250 psig and remain leaktight for 1 hour.

**C. PRESSURIZED LIQUID PIPING**

All PVC, ductile iron and steel piping for pressurized liquid, including sludge, shall be pressurized with water to 100 psig and remain leaktight for a period of 4 hours.

Plant potable and non-potable water piping shall be pressurized with water to 125 psig and remain leaktight for a period of 1 hour.

All cross connection protection equipment shall be tested by a certified inspector prior to putting the piping into service. Submit test report to Owner.

**D. DISINFECTION**

Before being placed into service, all new and modified potable water pipe and appurtenances shall be sterilized and a satisfactory bacteriological report obtained in accordance with Section 7-09.3(24) of the WSDOT Standard Specifications.

As each pipe is laid, sufficient high-test dry calcium Hypochlorite (65 to 70 percent chlorine) shall be placed in the pipe to yield a dosage of not

less than 50 mg/l available chlorine, calculated on the volume of water which the pipe and appurtenances will contain. Minimum free chlorine residual after 24 hours shall be 25 mg/l.

During the process of sterilizing, all valves, hydrants, and/or other appurtenances shall be operated to insure complete contact. All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5 to 6 percent chlorine).

Following chlorination, all pipe shall be flushed to remove any solids until a test shows no more than 0.2 parts per million available chlorine. If no hydrant is installed at the end of the main, then a tap shall be provided large enough to develop a velocity of at least 2.5 FPS in the main.

Before placing the lines into service, a satisfactory report shall be received from the local or state health department on samples collected from representative points in the new pipe after the 24-hour sterilization period has elapsed. Samples for bacteriological tests in the presence of the Owner and transported by the Owner.

Should the initial treatment result in an unsatisfactory bacteriological test or should corrective work be required because of testing, then the chlorination procedure shall be repeated by the Contractor at their own expense until satisfactory results are obtained. These repeat procedures shall follow Section 7-09.3(24) of the WSDOT Standard Specifications, as appropriate and as necessary for the addition of chlorine. The cost of disposal of water used for disinfection shall be borne by the Contractor.

**\*\*\* END OF SECTION \*\*\***

## SECTION 15066

### PIPE AND CONDUIT SUPPORT SYSTEM

#### PART 1 GENERAL

##### 1.1 DESCRIPTION OF WORK

The work specified in this Section includes pipe and conduit hangers, brackets, and supports. Pipe and conduit support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Plans and specified herein.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning, and Training
09900	Painting
15050	Piping Systems
15400	Plumbing
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

##### 1.3 REFERENCES

All pipe and conduit support materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this Section shall prevail.

ANSI A13.1	Piping and Piping System
ANSI B31.1	Power Piping
ASME	Boiler and Pressure Vessel Code
ANSI/MSS SP-58	Pipe Hangers and Supports C Materials, Design and Manufacture
ANSI/MSS SP-69	Pipe Hangers and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
UPC	Uniform Plumbing Code

## **1.4 SUBMITTALS**

In accordance with the requirements of Section 01300, submit the following project data prepared by a licensed Professional Engineer:

- A. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.
- B. Location of pipe and conduit support, including type of structural and pipe attachments, shown on detail drawings and/or specified under paragraph 1.5 of Section 15050.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

The Contractor shall design, provide, and install pipe and conduit support systems, which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers, supports and structural attachments as specified herein. The support system shall be designed in conjunction with the pipe and conduit to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in paragraph 1.3.

In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Plans, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the Contractor's responsibility to provide a complete system of pipe and conduit supports. Pipe support schedule under paragraph 2.7 of this Section sets forth minimum requirements for pipe supports.

### **2.2 PIPE RACKS AND TRAPEZE HANGERS**

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, clamps, brackets, fittings, and accessories for supporting pipes in equipment and pump rooms. All components for pipe and conduit rack and trapeze shall be Unistrut or equal.

### **2.3 PIPE CLAMPS AND HANGERS**

In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hangers and stanchion saddle support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied.

Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.

All pipe clamps and hangers, including all accessories, shall be galvanized steel for indoor use and Type 316 stainless steel for outdoor use.

Pipe and conduit clamps and hangers shall be as manufactured by Anvil or equal and shall be as follows:

Type	Pipe Size (In.)	Pipe Material	Anvil Figure
Swivel Ring, Split Type	3/4 to 8	All type	104
Split Clamp	1/2 to 3	All type	138R
Adjustable Ring	1/2 to 6	All type	97
Adjustable Ring	1/2 to 4	Copper	CT-269
Adjustable Clevis	3 to 24	All type	590
Pipe Clamp	3 to 42	All type	216
Socket Clamp	4 to 24	Cast Iron	595
Pipe Stanchion	4 to 24	All Type	63
Stanchion Saddle	4 to 36	All type	259
Adjustable Saddle Support	3 to 36	All type	264
Riser Clamp	2 to 24	All type	40
Adjustable Pipe Roll	6 to 12	Stainless Steel	177, 181, or 274

## **2.4 STRUCTURAL ATTACHMENTS**

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface-mounted channel or individual inserts for existing concrete or where applicable, steel, roof plate supported attachments in the control building, complete with all accessories required. All structural attachments including all accessories shall be galvanized steel for indoor use and stainless steel for outdoor use, and shall be provided by a single manufacturer. Structural attachments shall be as measured by Unistrut Corporation or approved equal.

## **2.5 PIPE SUPPORT ATTACHMENTS TO CONCRETE**

All pipe support attachment to concrete shall be in adhesive anchors unless noted otherwise.

Products which may be incorporated in the work include, but are not limited to, the following:

- A. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

- B. HIT HY 150 Injection adhesive Anchor, Hilti, Inc.
- C. Power-Fast, Powers Fasteners, Inc.

## 2.6 PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the Plans. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be Anvil Figure 160 through Figure 166 or approved equal.

## 2.7 SPACING

Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1" & Smaller	Iron or Steel	6
	Copper	4-1/2
	Plastic	continuous
	Tubing	continuous
1-1/4 to 2"	Iron or Steel	8
	Copper or Plastic	5
2-1/2 to 4"	Iron or Steel	10
	Copper or Plastic	6
6 to 8"	Iron or Steel	12
	Plastic	8

## PART 3 EXECUTION

### 3.1 DESIGN

Pipe and conduit support systems shall be designed in accordance with applicable reference standards specified in paragraph 1.3. Pipe and conduit supports shall be designed and selected to withstand seismic loads for IBC 2018 Seismic Design Category D with  $S_s=0.442g$  and  $S_1=0.168g$  and shall adhere to the following conditions:

- A. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps, and other support items shall not exceed the manufacturer's recommended loads.
- B. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping,

and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.

- C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
- D. All pipe supports shall provide a means of vertical adjustment after erection.
- E. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

### **3.2 INSTALLATION**

Pipe support system shall be installed strictly in accordance with standards and codes referenced in paragraph 1.3 of this Section and piping support system manufacturer and piping manufacturer's recommendations.

In addition, all piping shall be rigidly support and anchored so that there is no movement or visible sagging between supports.

Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper-plated. Those portions of pipe supports, which contact other dissimilar metals, shall be rubber or vinyl coated.

Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as required to force expansion and contract movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Plans or specified in other sections.

**\*\*\*END OF SECTION \*\*\***

## **SECTION 15100**

### **VALVES**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section shall consist of valves and accessories as shown on the Plans, described in these Specifications, and as required to completely interconnect all equipment with piping for complete operable systems.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<b><u>Section</u></b>	<b><u>Item</u></b>
01200	Payment
01300	Submittals
01800	Testing, Commissioning and Training
Division 11	Equipment
Division 15	Mechanical

##### **1.3 SUBMITTALS**

Submit Catalog cuts and shop drawings in accordance with Section 01300 to demonstrate that the valves and appurtenances conform to the Specifications requirements.

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all valves.

##### **1.4 QUALITY ASSURANCE**

All materials and equipment furnished under this Section shall be by the manufacturer specified.

All materials in contact with potable water shall be NSF 61 and NSF 372 certified for potable water use.

See Section 15400 for Plumbing specifications and requirements.

## **PART 2 PRODUCTS**

### **2.1 GATE VALVES**

Gate valves 3 inches and smaller shall be bronze, non-rising stem, wedge disc, 125 pound service, Crane No. 438, Kennedy Figure 427 or equal.

Gate valves larger than 3 inches shall be ductile iron body, bronze mounted, resilient seat, wedge disc, left opening, high-strength bronze stem, O-ring with a 2-inch-square operating nut and complying with AWWA C509 or C515. Gate valves shall be non-rising stem unless noted otherwise. Valves shall be rated at 250 psi minimum working pressure and furnished with either flanged or mechanical joints as shown on the Plans. All surfaces, interior and exterior, shall be epoxy coated meeting NSF standards for potable water.

Above ground gate valves shall be provided with handwheels. Buried valves shall be provided with a 2-inch square operating nut while exposed valves shall be provided with hand wheels.

Valves shall be Clow, M&H, Mueller, Kennedy, U.S. Pipe, American Series 2500, or equal.

### **2.2 PLUG VALVES**

Plug valves shall be non-lubricated eccentric plug type with port area exceeding 80 percent of full pipe area. The valve body shall be of ASTM A126, Class B cast iron. The plug shall be one piece construction of ASTM A536, 65-45-12 ductile iron or ASTM A126, Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with grease and/or petroleum-resistant neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240. All plug valves shall be furnished with a 1/8-inch overlay seat of not less than 90 percent pure nickel of minimum 200 Brinell hardness. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

Plug valves shall be glass lined on the digested sludge and scum lines as noted on the Plans.

Shaft bearings shall be sleeve-type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 stainless steel ASTM A743 Grade CF8M, or sintered oil impregnated bronze in 1/2- to 36-inch sizes. Non-metallic bearings shall not be acceptable. Shaft seals shall be of the multiple V-ring type

and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. Valve pressure ratings shall be 175 psi through 12 inches and 150 psi for 14 inches and larger. Each valve shall be given a hydrostatic and seat test with test results being certified.

Valves shall be furnished with end connections as shown on the Drawings. Flanged valve shall be faced and drilled to the ANSI 125 standard. Mechanical joint end shall be to the AWWA C111, grooved end per AWWA C606. Screwed ends shall be to the NPT standard. Valves shall be DeZurick PEC Eccentric or equivalent equipment manufactured by Pratt, Victaulic, or Milliken, or equal.

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, handwheels, etc., as indicated on the Drawings. All valves and larger than 4 inches shall be equipped with gear-handwheel actuators. All gearing shall be enclosed in a cast iron housing.

Buried valves and valves with extension stems that are to be lever-actuated shall be DeZurick Fig. 118, F, 10, RS26, ANG, or equal with low-friction nitrile butadiene packing on 4 inch and smaller sizes. Buried valves, larger than 4 inches shall have enclosed gear operators.

### **2.3 PVC BALL VALVES**

Ball valves shall be PVC Class 1245 4-B, conforming to ASTM D1784, true union type, threaded per ANSI B1.20.1, full port design, rated 150 psi, Nibco Chemtrol Tru-Block, Asahi/America, or equal.

### **2.4 VALVE BOXES**

There shall be furnished and installed with all valves installed underground, two piece adjustable cast iron valve boxes with a minimum inside diameter of 5 inches. The valve boxes shall be set concentric with the axis of the stem and adjusted to the finish grade. Valve box lids shall be identified with a letter/number code and opening direction designation as shown on the Plans.

### **2.5 PRESSURE REGULATORS**

Pressure regulators shall be sized and located as shown on the Plans and shall be diaphragm type with strainer with all working parts readily accessible without removing the regulator from the pipe line, Mueller H-9300, APCO, Clayton or equal.

### **2.6 VALVE INSULATION**

All new above ground valves carrying liquids shall be insulated with 1-inch-thick fiberglass insulation and 0.16 of an inch anodized aluminum jacket; insulation by Owens-Corning, Certainteed, Johns-Manville or equal, unless otherwise noted.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

All valves and accessories shall be installed in a manner and location as shown on the Plans or as required for the application and in accordance with manufacturer's instructions. Valve size is fully equal to line piping in which the valve is installed unless otherwise noted on the Plans. Support all valves where necessary. In case of conflict between these Specifications and a governing code, the more stringent standard shall prevail.

All valves of the same style or type shall be furnished by a single manufacturer.

Provide all accessories necessary for proper valve operation as specified or required for the application. Buried valves shall be installed with square operating nuts and adjustable cast iron valve boxes with covers. Valve boxes shall be set such that the slots in the boxes are in line with the run of pipe the valves are in. Provide two sets of T wrenches for buried valve operation.

Buried valves shall be provided with 1-inch solid steel extension stems with rock guards if the operating nut will be 18 inches or more below the ground surface.

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to insure that space is available for operation of lever or handwheel operated valves without interference to walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner suitable to the Engineer at the expense of the Contractor. Operations for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer.

For submerged valves, provide stem guides as recommended by the valve manufacturer on a spacing of 6'-0". As an alternate, provide valves with extended bonnets where practical. Provide supports for extended bonnets as required. Stem guides and supports shall be 316 stainless steel. All installation fasteners for submerged valves, guides, and supports (nuts, bolts and washers) shall be 316 stainless steel.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 15300**

### **FIRE PROTECTION SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section includes designing, detailing, fabricating, furnishing, delivering, storing, installing, and testing of a fire alarm and sprinkler system as shown on the Plans and as specified herein.

The system shall be designed by an entity specializing in the design, coordination, procurement, and installation of equipment associated with the protection of buildings utilized for commercial and industrial purposes. The fire alarm and sprinkler system must be provided complete with any and all equipment, appurtenances, and accessories required for a complete and workable system.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01300	Submittals
Division 16	Electrical

##### **1.3 QUALITY ASSURANCE**

All equipment and materials covered by this Specification shall be designed, fabricated, manufactured, installed and tested in accordance with all currently approved or accepted provisions of the Codes listed herein, including Occupational Safety and Health Act (OSHA) and all federal, state, or city codes, laws or ordinances of the place of installation of work:

- A. National Fire Protection Association (NFPA 13, 14, 24, and 70)
- B. Underwriters' Laboratories (UL)
- C. American National Standards Institute (ANSI)
- D. American Water Works Association (AWWA)
- E. American Society of Testing Materials (ASTM)
- F. International Building Code (IBC)
- G. International Fire Code (IFC)

H. All applicable federal, state and county ordinances

I. Local Fire Marshal or Authority Having Jurisdiction

The Fire Alarm and Sprinkler System Contractor shall coordinate their design and install the systems so that no interferences exist between the fire alarm piping or conduit and equipment and systems designed and installed by others.

The Fire Alarm and Sprinkler System Contractor shall be duly licensed in the State of Washington and regularly engaged in the installation of fire protection systems. All drawings shall be completed by a professional located in the State of Washington and by a professional with minimum of 10 years of design and installation experience for fire protection systems of similar size and scope.

The fire alarm system and security system shall be provided by Statewide Security (Redmond), Allied Fire & Security (Kent), ADT Commercial (Spokane), or equal.

#### **1.4 DEFINITIONS**

A. LISTED

Use of the word “listed” for fire protection equipment, components, etc., in this Section shall mean listed by UL and approved for fire protection.

B. APPROVED OR APPROVAL

Use of the word “approved” or “approval” in this Section shall require the approval or acceptance from the authorities having jurisdiction and the District.

#### **1.5 PERMITS, CERTIFICATES, AND FEES**

The Fire Alarm and Sprinkler System Contractor shall be responsible for obtaining all permits, certificates, fees, and other approvals required to satisfactorily complete the scope of work described herein and shall forward copies of all permits and Certificates of Inspection to the General Contractor who shall immediately submit them to the Owner.

A Fire Alarm system permit will be required through the Authority Having Jurisdiction (AHJ). The Fire Alarm system Contractor shall obtain all approvals or acceptance of AHJ and must pay all associated costs. Any ordering of material, fabrication or installation initiated prior to receiving approval from the

Owner or the AHJ to proceed shall be entirely at the Fire Alarm and Sprinkler System Contractor's risk.

Any additional permits, inspections, or approvals will be the responsibility of the Contractor, in coordination with the Fire Alarm and Sprinkler System Contractor.

## **1.6 SUBMITTALS**

Submittals shall be provided in accordance with Section 01300 of this Specification. In addition to the minimum requirements listed in Section 01300, the Contractor shall provide the following information, which shall be prepared by a qualified professional with expertise in fire alarm and security system design.

### **A. SYSTEM DESIGN**

1. Proposed system equipment shop drawings
2. Proposed system floor plan and piping plans
3. Proposed system wiring diagram
4. Specifications and technical information for all components of each system to be supplied

### **B. SYSTEM CONSTRUCTION**

1. Construction floor plan and piping plans
2. Bill of materials
3. Location of alarm initiating and notification appliances
4. Alarm control and trouble signaling equipment
5. Annunciation
6. Power connections
7. Battery calculations (if applicable)
8. Conductor type and size
9. All technical information for the equipment to be installed including wiring diagrams and/or manufacturer's literature,

troubleshooting and/or repair information, maintenance information

10. Installation details including mounting height, orientation, and required materials
11. The interface of fire safety control functions

**C. SYSTEM COMPLETION AND TESTING**

1. Record drawings as required in Section 01720 of this Specification
2. Final wiring diagrams
3. Operation and maintenance manuals
4. Software programming materials as necessary
5. Complete testing and analysis report

**PART 2 PRODUCTS**

**2.1 FIRE ALARM SYSTEM**

**A. GENERAL**

The fire alarm system shall utilize new, high-quality materials suitable for installation in a commercial/industrial application.

The information below is provided as the minimum requirement for a complete fire alarm system. It is the responsibility of the Fire Alarm and Sprinkler System Contractor to provide any additional equipment, accessories, or appurtenances that would be required for a complete and workable system as described herein.

The design shall include a list of the required size of all conduit between the fire indicator panel and the individual alarm devices.

The design shall also include a list of the required size of all conductors between the fire indicator panel and the individual alarm devices.

## B. FIRE ALARM AND SIGNAL DEVICES

### 1. Fire Indicator Panel

The fire indicator panel shall be sized to provide sufficient room to house all of the required components to monitor, relay, and alarm the devices in the event of a fire within the new building. The panel enclosure shall be cold-rolled steel and shall include a red powder-coated finish to designate it as a fire system panel. The panel shall be surface mounted in the location shown on the Plans, and shall be provided with any and all accessories necessary to accommodate this installation.

The panel shall be provided with a keyed lock, LCD display, and numeric keypad for programming. The panel shall include pushbutton control options, including, but not limited to “Silence,” “Reset,” “Drill,” and “Test.” The panel shall be addressable and shall also contain status indicating lights. The panel shall accommodate at least five unique communication pathways to subsequent panels and/or monitoring stations. The panel shall accommodate at least two SPDT relay outputs and four open collector outputs that may be activated by zone or system events, by schedule, through the user menu, or when a card is presented.

The panel shall contain a minimum of 50 addressable points.

The panel shall contain a supplementary battery power source to provide a minimum of 24 hours of power to the fire alarm system in the event that electrical service is discontinued to the building. Adapters, converters, and safety devices required to monitor and/or deliver the standby power shall be provided as required by current electrical codes.

### 2. Heat Detectors

The fire alarm system shall include heat detectors that will alert occupants in the event of a fire. The detectors will also send an alarm signal to the field indicator panel, which will in turn notify the Owner and the appropriate authorities that a fire alarm has been activated.

The detectors shall be low-profile design, and shall utilize both “rate-of-rise” and temperature set point sensing processes. The devices shall be compatible with the field control panel and all

other components provided with the fire alarm system design and shall include at least two Form C dry contacts.

Detectors shall be provided with accessory back boxes required for surface mounting to the building walls/roofing. Back boxes shall include punch outs for direct conduit connection.

3. Audible/Visual Combination Device

The fire alarm system shall include audible-visual strobe devices. Strobe devices shall provide both a visual and audible indication that a fire alarm signal has been triggered.

Strobe devices shall provide field adjustable candela values up to 110 candelas. Horn and strobe devices shall be synchronized to operate in unison should one system receive an alarm signal. Audible tone style and volume shall be field selectable. The strobe device shall be tamperproof and shall be provided with mounting bracket for surface mounting. Mounting bracket shall include punch outs for direct conduit connection. Strobes shall be die-cast metal housing, and shall be painted red according to the manufacturer's standard coating procedures.

Exterior strobe devices shall be suitable for outdoor installation, and shall be provided with weatherproof, water tight enclosures that will maintain the full function of the visual and audible alarm signals. All conduit and/or back plate connection locations shall be gasketed to protect against moisture damage. Specialized mounting accessories for any weatherproof enclosures shall also be provided.

Equipment shall be UL listed and must include a 3-year warranty. The strobe devices shall be compatible with the fire indicator control panel specified herein.

4. Manual Pull Stations

The fire alarm system shall include fire alarm manual pull stations. At a minimum, manual pull stations shall be provided as shown on the Plans. Additional stations, as required for fire alarm system approval, shall also be provided. Pull stations shall be provided such that any individual may trigger a fire alarm. If a manual pull station is triggered, the audible/visual strobe devices shall be enabled, and a signal shall be sent to the existing master fire alarm panel.

Pull stations shall be field-programmable, addressable, and shall be the double-action PUSH-PULL type. Stations shall be provided with back boxes and gaskets as required for surface mounting, and shall be suitable for indoor applications. Stations shall be die-cast metal housing, and shall be painted red according to the manufacturer's standard coating procedures. Back boxes shall contain at least two punch outs for direct conduit connection.

Equipment shall be UL listed and shall be provided with a 3-year warranty. The manual pull stations shall be compatible with the fire indicator control panel specified herein.

#### 5. Intercommunication Devices

The design shall include any and all intercommunication devices or modules required for communication between fire alarm equipment and the fire indicator panel. Additional intercommunication equipment shall be specifically called out in during the design and submittal period. Design shall include cellular-based communication for all dial-out features.

### C. CONDUIT AND CONDUCTORS

All conductors between devices, and between devices and the field indicator panel shall be in conduit. All conduits and conduit bodies in the Chemical Room shall be PVC-40.

While the Fire Alarm and Sprinkler System Contractor will provide design for the conduits and conductors, the intent for the project is that the General Contractor shall provide and install the conduits and conductors specified by the Fire Alarm and Sprinkler System Contractor in accordance with the approved and permitted design. See Part 3 of this Section for additional information regarding installation.

## 2.2 FIRE SPRINKLER SYSTEM

### A. PIPE AND FITTINGS

Schedule 40 ASTM A53 black steel pipe with 125 psi, UL-rated ASTM A47 malleable iron or ASTM A536 ductile iron fittings and grooved joint couplings, chlorinated butyl gaskets, ASTM A183 nuts and bolts; Central, Victaulic, Gruvlock or equal.

B. SPRINKLER HEADS

Sprinkler heads shall be UL listed institutional type pendent 1/2-inch male thread, bronze finish, ordinary temperature rating, Grinnell Universal model A, or approved. Provide head style as appropriate for installation locations and guards where required by code.

C. WET PIPE ALARM VALVE

UL listed valve complete with accessories and appurtenances, Reliable Model E, or equal.

D. FIRE DEPARTMENT CONNECTION

Two-way, cast brass, two clappers, chained cast brass plugs, threaded to local fire department specifications, "Auto-Sprkr" lettering, UL approved. Elkhart, Allen, Potter-Roemer No. 5025, or equal.

E. CHECK VALVE

Iron body, bronze trim, 175 psi, bottom drain, UL and FM approved, Viking Swing Check, or equal.

F. SHUT-OFF VALVE

Wall type indicator post, UL and FM approved. Kennedy, Mueller No. A-20810, or equal.

G. WATER MOTOR ALARM

3/4-inch water connection, 1-inch drain, 10-inch-diameter red hood, letter "Sprinkler Alarm." Reliable Model C, or equal.

H. PRESSURE SWITCH

Alarm actuation switch for connection to electric annunciation system. Reliable Model J54, or equal.

I. BACKFLOW PREVENTOR

Assembly shall consist of two independently operated spring loaded cam-check valves, test cocks, and inlet and outlet gate valves. Unit shall be stainless steel construction. Ames Model 2000ss, or equal.

## **J. INSPECTOR'S TEST AND DRAINS**

Provide inspector's test valves for each system. Discharge into a drain riser located adjacent to the system riser or into a drain for a remote inspector's test valve when provided. The valve shall be readily accessible, at a location no higher than 7 feet above finished floor. Provide main drains at all system and floor control valves. Discharge shall be into drain risers. Provide auxiliary drains at all low points of the system as required by NFPA 13.

## **PART 3 EXECUTION**

### **3.1 DELIVERY, STORAGE, AND HANDLING**

All equipment shall be completely factory assembled, crated or boxed and delivered to protect against damage during shipment.

All exposed components shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored in accordance with the manufacturer's recommendations.

### **3.2 INSTALLATION**

Installation shall be as shown on the approved submittal documents and shall be in strict accordance with the equipment manufacturer's recommendations. Installation shall also be in accordance with current "best practices" of the industry. Installation of piping, cable and conduit for each system shall be coordinated with other trades to ensure adequate space for piping placement. System installers and Contractors shall thoroughly review plans, specifications and shop drawings of other trades to coordinate work, and any conflicts that arise as a result of the proposed system equipment placement shall be brought to the attention of the Engineer.

Conduit installation and pulling of conductors shall be by the electrical contractor performing the work on the rest of the project. Terminations shall be by those with all certifications required for fire and security installations.

Piping installation shall be in accordance with NFPA 13 to include hangers, supports and seismic bracing. Piping shall be installed straight, true, and plumb. Hangers, flexible connectors and earthquake bracing shall be in compliance with NFPA 13 and the AHJ.

Provide fire proofing of penetrations as required by the Building Codes and the AHJ.

Install accurately cut steel piping to measurements established at the jobsite, free of fins and burrs. Install using full pipe length; random pipe lengths joined by couplings will not be accepted. Clean all piping before placing in position and maintain in a clean condition. Work into place without springing or forcing. Support pipe from structural members only. For pipe joints, provide full; cut threads. Apply pipe compound on male threads only. Connect joints so that not more than three threads on the pipe remain exposed.

Install drips and drains where necessary to discharge to standard interior floor drains or sinks, to standpipe drains or to sumps. Do not direct connect to any of the sewer systems. Install drain valves at low points of all piping to permit complete drainage of the system without disconnection of any piping.

Provide chrome-plated escutcheon plates at exposed pipe penetrations of ceilings, floors and walls.

### **3.3 CLEANUP**

At the completion of each portion of work, all waste material, rubbish, equipment, and surplus material shall be removed from the site. The Fire Alarm and Sprinkler System Contractor is responsible for the daily clean up of their work.

### **3.4 SYSTEM TESTING**

#### **A. FIRE SYSTEM OPERATIONAL TESTING**

Contractor shall perform thorough operational testing of all equipment in order to verify that all equipment is fully operational and has been installed correctly. A checklist of all equipment, whether or not this equipment was tested, and whether or not the equipment successfully completed the operational testing phase shall be provided. Once testing is completed, provide written certification to the Engineer that all equipment has successfully passed the operational testing within five working days of test completion.

#### **B. FIRE SYSTEM ACCEPTANCE TESTING**

The Contractor shall perform final acceptance testing of all fire protection system equipment in the presence of the Owner, and if desired, the Engineer. Acceptance testing shall verify that the fire protection equipment components are able to operate as complete, workable systems and will provide their necessary function(s). The Contractor shall be

responsible for providing all personnel, lifts, tools, testing devices, radios, and all other equipment that may be necessary to complete the testing procedures. After completion of the acceptance testing, all noted deficiencies shall be remedied within 72 hours. Depending on the number of deficiencies noted, the Owner may request additional acceptance testing. All associated costs incurred as a result of additional acceptance testing shall be the responsibility of the Contractor.

### **3.5 TRAINING**

Training shall be provided by factory trained representatives from the fire alarm system manufacturer. Training shall cover the operation, maintenance, and troubleshooting of each type of device provided. At a minimum, training shall include arming, disarming, activation, resetting of zones or equipment, and basic operational functions for the typical regular use of the respective equipment.

### **3.6 MANUFACTURER'S SERVICES**

The services of a factory-trained representative of the fire protection equipment manufacturer shall be provided by the Contractor. Services shall include 8 hours on-site (over multiple visits) for each system for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. A minimum of one trip shall be for installation inspection, certification and testing; and a minimum of one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 15400**

### **PLUMBING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section shall consist of plumbing to include interior water systems, drain and waste systems, and fixtures and trim as shown on the Plans and specified herein.

All permits shall be obtained in accordance with Section 01160 of these Specifications.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u><b>Section</b></u>	<u><b>Item</b></u>
01300	Submittals
15050	Piping Systems

##### **1.3 REFERENCES**

ASTM B62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	Specification for Seamless Copper Water Tube
ASTM B371	Specification for Copper-Zinc Silicon Alloy Rod
AWWA C502	American Water Works Association Standard for Dry-Barrel Fire Hydrants

##### **1.4 MANUFACTURERS**

Use products of a single manufacturer where two or more units of the same class of equipment are required.

##### **1.5 QUALITY ASSURANCE**

All plumbing shall be performed in accordance with the current edition of the Uniform Plumbing Code. The Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as part of this Project.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

Material shall be delivered to the project site in its original unopened containers with labels informing manufacturer and product name. Material shall be stored and handled in compliance with manufacturer's recommendation to prevent damage.

## **1.7 NAMEPLATES**

Provide major components of equipment with manufacturer's name, address, catalog number, capacity, and equipment designation securely affixed in a conspicuous place.

## **PART 2 PRODUCTS**

### **2.1 PIPE AND FITTINGS - WATER SYSTEM**

#### **A. BURIED PIPE**

1. Pipe
  - a. Type "K" copper, ASTM B88, silver solder.
  - b. Type "B" crosslinked polyethylene (PEX) tubing, ASTM F876.
2. Fittings
  - a. Wrought copper; ANSI B16.22, silver solder.
  - b. Forged Brass, ASTM F1807, crimp connection method.

#### **B. ABOVE GROUND PIPING**

1. Pipe
  - a. Type "K" copper, ASTM B88, silver solder.
2. Fittings
  - a. Wrought copper; ANSI B16.22, silver solder.

## **2.2 PIPE AND FITTINGS – DRAIN AND WASTE SYSTEM**

### **A. BURIED PIPE**

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM 888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

### **B. ABOVE GROUND PIPING**

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM 888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

### **C. FITTINGS**

All fittings and pipe joints shall be hubless, conforming to the requirements of the latest issue of CISPI Standard #301.

### **D. COUPLINGS**

Hubless coupling gaskets shall be the heavy-duty type with dual stainless steel pipe clamps on each side, and shall conform to ASTM C1540, as manufactured by Anaco, Tyler, Ideal Tridon, or equal.

## **2.3 VALVES**

### **A. RELIEF VALVES (ASME - UFPVC)**

Bronze ASTM B62 with bottom inlet, side outlet spring-loaded top guided type with 10-percent overpressure and reset. Setting at lesser of 10-percent or 25 psig over operating pressure or as required by code for specific application. Threaded inlet. B&G, Farris, Consolidated, Lonergan, Watts.

### **B. PRESSURE REDUCING VALVE (DOMESTIC WATER)**

Adjustable self operated type, bronze body, stainless steel integral strainer, and cast iron spring case, 20- to 70-psig outlet pressure range and inlet pressures to 200 psig. Watts, B&G, Fisher, Leslie.

C. BALL VALVES

Ball valves 2 inches and smaller shall be bronze, full port, two-piece, lever handle, 200-pound service, meeting standard MSS SP-110, Apollo Series 77-100, or equal.

D. BACKFLOW PREVENTER

Backflow preventers shall be of the reduced pressure type, double check valve assembly, or double check detector assembly as indicated on the Plans by Febco , Beeco , Watts or equal. Sizes to be as indicated on the Plans.

**2.4 SUMP PUMPS**

There shall be furnished and installed submersible sump pumps as shown on the Plans and specified herein. These pumps shall be located in the Sludge Pump Room.

A. EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Sump Pump at Sludge Pump Room	SP 01

B. PERFORMANCE REQUIREMENTS

The sump pumps shall be provided with the following capacities and motor characteristics: 20 gpm at 20 feet TDH; 1 phase, 120 volts, 60 hertz, 1/3 horsepower minimum.

C. APPROVED MANUFACTURERS

The sump pumps shall be Hydromatic Model VS33, or equal, with integral vertical mechanical switch, No. 12 AWG switch cord and NEMA 5-15P plug.

D. MATERIALS

Pumps shall have cast iron body, stainless steel hardware, stainless steel shaft, and carbon ceramic mechanical seal. Motor windings contain automatic thermal overload protection.

## **2.5 FLOOR DRAINS**

### **A. GENERAL**

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Floor Drain – FD – 2320, galvanized with a nickel bronze top.
2. Funnel Floor Drain – FFD – 2320, galvanized with a nickel bronze top and 6-inch-diameter funnel.

## **2.6 CLEANOUTS**

### **A. GENERAL**

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Grade Cleanout - GCO - 4283 - brass tapered thread plug.
2. Floor Cleanout - FCO - 4023 - brass tapered thread plug.
3. Floor Cleanout - FCO - 4183 - use in tile floors.
4. Wall Cleanout - WCO - 4472 - bronze plug, chrome cover.
5. Floor Cleanout - FCO - 4023-Y - with carpet marker.

## **2.7 FLASHING AND COUNTER FLASHING**

### **A. REQUIREMENTS**

3-lb. lead soldered joints and seams, 24" x 24" base pad and counterflashed into pipe.

## **2.8 PIPING SPECIALTIES**

### **A. STRAINERS**

0.045 of an inch perforated 304 stainless steel screen, Armstrong A1SC or equal by Yarway, Sarco.

### **B. UNIONS**

2 inches and smaller; ground joint, malleable iron type. Crane, Walworth, Syspac.

C. INSULATING UNION

Epco, Capitol.

D. ACCESS PANELS

Milcor, Type "DW" with screwdriver operated lock. Stainless steel access panels in tile walls.

E. ESCUTCHEON

Grinnell Fig. 2 or 13, nickel plated.

F. TRAP PRIMERS

J.R. Smith, Josam, Zurn or Wade, equal to J.R. Smith model S-2699.

G. PIPE MARKING

See Section 15050.

## **2.9 FIXTURES AND TRIM**

A. SHOWER COMPARTMENT AND FIXTURES

Furnish and install institutional shower stalls as shown on the Plans. Institutional shower stalls shall be Florestone Model 42-3W, or equal. Units to be manufactured of gel-coated fiberglass meeting Class 1 Flame Retardance, with galvanized steel stiffeners laminated into each wall. Unit to be supplied with heavy duty hand held shower head, chrome plated hose, valve, side wall bar, two grab bars, stainless steel soap dish, and curtain rod.

B. TOILET

Furnish and install toilets as shown on the Plans. The toilet shall meet the American Disabilities Act guidelines and ANSI A117.1 requirements for people with disabilities.

The toilet shall be Vitreous China with an 18-inch rim height. The toilet shall be American Standard Products Elongated Water-Saver Cadet Toilet, Model No. 2108.408, or equal.

C. LAVATORY AND FIXTURES

A lavatory with fixtures shall be provided for installation as shown on the Plans. The lavatory shall meet the American Disabilities Act guidelines and ANSI 117.1 requirements for people with disabilities.

The lavatory unit shall be Vitreous China, with front overflow and nominal dimensions of 20" W x 27" L. Faucet holes shall be 4 inches on center. The lavatory shall be American Standard, Wheelchair Lavatory for the handicapped, Model No. 9141.011, or equal.

The lavatory fixtures shall include aquaseal valves with renewable seats, 4-inch centers and 4-inch brass wrist handles; an aerator with 2-1/2-gpm flow restrictor; and a pop-up drain with a 1-1/4-inch tailpiece. The fixtures shall be American Standard, Heritage Centerset Faucet, Model No. 2103.786, or equal.

D. TWO BASIN SINKS

Furnish and install stainless steel two basin sinks as shown on the Contract Drawings. Basin dimensions shall be 33" x 22" x 8". The rectangular sink shall be an 18-gauge, stainless steel Type 304 top-mount basin with 1-3/4 inch radius cove corners. Exposed surfaces shall have a brushed finish and basin underside shall be coated with sound deadening material.

The sink shall be an Elkay Model LR3322, or equal. The sink shall be complete with an LK810 chrome plated 8 inch gooseneck spout facet with aerator and 4 inch wristblade handles, LK99 drain fitting, and satin chrome tubing P-trap with cleanout and waste arm to wall.

E. SINK MOUNT EMERGENCY EYE/FACE WASH

Sink mount eye/face wash shall be a sink deck mounted unit with eye/face wash head featuring inverted directional laminar flow providing a minimum 4 gpm flow. Unit shall include a polished chrome brass single action pull-down valve body, universal sign, and 1/2" OD slip joint inlet. Sink mount eye/face wash shall be Haws Axion Model 7510S, or equal.

Eye/face wash shall be provided with a thermostatic mixing valve. Thermostatic mixing valve shall mix hot and cold supply water to produce up to 10 gpm of water at 85 degrees F. Valve shall include a cold water bypass which provides at least 3.8 gpm. Thermostatic mixing valve shall be Haws model 9201EW, or equal.

**F. STORAGE WATER HEATERS**

Storage water heaters shall be electric tank style water heater. Storage water heaters construction shall be steel with baked enamel finished exterior. All internal surfaces of the heater exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing. Electric heating elements shall be low watt density. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused. Electrical junction box with heavy duty terminal block shall be provided. Tanks shall include drain valve shall be located in the front for ease of servicing. Heater tanks shall include a three year limited warranty. Storage water heaters shall have a water capacity and electrical requirements per the Water Heater Schedule. Storage water heaters shall be A.O. Smith DRE series, or equal.

Storage water heaters shall be provided with all code-required accessories such as insulating base-pads, expansion tanks equal to Amtrol ST-25V, and pressure/temperature relief valves.

**PART 3 EXECUTION**

**3.1 PIPE AND PIPE FITTINGS – WATER SYSTEM**

**A. BURIED WATER PIPE**

Install with not less than 1 foot of cover, measured from top of pipe to approved finish floor. Install pipe in accordance with the manufacturer's recommendations. Construct water lines under other utilities where necessary to meet the minimum cover requirements.

**B. HORIZONTAL SOIL AND WASTE PIPE GRADING**

Provide a grade of 1/4 inch per foot where possible, but in no case less than 1/8 of an inch per foot. Install main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

**C. PIPES**

Remove burrs by reaming. Use Teflon tape on male threads only.

**D. OPENINGS IN PIPES**

Keep closed during progress of work.

E. COORDINATION

Install so as not to interfere with light fixtures or other trade components.

F. CLOSE NIPPLES

Not permitted on any part of work. Use standard short nipples for short pipe connections. Use of bushings not permitted.

G. PIPING OF COPPER TUBING

Continuous. Copper tubing inserts in runs of steel pipe not permitted. Solder joints in copper piping. Do not lay copper tubing on rocks or gravel.

H. CONNECTIONS BETWEEN PIPES OF DISSIMILAR METALS

Make with insulating union (Dielectric). Include cast iron valve connections to adapters for copper pipe. Does not apply to waste piping.

I. CUTTING OF COPPER PIPE

Use a cutter. Smooth sharp edges with emery cloth.

J. SADDLES ON PIPE IN LIEU OF TEES AND BENDING PIPE

Not permitted.

K. EQUIPMENT ISOLATION

Provide isolation valves (gate or ball valve) and unions at piping connections to all equipment.

L. CONCEALED PIPING

Conceal all piping in finished areas unless otherwise noted.

### **3.2 VALVES**

A. RELIEF VALVES

Install at all points required by code and where required for protection of equipment and piping. Set pressure shall be as indicated or directed. Pipe discharge to nearest floor drain where pressure cannot exceed 30 psig or to safe acceptable terminus.

**B. PRESSURE REDUCING VALVE ASSEMBLY**

Install with a strainer on inlet side and relief valve on low pressure side. Make connections to pressure reducing valve through a gate valve and a union on each side and a full-size globe valve bypass around reducing valve. Install valves so that they are easily accessible for maintenance and removal. Provide pressure gauges on both high and low pressure sides.

**C. BACKFLOW PREVENTER**

Provide for boilers and chillers, and to comply with “Cross-Connection Control Regulation in Washington State.” Install relief valve on downstream side. After being installed, all backflow preventers shall be inspected and tested by a certified Backflow Assembly Tester and/or a Cross-connection Control Specialist to ensure that protection is provided commensurate with the assessed degree of hazard according to the standards listed in the current edition of the International Plumbing Code.

**D. AIR GAPS**

Distance between inlet pipe and flood level rim twice the diameter of supply pipe.

**E. VACUUM BREAKERS**

Use atmospheric type where vacuum breaker is not upstream of shut-off. Install 12 inches above highest downstream pipe elevation. Use pressure type otherwise. Provide for lawn sprinkling, hose bibs, and faucets with hose end connections.

**F. BALL AND BUTTERFLY VALVES**

May be used in lieu of gate valves on all services except steam systems.

**3.3 SUMP PUMPS**

Submersible sump pumps shall be installed as shown on the Plans and in accordance with the pump manufacturer’s recommendations. All sump pumps shall be checked for rotation prior to lowering into the liquid. When sump pumps are put into service, amperage draw on each phase of power shall be checked immediately.

### **3.4 CLEANOUTS**

Provide every 50 feet and install at all locations required by code and to permit cleaning of all sewer piping. Provide cleanouts full size of pipe, but not larger than 4 inches. Close cleanout openings with brass screw plugs. Where cleanouts occur in floor, install a brass ferrule complete with a screwed brass cover, flush with floor. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and make them easily accessible.

### **3.5 VENTS**

#### **A. FLASH AND COUNTERFLASH**

Install vents passing through roof with roof flashing and counterflashing assemblies.

### **3.6 AIR CHAMBERS**

Provide at each water connection to a plumbing fixture, same size as connection. Minimum length 16 inches, except 24-inches length at flush valves.

### **3.7 PIPING SPECIALTIES**

#### **A. GAUGES**

Mount so gauges can be easily read from the floor. Provide ball valves to isolate pressure gauges. Cocks or petcocks are not acceptable.

#### **B. THERMOMETERS**

Mount to be easily read from the floor. Provide swivel at neck.

#### **C. UNIONS**

Install at final connections to all equipment items and on control side of all valves in mains, branches and risers.

#### **D. ESCUTCHEONS**

Install at all places where exposed piping passes through walls, floors or ceilings.

E. ACCESS PANELS

When not specifically shown on the Plans, provide in walls, ceilings, etc., to provide adequate access for service and maintenance of concealed valves, dampers, motors, air vents or any other concealed equipment or accessories. Minimum size 12" x 12".

F. TRAP PRIMERS

Install automatic trap primers at all locations as shown on the Plans.

G. EQUIPMENT, VALVES, AND PIPING

Tag for identification, indicating equipment, zone and area served. Provide nameplates for access doors and removable ceiling panels to areas containing mechanical equipment, valves, etc. Submit to Engineer for approval proposed list of nameplates. Run all drips and drains for pumps, pans, reliefs, etc., to the drain. Discharge onto floor not permitted.

H. GALVANIZED IRON SLEEVES

Not less than 20 gauge, cast in concrete, and installed wherever piping passes through floors, footings or walls of concrete or masonry construction. Sleeves for insulated pipe shall be of sufficient size to allow the covering to pass through sleeve. Use steel pipe extended 1 inch above finished floor for sleeves in floors of rooms exposed to water. Watch and protect all sleeves and inserts while concrete is poured. For penetration of floors and walls from buried pipe, caulk annular space between pipe and sleeve with first quality oakum and fill with pitch.

I. FIRE PROTECTION

Fire stop pipe penetrations through fire rated walls, floors, and ceilings in accordance with the current edition of the International Building Code.

J. EXPOSED PIPING, VALVES, HANGERS, ETC., AT FIXTURE

Chromium-plated finish.

K. SINK SIZE

Coordinate and verify each sink size with cabinet manufacturer prior to ordering.

**L. ROUGH-IN AND CONNECTION FOR FIXTURES AND EQUIPMENT**

Connect fixtures and equipment furnished and installed by General Contractor, Owner, or others. It is the Contractor's responsibility to obtain from supplier sufficient information to rough-in properly and connect all fixtures in accordance with manufacturer's recommendation. Furnish all traps, valves tailpieces and other trim not furnished with equipment.

**M. SHUT-OFF VALVES**

Provide shut-off valves on all water lines to fixture groups.

**N. LOCATION OF FIXTURES**

Locate in accordance with details and dimensions on Plans.

**O. INSTALLATION OF FIXTURES AND EQUIPMENT**

Support and fasten wall hung fixtures with concealed floor support type carriers. Align fixtures and equipment installed in batteries in accord with architectural drawings. Fit fixtures on finished walls without noticeable warpage on either the wall or fixture and grout with G.E. silicone or similar approved material.

**P. VACUUM BREAKERS**

Locate and install on water supply to all fixtures which have water connection located below rim. Install on all hose bibs.

**Q. WATER CONNECTION STOPS**

Install individual loose key stops on all fixtures. If water connections are concealed, install valves in lieu of stops.

**3.8 MECHANICAL SUPPORTING DEVICES**

**A. GENERAL**

Mechanical equipment and materials are not to be suspended or supported from pipe, electrical conduit, ceiling systems or any non-structural member.

**B. CONCRETE ANCHORING**

Use cast inserts in new construction; stamped metal inserts not acceptable. Expansion shells may be used in existing construction; powder actuated inserts are not acceptable.

**C. PIPE HANGERS AND SUPPORTS**

Item selections, hanger spacings, rod diameters, and protection shields in accord with MSS SP-69 and MSS SP-58, unless otherwise indicated. Pipes shall not be hung or supported from each other. Isolate copper water pipes from dissimilar metals, hangers, steel or aluminum studs, etc.

**D. STRUCTURAL ATTACHMENTS**

Beam clamps where possible.

**E. VERTICAL ADJUSTING DEVICES**

Provide on all rigid hangers.

**F. PROTECTION SHIELD/PROTECTION SADDLE**

Use on insulated pipe.

**3.9 EXISTING UTILITIES**

Locate well enough in advance of the excavation to prevent damage during construction. The Contractor is responsible for any damage whatsoever resulting from his operations on the project.

**3.10 CONTAMINATION**

Prevent contamination of the pipeline during construction from any operation or source.

**3.11 HOT WATER**

Generate at 120 degrees F unless indicated otherwise on the Plans.

**3.12 SYSTEM DRAINING**

Grade domestic water piping so that it can be drained from low points. Provide a valved drain run to nearest floor drain or approved terminus.

### **3.13 HEAD PROTECTION**

Where duct angles, pipe hangers, equipment support angles, etc., are exposed in walkways or in access ways to equipment for maintenance purposes, cover all such potentially injurious protrusions less than 6'-8" above the floor with padding. Secure padding permanently and finish comparable to adjacent surfaces.

### **3.14 TESTING AND STERILIZATION**

#### **A. WATER SYSTEM (POTABLE AND NON-POTABLE)**

Clean piping prior to testing by thoroughly flushing with water until all dirt and foreign materials have been removed. Maintain flushing operations for not less than 1 hour and until piping is clean. Not less than 80-psi flushing pressure.

Conduct for a period of not less than 8 hours at 150-percent operating pressure, 125 psig minimum.

Potable water piping shall be sterilized with calcium hypochlorite at 50 mg/L chlorine for 24 hours prior to line acceptance. Contractor shall furnish hypochlorite. The cost of disposal of water used for sterilization shall be borne by the Contractor.

#### **B. DRAIN AND WASTE SYSTEM**

Subject all work to hydrostatic test of 10-feet head of water or as directed by local plumbing inspection authority. Obtain approval for all work or portions of work as tested, in writing, prior to covering or concealment in any manner. Notify Engineer at least two normal working days prior to testing any portion of work and do not conceal any work until so directed by the Engineer.

### **3.15 INSPECTION**

It shall be the Contractor's responsibility to contact the Owner and arrange for final inspection.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 15700**

### **HEATING, VENTILATION, AND AIR CONDITIONING**

#### **PART 1 GENERAL**

##### **1.1 SCOPE**

The work specified in this Section shall consist of the heating, ventilation, and air conditioning equipment and other associated items as shown on the Plans, and as further specified herein.

All permits shall be obtained in accordance with Section 01160.

##### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

<u>Section</u>	<u>Item</u>
01300	Submittals
Division 16	Electrical

##### **1.3 QUALITY ASSURANCE**

Submittals shall be in accordance with Section 01300.

All equipment supplied in this Section shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on shop drawing submittal for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work to ensure connecting and disconnecting accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor whenever possible. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as approved by the Owner.

The manufacturer's recommendations and instructions of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

## **1.4 PROJECT MEETINGS**

Attend a minimum of two site meetings, each up to 2 hours in duration. The first site meeting will be held after 95 percent of the HVAC equipment and controls have been installed. Any required training should be scheduled and performed at this first site meeting. A follow up site meeting shall be scheduled 6 months after the complete installation of the HVAC and controls to ensure proper operation. Any additional training required should be scheduled and performed at the follow up site meeting.

## **1.5 EQUIPMENT LIST**

Refer to Heating, Ventilation and Air Conditioning Schedules shown on the Plans.

## **1.6 SUBMITTALS**

Submit manufacturer product data on HVAC equipment, as listed in this Section, under the provisions of Section 01300.

# **PART 2 PRODUCTS**

## **2.1 APPROVED MANUFACTURERS**

Equipment manufacturers and model numbers shall be as shown on the Plans except where indicated herein.

## **2.2 LOUVERS**

Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. Certified performance data shall include airflow pressure loss and water penetration.

### **A. DRAINABLE BLADE**

Louvers shall be stationary type with drainable blades in a 6-inch louver frame. Each stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill. The louver construction shall consist of a frame and blades from aluminum extrusions of minimum 0.081-inch nominal wall thickness. The blades shall be positioned at 37 degree angles. Each louver shall be equipped with a framed, removable, 0.125 x 3/4 flattened aluminum rear-mounted bird screen or 16 x 18 mesh aluminum insect screen. Louvers shall be supplied with a finish as shown on the equipment schedules. Each factory-

assembled louver section shall be designed to withstand wind loadings of 25 psf. Drainable blade louvers shall be Greenheck ESD series, or equal.

**B. BRICK VENTS**

Provide and install brick vent(s) as shown on the Plans. Brick vents shall be of heavy gauge aluminum construction, and be 1.5 inches in depth with 1-inch face flange. The vents shall have water stops and deep overlapping blades, each with integral storm drip. The free area of each vent shall be at least 39 percent.

**C. COLOR SELECTION**

Louver color to be selected by Owner from the manufacturer's standard palette of at least 24 colors.

**2.3 DAMPERS**

Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

**A. GRAVITY BACKDRAFT DAMPERS**

Gravity backdraft dampers shall be suitable for pressures up to 1-inch w.g., velocities to 2,500 ft/min and temperatures to 180 degrees F. Gravity-operated back draft dampers shall rotate to the fully open position in the direction of the airflow when subjected to a differential pressure of 0.2 of an inch w.g. or less. Gravity damper construction shall consist of minimum 18-gauge galvanized steel frame with 2.5-inch to 3.5-inch depth; aluminum blades; 304 stainless steel axles turning in acetal bearings. The damper shall be equipped with extruded vinyl blade seals; and internal aluminum tie bar with spring assist. Finish shall be as shown on equipment schedule. Gravity backdraft dampers shall be Greenheck WD series, or equal.

**B. INSULATED FRAME AND BLADE DAMPERS**

Dampers shall be suitable for pressures up to 8-inch w.g., velocities to 4,000 ft/min, standard air leakage less than 3 CFM/square foot at 1-inch w.g. and temperatures to 200 degrees F. Dampers shall consist of: 0.125-inch aluminum channel frame; aluminum airfoil blade internally insulated with polyurethane foam and with polystyrene on four sides and thermally broken with dual polyurethane resin gaps; aluminum airfoil blade internally insulated polyurethane foam and thermally broken. The airfoil blades shall be completely symmetrical relative to their axle pivot

point, presenting identical resistance to airflow in either direction or pressure on either side of the damper. The axle shall be 304 stainless steel with dual bearings in an acetal inner sleeve. The airfoil blade and jamb seal shall be silicone rubber. Blade-to-blade linkage shall be 304 stainless steel. Insulated frame and blade dampers shall be Greenheck ICD-45, or equal.

#### C. RECTANGULAR MANUAL BALANCING DAMPERS

Dampers shall be suitable for pressures up to 1-inch w.g., velocities to 2,000 ft/min and temperatures to 180 degrees F. Dampers shall consist of: a 22-gauge galvanized steel frame with 3.5 in depth; blades fabricated from 20-gauge galvanized steel; 0.375 in square plated steel axles, synthetic (acetal) flanged sleeve bearings to minimize axle leakage and allow for vertical blade mounting. The damper shall be single blade for ducts up to 12-inches diameter, opposed blade for ducts over 12-inches diameter. The damper shall be complete with a locking manual quadrant. A standoff bracket shall be provided for installations using insulated duct. Rectangular manual balancing dampers shall be Greenheck MBD-10M, or equal.

### 2.4 DAMPER ACTUATORS

Actuators shall have spring return operation and open in the direction of the airflow. Actuators shall fail in the open position. Actuators shall be sized by the damper manufacturer for the torque requirements of the damper. The mounting location, voltage, and NEMA enclosure rating shall be as shown on the schedules. Damper actuators shall be Belimo or equal.

### 2.5 GRILLES

Grilles shall be tested in accordance with ASHRAE Standard 70, current edition.

#### A. EXHAUST GRILLES

Grilles shall be of steel construction. Grilles shall consist of 0 degree deflection fixed louver type with blades spaced 3/4-inch on center. The blades shall run parallel to the long dimension of the grille. Grilles shall be finished in a powder coat. Exhaust grilles shall be Price 95 series, or equal.

#### B. SUPPLY GRILLES

Grilles shall be of steel construction. Grilles shall consist of 45 degree deflection fixed louver type with blades spaced 3/4-inch on center. The

blades shall run parallel to the long dimension of the grille. Grilles shall be finished in a powder coat. Supply grilles shall be Price 96 series, or equal.

**C. ACRYLIC GRILLES**

Acrylic grilles shall be constructed of an aluminum frame and acrylic blades. Blades shall be an egg crate arrangement. Grilles shall be finished in a powder coat. Acrylic grilles shall be Truair A960 series, or equal.

**D. COLOR SELECTION**

Grille color to be selected by Owner from the manufacturer's standard palette.

**2.6 FANS**

Fans shall bear the AMCA Certified Ratings Seal for both sound and air performance and be UL tested and approved.

**A. INLINE DIRECT DRIVE FANS**

Inline direct drive fans shall be of the centrifugal, direct drive inline type. The fan, fan housing, and accessories described below and in the Plans shall be one unit supplied by the same manufacturer. The housing shall be of square design constructed of galvanized steel and include square duct mounting collars. Fan construction shall include removable access panels. The fan wheel shall be centrifugal forward curved, constructed of galvanized steel. The wheel shall be statically and dynamically balanced. Motor shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20 percent of full speed (80 percent turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Fan motor shall be of the high-efficiency type running at a minimum of 85 percent efficient at all speeds. Motors shall be heavy-duty ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure as indicated on the Fan Schedules. Motor and drives shall be readily accessible for maintenance. The accessories, controls, and finish shall be as indicated on the Fan Schedule. Inline direct drive fans shall be Greenheck CSP series, or equal.

**B. ROUND INLINE FANS**

Inline fans shall be provided and installed as shown on the Plans. The fan shall be of the centrifugal direct driven type. Fan housing shall be constructed of UV resistant PC thermo plastic. Fan shall be supplied with an integral external electrical terminal box with prewired terminal strip connections. Motorized impeller shall be an external rotor type, Class B insulation, totally enclosed PSC Type. Motor shall be a permanently sealed self lubricating ball bearing type. Motor shall be equipped with automatic reset thermal overload protection. Motor shall be acceptable for continuous duty. Fan wheel shall be of the backward inclined centrifugal type. Motorized impeller shall be dynamically balanced as one integral unit. The hooded wall cap shall be of watertight construction and complete with bird screen. Each fan shall be controlled as shown on the Plans. Provide with accessories as shown on the schedules. Round inline fans shall be Fantech FR series, or equal.

**C. RESTROOM CEILING EXHAUST FANS**

Ceiling fans shall be ceiling mount with multi-speed control (0, 30-100 CFM) that shall be built-in with a high/low adjustable delay timer and activated by a wall switch. Select from 50/80/110 CFM. The motor shall be enclosed with brushless ECM motor engineered to run continuously. ECM motor speed shall automatically increase when the fan senses static pressure to maintain selected CFM. A High/Low delay timer shall return the fan to the preset CFM after a definable period of time. Power rating shall be 120v/60Hz. Duct diameter shall 4" or 6". Fan shall be UL and cUL listed. Ceiling exhaust fans shall be Panasonic FV series, or equal.

**2.7 ELECTRIC HEATERS**

Heaters shall be UL Listed, CSA Certified and meet requirements of the National Electrical Code.

**A. WALL MOUNTED HEATERS**

Provide and install fan forced electric wall mounted electric heaters. Heater shall be designed for wall recessed or surface mounting. Construction shall be galvanized steel housing with steel grille. The heating elements shall be resistance wire enclosed in a steel sheath with steel plate fins. Heater shall include thermal cutout switch and built-in thermostat. Wall mounted heaters shall be QMark AWH series, or equal.

**B. UNIT HEATERS**

Heaters shall be horizontal or vertical mount type. Heater housing shall be constructed of heavy gauge steel. Heaters shall be fan-forced air unit with aluminum finned, copper clad heating elements. The fan shall be completely enclosed and dynamically balanced. The unit shall be complete with pivotal wall or ceiling mounting kit as specified on Plans, control transformer, automatic reset thermal overheat protector, adjustable louvered outlet grille and enamel finished steel housing; all shall be one unit supplied by the same manufacturer. Unit heaters shall be Qmark MUH series, or equal.

**C. DUCT HEATERS**

Provide electric resistance, duct mounted heaters. Duct heater element housing and terminal box shall be fabricated of heavy gauge stainless steel. Element housing shall be configured for slip-in mounting. The terminal box shall be provided with a hinged, latching cover, door-interlocked disconnect switch, and multiple concentric knockouts for field wiring. Heating elements shall be constructed of nickel chromium resistance wire supported by ceramic insulators. The heater shall be rated for the voltage, phase and number of heating stages indicated in the schedule. Terminal blocks shall be provided for all field wiring and shall be sized for installation in accordance with NEC requirements. The heater shall be furnished with the control option, accessories and special features shall be as specified in the Plans. Duct heaters shall be Indeco QUA series, or equal.

**2.8 DUCTLESS SPLIT SYSTEMS**

Ductless split systems shall AHRI certified. Unit shall be constructed in accordance with UL standards and be UL listed. Unit efficiency shall meet or exceed those listed in the latest edition of the Washington State Energy Code.

**A. VRF OUTDOOR UNITS**

**1. General**

The system shall be a split system, heat pump with variable-speed inverter compressor technology. The system shall consist of a horizontal discharge, single-phase outdoor unit, a matched capacity indoor unit that shall be equipped with a wired wall-mounted controller. The system shall use R410A refrigerant. The outdoor unit shall be compatible with the indoor unit. The connected indoor unit shall be of the same capacity as the outdoor unit. The

outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0 degrees F ambient temperature without additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units. System shall operate at up to a maximum refrigerant tubing length of 100 feet between indoor and outdoor units without the need for line size changes, traps, or additional oil. The unit shall be precharged for a maximum of 100 feet of refrigerant tubing. The outdoor unit shall be completely factory assembled, piped, and wired. The outdoor unit sound level shall not exceed 52 dBA in cooling and 53 dBA in heating.

2. Cabinet

The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford a reliable equipment mount and stability. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

3. Fan

The unit shall be furnished with AC fan motors. The fan blades shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

4. Coil

The condenser coil shall be of copper tubing with flat aluminum fins. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of an electronic expansion valve (EV) metering device. The EV shall be control by a microprocessor-controlled step motor.

5. Compressor

The compressor shall be twin rotary compressor with variable compressor speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

6. Electrical

The electrical power of the unit shall be 208/230 volts, single phase, 60 hertz. Power for the indoor unit shall be supplied from the outdoor unit. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

B. WALL-MOUNTED INDOOR UNITS

The system shall consist of a wall-mounted indoor section with wired, wall-mounted controller and a horizontal discharge, single-phase outdoor unit.

1. Unit Cabinet

The indoor unit cabinet shall be wall mounted by means of a factory-supplied mounting plate. The cabinet shall be formed from high-strength molded plastic with front panel access for filter. The indoor unit shall factory assembled, wired, and tested. Contained within the unit shall be all factory wiring and internal piping, drain left mechanism, control circuit board, fan, and fan motor. The unit, in conjunction with the wired, wall-mounted controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.

2. Fan

The evaporator fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The

fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have a minimum of three speed settings, low, medium, and high. The fan shall have a selectable auto fan setting that will adjust the fan speed based on the difference between controller set point and space temperature.

3. Vane

There shall be a motorized horizontal vane to automatically direct airflow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

4. Filter

Return air shall be filtered by means of an easily removable, long-life, high-efficiency filter.

5. Coil

The indoor unit coil shall be of nonferrous construction with precoated aluminum fins on copper tubing. The coils shall be pressure tested at the factory. A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan. The lift mechanism shall be equipped with a positive-acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reaches maximum level. Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.

6. Electrical

The indoor unit shall be provided with a system allowing the indoor unit to be powered and controlled directly from the outdoor unit providing primary power and integrated by directional, digital control signal without additional connections. The indoor unit shall not have any supplemental electrical heating elements.

## 7. System Control

The control system shall consist of a minimum of two microprocessors, one on each indoor and outdoor unit, interconnected by a single nonpolar two-wire cable. Field wiring shall run directly from the indoor unit to the wall-mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

The indoor unit shall be connected to a wall-mounted wired controller to perform input functions necessary to operate the system. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit.

## 2.9 THERMOSTATS

Provide thermostats, as required to control heating and ventilating equipment. Thermostats shall be located on an interior wall that does not receive direct solar exposure unless otherwise indicated. Adjustment screws and temperature-setting indicator shall be accessible without opening the enclosure. Contractor shall provide power wire and appropriate conduit installation for all powered thermostats.

### A. SEVEN-DAY PROGRAMMABLE THERMOSTATS (FOR OFFICE SPACES)

Seven day programmable thermostats for Heat Pump and/or air conditioning control shall meet the following requirements:

1. System Requirements

- a. Control variable speed split system heat pump for heating, cooling and humidity, and three heating stages for standby electric heat.
- b. 7-day programming.
- c. Provide four periods per day for occupied and unoccupied conditions.
- d. Offer automatic or manual heat/cool changeover with 5 degree F minimum deadband.
- e. Provide override capability for a 1, 3, 8 or 12-hour period.
- f. Include a comfort adjust feature to modify set points for the override duration.
- g. Provide Proportional plus Integral (P+I) temperature control.
- h. Display room temperature in degrees F.
- i. Display time in 12-hour clock format.
- j. Disable system and fan selections so both are in AUTO continuously.
- k. Low voltage.
- l. The system shall comply with applicable provisions of ASHRAE 90-75. All wiring shall meet National Electric Codes and local electric codes.
- m. During power loss internal memory stores programmed settings for an unlimited time and the clock shall continue for 8 hours.

2. Sequence of Operations

The heating and cooling set points shall be individually adjustable for both the occupied and unoccupied periods. Space temperature deviation above the cooling set point or below the heating set point shall generate a demand signal to control the system as follows:

- a. Heating
  - i. The thermostat shall control the heating output based on the demand signal communicated from the thermostat program, taking into account both space temperature deviation (proportional error) and the duration of that temperature deviation (integral error).
  - ii. The thermostat shall energize heating equipment when space temperature falls below heating set point.
  - iii. In heat pump applications, auxiliary heat shall be controlled at 2 degrees F below heating set point.
- b. Cooling
  - i. The thermostat shall control the cooling output based on the demand signal communicated from the thermostat program, taking into account both space temperature deviation (proportional error) and the duration of that temperature deviation (integral error).
  - ii. The thermostat shall energize cooling equipment when space temperature exceeds cooling set point.
  - iii. Humidity Control
    - (1) Set relative humidity to 60 percent.
    - (2) Control compressor and blower for dehumidification.
  - iv. Heating Setback and Cooling Setup

Initiation of heating setback or cooling setup for each of 7 days shall be provided by a programmed time schedule manually entered into the thermostat. When all or a portion of a manually programmed schedule is unavailable, the thermostat shall control to the default program as follows:

<b>Table of Default Program</b>		
	<b>Occupied</b>	<b>Unoccupied</b>
Heating Set Points	70°F (21°C)	55°F (13°C)
Cooling Set Points	78°F (26°C)	90°F (32°C)
Start Times	8:00 am	10:00 pm

v. Set point Recovery from Unoccupied to Occupied

The thermostat shall select the optimum time to begin building warm up or cool down based on set points and occupied program as follows:

- (1) Heat Pump: 5 degrees F per hour in heating and cooling.
- (2) Conventional heat/cool: 3 degrees F per hour in heating. Five degrees F per hour in cooling.

vi. Fan Operation

Fan operation shall be selectable as follows:

- (1) Heat Pump Applications
  1. Intermittent: fan is energized with calls for heating and cooling in the occupied and unoccupied periods.
  2. Continuous Occupied: fan is energized continuously in the occupied periods and energized with calls for heating and calls for cooling in the unoccupied periods.

vii. Heating and Cooling Operation Minimum On and Off Times

The thermostat shall incorporate a program to maintain minimum-stage operation in both the heating and cooling.

(1) Five-Minute Compressor Timeguard

This timer prevents compressor from starting unless it has been off for at least 5 minutes.

(2) Fifteen-Minute Cycle Timer

This timer prevents the start of a heating or cooling cycle until at least 15 minutes after the last start of the same cycle. Its function is to assure that equipment is not cycled more than 4 times per hour.

(3) Fifteen-Minute Staging Timer

In multistage heating or cooling, this timer prevents any higher stage from turning on until preceding stage has been on for 15 minutes.

(4) Three-Minute Minimum On Time

In normal operation, when a stage turns on, it will not turn off for a minimum of 3 minutes.

(5) Heat/Cool Set Points (Desired Temperature)

A minimum difference of 2° is enforced between heating and cooling desire temperatures.

viii. Power Interruption

The system shall cycle off and provide timed restaging of heating or cooling equipment upon restoration of power. The restaging operation shall occur according to minimum stage operation times incorporated in the thermostat.

- (1) During a power interruption less than 8 hours, the thermostat retains all programmed occupied and unoccupied start

times and temperatures as well as the present time and day.

- (2) During a power interruption greater than 8 hours, the thermostat retains all programmed occupied and unoccupied start times and temperatures. Only the present time and day will need to be reprogrammed.

ix. Calibration

- (1) No calibration and no adjustment shall be required for mixed air temperature, throttling range, reset ratio, band width, or discharge air temperature.
- (2) Temperature setting displayed on thermostat shall be adjustable within  $\pm 3$  degrees F of measured room temperature.

x. Security

Two levels of security shall exist:

- (1) A key pad lockout switch located on the back of the thermostat shall allow for three types of keypad lockout.
  1. Lock out all keys on the thermostat.
  2. Lock out all keys on the thermostat except the System and Fan settings, temporary set point adjustments, and clock and day adjustments.
  3. Lock out thermostat installer setup mode only.
- (2) Thermostat shall allow for door to be locked by use of two Allen head screws to lock the cover and not allow access to the keypad.

xi. Overrides

Temperature set points can be overridden in three ways:

- (1) Thermostat shall allow for a 1, 3, 8, or 12-hour timed override from unoccupied set point to occupied set point from the thermostat keypad. In addition, the thermostat shall allow for the adjustment of the occupied set point during the timed override from the keypad.
- (2) Thermostat shall allow for a continuous override to the unoccupied set point from the thermostat keypad.

## **2.10 SENSORS**

### **A. AIRFLOW SWITCHES**

Airflow switches shall sense flow in the ductwork and provide a relay output when a no flow situation occurs. The airflow switch shall monitor the airflow using a paddle and adjustable spring which actuates a microswitch. The switch shall actuate at an adjustable low or no flow setpoint at flow rates between 195 FPM and 1575 FPM. The switch shall be suitable for direct duct mounting in horizontal or vertical positions. The switch shall be operable in duct temperatures up to 185 °F. The switch voltage shall be between 24 VAC and 250 VAC with a maximum resistive load of 15 A. Airflow switches shall be Kobold LPS series, or equal.

## **2.11 FLEXIBLE DUCT CONNECTORS**

At the inlet and discharge of all air handling equipment provide flexible duct connectors. The metal to fabric connection shall consist of fabric material a minimum of 3 inches wide with 3 inch metal on either side of the flex material. Metal shall match the duct material for which it is installed. The fabric and metal shall be joined by means of a double lock seam.

### **A. INDOOR**

Flexible fabric shall be Neoprene material with woven fiberglass as base fabric Neoprene coating and shall be UL listed. Material specification at a minimum shall be Weight: 30 oz./sq. yd, Tensile Strength of 500 psi, Tear

Strength: 12 psi, Low Temperature: -40 °F, High Temp: 200 °F. Indoor flexible duct connectors shall be Duro Dyne or equal.

## **2.12 REMOTE DAMPER OPERATORS**

Brass rod, universal joint and flush cover.

## **2.13 AIR EXTRACTORS**

Adjustable blades, push-pull operator. Krueger EX-88A, or equal.

## **2.14 ELBOWS**

Standard radius or vaned square, as per SMACNA Standards.

## **2.15 DUCT ACCESS DOOR**

Hinged, sash lock, as per SMACNA Standards.

## **2.16 TAPE**

Non-combustible, three inches in size, foil backing, pressure-sensitive lap of facing material. NASHUA 322, or equal.

## **2.17 DUCT SEALANT**

Duct sealant shall be Foster 32-19 Duct-Fas, or equal.

## **2.18 ADHESIVE**

Adhesive shall be Foster 85-60 Quick-Tack, or equal.

## **2.19 INSULATION**

### **A. ELASTOMERIC**

Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form conforming to ASTM C 534. Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's and also formaldehyde free, low VOC's, fiber free, dust free and resists mold and mildew. The material shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. Material shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft<sup>2</sup>- °F at a 75 degrees F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518. Materials

shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision. Adhesive and insulation finish shall be the insulation manufacturer's recommended contact adhesive and recommended finish. Provide Armacell APArmaflex or equal.

## **2.20 LINE HIDE SET**

Line hide set shall be plastic duct to aesthetically contain HVAC piping and wiring. Sets shall be weather resistant, UV stabilized, paintable, PVC duct and fittings. Sets shall be suitable for use in ambient temperatures ranging from -4 °F to 140 °F. Mounting shall be done using stainless steel fasteners. Line hide sets shall be Mitsubishi Line-Hide, or equal.

## **2.21 METAL DUCTWORK**

Metal ductwork for air supply and return air shall be fabricated in accordance with ASTM A527 (galvanized sheet metal) or ASTM A167, ANSI Type 302/304 (stainless steel sheets) if S.S. ductwork is shown on the Plans. Metal ductwork shall be rigidly constructed and installed. Slip joints shall be in the direction of air flow. All joints shall be sealed tight. Bonding materials for sealing duct system and attaching insulation shall be supplied by manufacture. Ducting shall be United McGill, SMACNA or equal.

Hangers shall be secured to the ceiling or walls and shall be adequate to support ductwork. Where ducts go through walls, there shall be 1/4-inch clearance left and this area shall be sealed tight with compatible mastic and foam rubber and the penetration area covered over with flanges that are secured to the ductwork only. Volume dampers shall be located as shown on the Plans, and at a minimum of one damper for each branch duct installed. Dampers are to be of the same material as the ducts they are installed in. Fire dampers shall be installed in ductwork as directed by the Building Permit or required by the Owner.

Ductwork shall be installed and supported to comply with the requirements and recommendations of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards. Sheet metal plenum shall be constructed of not lighter than 18-gauge galvanized steel and reinforced with 1-1/2-inch by 1-1/2-inch by 1/8-inch angles as required to prevent drumming or breathing. Access openings and covers shall be provided for cleaning, wiring and servicing motors, filters, fans and dampers located within or blocked by sheet metal work.

## **2.22 FIBERGLASS DUCTWORK**

Fiberglass ductwork shall be fiberglass reinforced plastic ductwork which is resistant to corrosion and designed to be used in buried applications. Ductwork construction shall be a thermoset acrylic resin and Type E woven fiberglass mat. Ductwork shall comply with ASTM E84, Class 1, with a maximum flame-spread index of 25 and maximum smoke-spread index of 50 as tested by NRTL. Ductwork shall be able to operate at temperatures between 45 degrees F and 175 degrees F while maintaining strength requirements of ASTM 2412. All fittings shall be made of the same resin and have the same strength as the rest of the ductwork. Fiberglass ductwork shall be Monoxivent Underduct, or equal.

## **2.23 DUCT HANGERS AND SUPPORTS**

Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

Conform to requirements of SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems."

Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

Provide galvanized steel band or fabricated angle iron brackets for wall supports, except in wet well area where stainless steel components are required.

### **A. HANGER RODS**

Carbon Steel, with hex nuts and flat washers.

### **B. CONCRETE INSERTS**

1. Continuous channel - Unistrut.
2. Universal, malleable iron - Type 18, FS WW-H-171.

Beam Clamps and Attachments as required.

## **2.24 SEISMIC SUPPORTS**

All HVAC supports, tie rods, bracing, brackets or other types of supports shall be designed in accordance with the current edition of the International Building Code (IBC) and ASCE 7. Evaluate the seismic loads in accordance with IBC and Chapter 13 of ASCE 7 for the seismic design parameters shown on the Plans.

## **2.25 FIRE SEALANT**

UL listed field installed self-curing fire barrier material (1 hour minimum rating), suitable for insertion in the annular space between a pipe or duct and its wall penetration or sleeve; Dow Corning "Fire Stop" sealant, 3M "Fire Barrier" caulk or putty or Nelson "Flameseal" putty.

Three-hour rated fire seals shall be manufactured modular mechanical type, Thunderline "Link-Seal" Model FS Pyro-Pac with accessory wall sleeve or equal.

## **2.26 FILTERS**

Air filters shall be 80 percent efficiency, disposable type, and not less than MERV 12 rated. Filter shall UL Class 2 listed unless specifically noted otherwise on the Plans.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

All materials shall be installed as shown on the Plans and according to manufacturer's recommendations. Adjust all dampers and louvers to provide tight seal when closed and unobstructed flow when open. Provide all necessary controls, and coordinate all control wiring with Division 16. All installed equipment shall function in manner intended.

The heating/cooling system shall be installed as shown on the Plans and shall be connected to any ductwork with flexible connections. The Contractor shall be responsible for the installation of any condensate drain piping and conduit/wire runs for controllers/thermostats.

## **3.2 TESTING, ADJUSTING AND BALANCING**

### **A. QUALIFICATIONS**

All work shall be performed under the direct supervision of an AABC Certified Test and Balance Engineer. Resumes including education, experience, and certification of each person on the project shall be

submitted for review and approval by the Owner. Notify the Owner 10 days prior to testing. The Owner shall witness the testing and balancing.

**B. INSTRUMENTATION**

All instruments used will be currently calibrated and listed in the TAB report showing instrument description, serial number, and date of calibration.

**C. AIR BALANCE**

When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the AABC Standard. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

**1. Filters**

Check air filters and filter media and balance only systems with essentially clean filters and filter media.

**2. Fan Speed**

Measure and record RPM at each fan speed.

**3. Voltage and Amperage Readings**

Measure and record the final operating amperages and voltage for each motor.

**4. Static Pressure Profile**

Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device. Static pressure profiles shall also be provided for systems, which do not perform as designed.

5. Equipment Air Flow

Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan and coil.

6. Coil Temperatures

Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil, and HVAC terminal unit. At the time of reading, record water flow, entering and leaving water temperatures (In variable flow systems adjust the air and water flow to design for all the above readings).

7. Zone Air Flow

Adjust each zone of multizone units, each HVAC terminal unit, and air-handling unit for design CFM.

8. Outlet Air Flow

Adjust each exhaust inlet and supply diffuser, register and grille to within the tolerances shown in the AABC Standard. Include all terminal points of air supply and all points of exhaust.

9. Pitot Tube Traverses

For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts, outside air, and return ducts shall have air velocity and volume measured and recorded by the Pitot tube traverse method shown in the AABC Standard. Locations of these traverse test stations shall be described on the sheet containing the data.

D. REPORTS

The report will contain all required information as described within this specification, including the information formatted and shown in the AABC Standard. Include with the data the date tested, personnel present, records of test instruments used, and a list of all measurements taken. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports shall be certified by the Agency's Test and Balance Engineer. Six copies of the final report shall be submitted to the Owner indicating a summary of actual operating data and any abnormal operating conditions.

E. EXECUTION

1. Provide additional dampers, and clean filters as specified herein and shown on the Plans.
2. Put all system and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions, and cleaning of systems have been completed.
3. Do not begin testing and balancing until systems are completed and in good working order.
4. Check motors for proper rotation, coupling and drive alignment, belt tension, and freedom from vibration, etc.
5. Make all changes to drives and dampers as necessary to accomplish specified airflows.

**\*\*\*END OF SECTION\*\*\***

**DIVISION 16**  
**ELECTRICAL**

**SECTION 16010**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. General requirements for electrical work.
    - a. Systems Descriptions
    - b. Area classifications
    - c. Submittals
    - d. Records
    - e. Coordination
- B. Related Sections include but are not necessarily limited to:
  - 1. General Conditions.
  - 2. Division 1 - General Technical Requirements.
  - 3. Division 2 - Site work.
  - 4. Division 3 - Concrete.
  - 5. Division 11 - Equipment.
  - 6. Division 13 - Special Construction.
  - 7. Division 14 - Conveying Systems
  - 8. Division 15 - Mechanical.
- C. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

**1.3 WORK DESCRIPTION**

- A. Provide the labor, materials, and equipment necessary to furnish, install, and place into operation the power, lighting, instrumentation, control, alarm, and associated electrical systems of this Contract.
- B. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified or indicated, and modifications resulting from reviewed shop drawings and field coordinated drawings.

- C. Provide electrical connections to motors, instrumentation, controls, meters, and any other electrical device installed or provided as part of the project.
- D. Test, adjust and calibrate equipment and start-up all electrical equipment, instrumentation equipment, and its associated mechanical attachments as necessary to place the project into operation.
- E. Mark and identify circuits, equipment, and enclosures with wire numbers, nameplates, and warning signs.

#### **1.4 SYSTEMS DESCRIPTIONS**

- A. Provide complete 480Y/277 and 208Y/120 volt power distribution systems including raceways, wiring, and power supply to equipment:
- B. Provide complete interior lighting system including all lighting equipment, raceways, wiring, and switching/control equipment.
- C. Provide complete building exterior lighting system including all lighting fixtures, raceways, wiring, photoelectric and switching/control equipment.
- D. Provide complete process control systems including instrumentation equipment, and associated raceways, wiring, control panels, enclosures, and similar items.
- E. Provide a complete communications system including raceways, conductors, cables (copper), fiber optic cables, patch panels (workstation and fiber), communications outlets, and backboard.

#### **1.5 AREA CLASSIFICATIONS**

- A. Areas of the project are classified as “damp” or “wet” as defined in Article 100 - Definitions of the NEC. For the purposes of this specification, areas considered as damp under the NEC shall be considered wet. Areas are also classified as wet as listed below:
  - 1. Areas outdoors or underground.
  - 2. Areas in below grade vaults, manholes, or pullholes.
  - 3. Areas in buildings or structures that are below grade:
    - a. Sludge Pump Room
    - b. Basement
- B. Hazardous (Classified) Areas: Areas of the project may be classified as hazardous in accordance with NFPA standards. Hazardous (Classified) locations are generally indicated on the plans and/or noted in these specifications. Refer to Appendix for area classification letter giving details of each classification area.

1. Hazardous areas may also be considered corrosive.
- C. Corrosive Areas: Corrosive areas are those areas where equipment or devices will be exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the device or equipment. Corrosive areas are generally indicated on the drawings and/or noted in these specifications. The following shall be considered Corrosive Locations:
  1. Chlorine Areas for Well and Water Treatment:
    - a. Chlorine Gas Room
  2. Corrosive areas may also be considered hazardous.
- D. Process Areas:
  - a. Chlorine Storage Room
  - b. Sludge Pump Room
- E. Finished Areas: Areas that will require concealed construction in walls and ceilings. Finished areas are generally indicated on the drawings and/or noted in these specifications. The following shall be considered Finished Areas:
  - a. Electrical Room
  - b. Laboratory / Office
  - c. Locker Room

## **1.6 DEFINITIONS**

- A. Outdoor Areas:
  1. Those locations on the Project site where the equipment is normally exposed to wind, dust, rain, snow, or similar natural environmental conditions.
- B. Indoor Areas:
  1. Those locations on the Project site where the equipment is normally protected from wind, dust, rain, snow, and similar natural environmental conditions by a building or structure with a complete floor-wall-roof/ceiling enclosure.
- C. Shop Fabricated:
  1. Manufactured or assembled equipment for which a NRTL test procedure has not been established.
- D. NRTL: Nationally Recognized Testing Laboratory.
- E. NEC: National Electrical Code
- F. NFPA: National Fire Protection Association

G. NECA: National Electrical Contractors Association

**1.7 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).
  - 1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies, or equal, to supervise on-site testing specified in Part 3.
  - 2. Comply with NEC for components and installation.
  - 3. Comply with WAC and RCW requirements.
- B. Listing and Labeling: Provide products specified in these specifications that are listed and labeled.
  - 1. The Terms "Listed and Labeled": As defined in the NEC, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
  - 3. Comply with WAC and RCW requirements.
- C. Electrical Component Standard: Provide components that comply with NFPA 70.
- D. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations apply:
  - 1. American Association of State Highway and Transportation Officials (AASHTO).
  - 2. American Iron and Steel Institute (AISI).
  - 3. American National Standard Institute (ANSI).
  - 4. American Society for Testing and Materials (ASTM).
  - 5. ETL Testing Laboratories, Inc (ETL).
  - 6. Insulated Cable Engineers Association (ICEA).
  - 7. Institute of Electrical and Electronic Engineers (IEEE).
  - 8. Illuminating Engineering Society of North America (IES).
  - 9. Instrument Society of America (ISA).
  - 10. Joint Industrial Council (JIC).
  - 11. Lightning Protection Institute (LPI).
  - 12. National Electrical Manufacturers Association (NEMA).
  - 13. National Fire Protection Association (NFPA).

- 14. Occupational, Health and Safety Administration (OSHA).
- 15. Underwriters Laboratories, Inc. (UL).
- E. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, plans and specifications, or within either document itself, the more stringent condition governs.

## **1.8 SUBMITTALS**

- A. See Section 01300.
- B. Make submittals as soon as practical after the date of notice to proceed, but prior to purchase, fabrication, or installation of materials or equipment. Make submittals as a single package for each specification section or group related sections in one submittal, with proposed products and materials grouped according to the sections specified in Division 16. Do not split submittals having a common bill of materials. Group Division 16 submittals with Division 13 submittals where submittals have related items.
- C. Submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- D. Submit Electrical System Study Report (ESSR) with or before the submittal information for switchboards, motor control centers, panelboards, variable frequency drives and circuit breakers and similar items that may affect or be affected by each study. Equipment that is submitted prior to ESSR will not be reviewed and will be returned as "Not Reviewed". Equipment shall not be ordered until the ESSR has been reviewed and approved.
- E. Product Data:
  - 1. Provide manufacturer's product technical data, including, but not limited to:
    - a. Identification of the manufacturer.
    - b. Manufacturer's product descriptive bulletin.
    - c. Current, voltage, nameplate, load, impedance, and other electrical data pertinent to the Project and necessary to assure compliance with the Specifications and Plans.
    - d. Equipment weights and dimensions.
  - 2. Clearly indicate by using arrows or brackets precisely what is being submitted on. Designate optional accessories, which are being included and those which are excluded in the submittal.

- F. Shop Drawings: Submit Shop Drawings containing detailed drawings, diagrams and instructions for installing, operating and maintaining the material and equipment proposed for installation in the electrical work.
1. See individual Division 16 sections for specific additional requirements.
  2. Prior to submittal, coordinate the electrical equipment (particularly panelboards, motor control equipment, control panels, and instrumentation) and materials, with other applicable equipment and systems of the contract documents, particularly process equipment and systems. Any modifications to the electrical equipment or other equipment, due to the use or submittal of process or other equipment which is different from that specified, shall be reflected in the submittal of the electrical equipment so affected. (Refer also to section 01300, 1.1 SCOPE and Section 01300, 3.5 PREQUALIFICATION AND SUBSTITUTION.)
    - a. Where electrical equipment submitted by the Contractor is a different size than the scaled dimensions shown on the plan, section or elevation drawings of the Contract Documents or requires clearance (for Code compliance, ventilation or other reasons), the Contractor shall mark and submit copies of the Contract Documents (or provide a modified AutoCAD drawing) showing the actual size of the proposed equipment, its placement drawn to scale in red pencil on the copies and any necessary clearances which demonstrate the suitability of the proposed equipment for the conditions of installation i.e. adequate space, clearance etc.. Submittals which do not meet this requirement will be rejected as incomplete.
    - b. Where equipment dimensions, layout, conduit connection routing, or conductor and conduit quantities, sizes or types are required to be different than indicated on the Contract Plans to accommodate the submitted equipment, the submittal shall clearly indicate the required changes (increased sizes, ratings of equipment or devices) and shall note that they are being provided to accommodate the submitted equipment without additional cost. The submittal shall indicate increased ratings, sizes. Submittals which do not meet this requirement will be rejected as incomplete.
    - c. Enclosures for equipment submitted by the Contractor shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Submittals which do not meet this requirement will be rejected.

- d. Lugs or connections for equipment submitted by the Contractor shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans. Submittals which do not meet this requirement will be rejected.
3. Provide technical drawings as follows:
- a. Provide diagrams and drawings similar to the Contract Plans and named in a similar fashion for all technical drawings submittals.
  - b. Use diagrams and symbols for shop drawings that conform to Joint Industry Conference (JIC) Electrical Standards for Industrial Equipment and/or NEMA, Industrial Control Systems, ANSI and IEEE standards, latest revisions. Prepare drawings on size A, B or D sheets in a format similar to the Contract Plans or other nationally recognized drawing standard.
  - c. Provide electrical elementary wiring diagrams for the electrical control systems showing the interconnecting wiring of electrical control items, such as motor starters and controllers, control systems, interlocks, switches, programmable controllers, microprocessor controllers, and relays. Use equipment manufacturer's approved submittal drawings as a reference for motor control centers, variable frequency drives, control panels, field instruments etc.
  - d. Provide scaled and dimensioned panel or enclosure face layout drawing; panel/subpanel material of construction, dimensions, and weight; conduit and wiring access locations; and material wiring and terminal block drawings for each control panel.
  - e. Provide schematic interconnection diagrams and/or Process Instrumentation Drawings (PID) diagrams for each separate control system or control panel. Each control diagram shall show a schematic representation of process equipment and locations of switches, meters, automatic valves, and indicators, controllers and recorders. Correct operating settings and ranges for each control instrument shall be marked on these diagrams.

- G. Clearly indicate on submittals that equipment or material is NRTL listed or is constructed utilizing listed or recognized components. Where a NRTL standard has not been established clearly identify that no NRTL standard exists for that equipment.

H. Operation and Maintenance Manuals:

1. See specific sections for information specific to each type of equipment which is to be included in O&M manuals.
2. Provide preliminary manuals of each equipment item to the Owner for review no later than when the electrical equipment is submitted for approval and accepted.
3. Provide final manual copies before the equipment is shipped to the job site. For equipment which also requires third part (NETA) testing, provide reports with O&M manuals after installation but before equipment is put into use. Equipment installation will not be accepted without O&M manuals and third party testing reports.
4. Drawings and Bill of Materials included in final manuals shall show "as shipped" wiring and components. Provide updates to the final manuals with Record Drawings of the work upon completion of the work, folded and punched for insertion into the manual after they are reviewed by the Owner.
5. Clearly indicate by using arrows or brackets precisely what has been provided. Designate optional accessories, which are being included and those which are excluded in the manual.
6. Final manuals for the electrical system shall consist of 3-post, expandable metal hinge binders labeled with the job name and the Contractor's name with tab dividers for each major type of equipment.
  - a. Provide manufacturer's installation, operation, maintenance, and service information for each item of equipment furnished under Division 16.
  - b. Assemble and index each section listing the contents individually on the tab divider for that section.
  - c. Compile a spare parts list and a suppliers index for each section and assemble in the section provided.
  - d. Assemble records of tests, measurements, and calibration settings made for each device. Provide Record Drawings of the work upon completion of the work. Fold, punch, and insert these records into the manual after they are reviewed by the Owner.

**1.9 RECORDS**

- A. Maintain and annotate on the job at all times a separate set of Record Drawings in accordance with the General Conditions. Show changes from the Contract Documents plan drawings including: routing of raceways, stubups, actual equipment and fixture locations, equipment

sizes and dimensions and building or structure outline changes. Review the drawings with the Owner as the work progresses whenever requested and provide color copies of record drawings when requested. At the end of the project, forward to the Owner a complete set of drawings marked in red pencil in a manner consistent with the Contract Plans, indicating the changes made on the job.

- B. Equipment furnished under this Contract for use on future work and all concealed materials, including conduits, shall be dimensioned from visible and permanent building/structure features or drawn to scale on the record drawings.
- C. Record voltage, current, and megohmmeter and ground ohmer resistance test measurements made on the electrical work, the size, type and settings of trip units, fuses, and overload relay elements installed in the equipment. Record the setting of all pressure, temperature, level, and similar instrumentation and control devices. When the project is operating, turn over these records to the Owner.
- D. Digital Record Photographs
  - 1. Requirements for the Photographs
    - a. Digital photographs shall be at the native resolution of the camera or smart phone. The file format of the photographs shall be JPEG using the modest compression. (Where the compression levels are described, the typical description of the compression level might be “good”.)
    - b. JPEG files shall be stored so that the EXIF (Exchangeable Image File Format) data is maintained. Prior to taking any photographs, the camera time should be set so that EXIF data includes the time and date of the photograph. The JPEG files shall be stored so that the creation (or modification) time and date of the file also reflect the time and date of the photograph. (The EXIF data should be viewable under Windows 10.)
    - c. The camera shall have a native resolution of at least 8.0 megapixels.
    - d. Photographs of signs, nameplates, or labels shall be taken using macro modes. The photographs shall be taken so that settings, serial numbers, catalog numbers, order numbers, etc. are legible. The photographs of reflective items shall be taken at an angle to the item to reduce glare.

2. Take photographs of electrical equipment possibly requiring coordination when the equipment arrives on site. The photographs shall include nameplates and labels if available. The equipment shall include but not necessarily be limited to, the following:
  - a. 480 VAC Motors
  - b. HVAC equipment
  - c. Control Panels
  - d. VFDs
3. Take photographs of conduits prior to concealing them. The photograph files shall be labeled with location or shall contain adequate context to determine location such as a tape measure showing distance from a wall or depth below grade. The photographs shall include the following:
  - a. Conduit placement prior to pouring concrete or backfilling
  - b. Conduit placement prior to covering walls
  - c. Stub up locations prior to placing equipment such as Control Panels.
4. Take photographs of electrical equipment following installation or modification. The photographs shall include nameplates, labels, and similar identifiers. The equipment shall include but not necessarily be limited to, the following:
  - a. Motors and motor drive equipment.
  - b. Control Stations
  - c. HVAC equipment
  - d. Control Panels
  - e. Instrumentation providing electrical signals including transmitters, sensors, and switches.
  - f. Panelboards
  - g. Safety Disconnect Switches
  - h. Circuit Protective Devices showing catalog number, serial number and adjustable trip settings.
5. Photographs shall be supplied to the Owner at least once every day. Photographs shall be supplied to the Owner no later than one day after they are taken. Photographs shall be supplied on optical media (CD-R, DVD-R, or DVD+R), by email or by another method by prior arrangement with the Owner.

## **1.10 COORDINATION**

- A. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with

requirements of governing regulations, franchised service companies, and controlling agencies.

- B. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 48 hours before interruption of the system.
- C. Coordinate the cutting of existing structures with the new and existing electrical systems. Identify, locate, and protect existing and underground, underslab or embedded conduits/cables where excavation or cutting of existing structures is to be performed.
- D. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.
- E. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- F. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces.
- G. Coordinate the electrical work with the requirements of equipment provided under other Divisions. Portions of the electrical design are based upon the equipment specified in other Divisions. Where modifications to the specified electrical systems or equipment devices or materials are required to accommodate actual electrical requirements of equipment which is specified under other Divisions of the Contract but which has electrical requirements different from those specified under those Divisions for the equipment, make modifications to the electrical system or systems required to accommodate the equipment, and pay for all such changes. No additional payment, “extras”, or additive change orders are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.
- H. Where changes in the work, or substitutions in material or equipment specified under this Division are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division. If changes to work outside this Division are required to accommodate substitutions or changes proposed by the Contractor, submit complete descriptions of these changes for approval by the Owner, and pay for all such changes. No additional payment or “extras” are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.

- I. Coordinate the installation of electrical equipment with other trades:
  - 1. Arrange for the building-in of equipment and materials during structure construction. Arrange for the building in of anchors, supports, sleeves, or other equipment and materials during concrete placement, framing, precasting or other structure construction. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed. Install sleeves for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls. Gypsum wall sleeves may be cut-in after erection if desired.
  - 2. Where equipment or materials cannot be built-in during construction, arrange for chases, slots, box-outs or other openings in the structure, as required to allow installation of equipment after structure construction is complete.
  - 3. Where penetration of completed or permanent construction elements such as walls, beams, ceilings, floors, etc. is required, obtain approval from Owner for penetration (drilling, cutting, shooting, punching) of structural components prior to penetrating the element or component.
  - 4. Accurately locate panelboards, outlets, switches, control stations and similar devices with respect to equipment and the finished work of others. Verify dimensions and locations with the general, civil, structural, mechanical, process, architectural and other Contract plans as well as shop drawings/supplier's drawings and trades.
  - 5. Coordinate installing large equipment requiring special access openings or positioning prior to closing in the building.
- J. Coordinate electrical work with work under other Divisions. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Cooperate in locating equipment to avoid interference with work of others, and plan this work to harmonize with the work of other trades so that all work may proceed as expeditiously as possible. No extras are allowed because of moving work required to avoid interference with work of other trades or contractors.
- K. Coordinate connecting electrical circuits to components furnished under other Divisions. Coordinate the location of motors, switches, panel connections and other points of connection with the equipment

manufacturers or vendors prior to conduit installation, and route circuits to the actual connection point. Remove and reinstall conduit, outlet boxes and other electrical connections, even if removal and reinstallation of building materials is necessary, where electrical connections are not made to the appropriate equipment location.

#### **1.11 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01600.
- B. Receive, handle, and store electrical materials and equipment in accordance with the manufacturer's instructions.
- C. Protect materials and equipment from damage, corrosion, or disfiguring; protect nameplates on electrical equipment from defacing. Deliver equipment to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.
- D. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.
- E. Provide dry, heated storage for materials and equipment intended to be installed indoors which is not protected by packaging suitable for outdoor storage by the manufacturer and for equipment that requires an electrical connection or heater to mitigate water condensation and like hazards.
- F. Keep electrical equipment rooms clean and vacuumed after each day when work is performed in the area. Do not place electrical equipment rated for indoor installation into its final location until this location is weathertight and heated with openings to the outside closed with temporary weather barriers or with the installation of permanent doors, fans, and ducts. (The final location shall be the electrical equipment location shown on the Contract Plans or otherwise described in the Contract Documents.)
- G. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage - either inside or on top of enclosures.
- H. Protect nameplates on electrical equipment from defacing.
- I. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.

## **1.12 EXTRA MATERIALS**

- A. Provide extra materials including spare parts where noted in individual specification sections.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site or house equipment in a storage area not accessible to the Owner. Provide an inventory and listing of the spare parts to the Owner when the parts (and spares) arrive onsite.

## **PART 2 — PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to individual Division 16 sections.
  - 1. Provide equipment, which is of a similar type, made by one manufacturer throughout the project unless otherwise noted in the Specifications.
- B. Submit requests for substitution in accordance with Specification Section 01300

### **2.2 MATERIALS**

- A. Except as otherwise indicated, provide new materials and equipment which are standard products of manufacturers regularly engaged in production of such equipment. Provide similar items of equipment of the same manufacturer and quality. Where systems are specified, provide components of the system from one manufacturer.
- B. Trade names and catalog numbers may be used in the Plans or Specifications to establish quality standards and basis of design:
  - 1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.
  - 2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.
- C. Provide material or equipment approved and labeled for the purpose for which it is to be used by a nationally recognized electrical testing laboratory (NRTL) or other organization acceptable to the State of Washington Department of Labor and Industries.
  - 1. Where NRTL test procedures have been established for the product type, provide electrical equipment approved under that procedure and bearing the NRTL label.

- D. Where voltage, current, power, temperature or other ratings are specified that do not correspond to standard ratings of the manufacturer selected by the Contractor, furnish the next rating level which increases the capacity of the device or material in question.
- E. Furnish materials, devices, equipment or supplies of materials that are inherently non-corrosive or are coated or covered in a manner, acceptable to the Owner, which renders them non-corrosive. Do not provide materials which contain polychlorinated biphenyls, asbestos or other hazardous or detrimental materials. Do not install materials in a manner, location or construction that produces galvanic action or any other materials corroding or eroding action. Material that may cause rusting or streaking on a building/structure surface shall not be used.
- F. Fabricate equipment or devices in the field equivalent in every respect to manufactured items used for the same purpose. Where cutting, drilling, grinding, or similar actions are performed on galvanized or painted metal, regalvanize or repaint, respectively, to match original finish.
- G. When equipment is shop fabricated for the Project, use electrical devices and enclosures which are NRTL listed and labeled or recognized.

## **2.3**

### **ELECTRICAL SYSTEM STUDY REPORT (ESSR)**

- A. The short circuit calculation and withstand evaluation report, circuit protective device coordination studies and arc flash studies shall comprise the Electrical System Study Report (ESSR).
- B. Create reports for existing, new and modified electrical distribution equipment including the Utility Point of Service and submit reports of equipment submittals for approval. Distribution equipment shall include switchboards, panelboards, motor control centers, dry type transformers, etc.
- C. short circuit calculation and withstand evaluation report, circuit protective device coordination studies, and arc flash studies shall be stamped and signed by an electrical engineer registered in the State of Washington.
- D. short circuit calculation and withstand evaluation report, circuit protective device coordination studies, harmonic analysis studies, or arc flash studies shall be submitted with or before the distribution and control equipment being provided on the project (switchboards, motor control centers, variable frequency drives, panelboards, etc.). It is not acceptable to submit the ESSR after the distribution equipment has been submitted. As a minimum, include the following in the report:

1. Utility source information including primary system & service transformer impedance, X/R ratio, symmetrical and asymmetrical fault currents for 3 phase, line-to-line and line-to-neutral faults.
  2. Equipment manufacturer's information used to prepare the study.
  3. Assumptions made during the study.
  4. Short circuit calculations listing short circuit levels at each bus.
  5. Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
  6. Time-current curves including the instrument transformer ratios, model numbers of the protective relays or trip devices, and the relay or trip device settings associated with each breaker.
  7. Comparison of short circuit duties of each bus to the bracing and interrupting capacity of the equipment connected to that bus.
- E. Elements of short circuit calculation and withstand evaluation report
1. One-line Diagram:
    - a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
    - b. Type designation, current rating, range or adjustment manufacturer's style and catalog transformers.
    - c. Power, voltage ratings, impedance, primary and secondary connections of all transformers.
    - d. Nameplate ratings of all motors and generator with their subtransient reactances.
    - e. Transient reactances of generator and synchronous reactances of generator.
    - f. Sources of short circuit elements such as utility ties, generators, and induction motors.
    - g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.
    - h. Standby as well as normal switching conditions.
  2. Impedance Diagram
    - a. Available MVA or impedance from the utility company.
    - b. Bus impedance.
    - c. Transformer and/or reactor impedances.
    - d. Cable impedances.
    - e. Equipment impedances.
    - f. System voltages.
    - g. Grounding scheme (solid grounding, resistance grounding, or no grounding).

3. Calculations:

- a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
- b. Calculate the maximum and minimum ground-fault currents.

F. Circuit Protective Device Coordination Study

1. As a minimum, include the following on 5-cycle, log-log graph paper:
  - a. Time-current curve for each protective relay or fuse showing graphically that the settings will allow protection and selectively within Industry standards. Identify each curve and specify the tap and time dial setting.
  - b. Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Project Representative as to the cause.
  - c. Time-current curves and points for cable and equipment damage.
  - d. Time-current curves and points for standby power generation equipment (e.g., engine generator) protective relays
  - e. Circuit interrupting device operating and interrupting times.
  - f. Indicate maximum fault values on the graph.
  - g. Sketch of bus and breaker arrangement.

G. Arc Flash Study

1. Prepare a report summarizing the arc flash study and conclusions or recommendations which may affect the integrity of the electric power distribution system.
2. Determine the incident energy, arc flash boundary, and minimum PPE requirements for locations throughout the studied portions of the power system. Arc flash warning labels are to be produced and attached to the electrical equipment. These labels must indicate approach boundaries, incident energy level, and the minimum PPE that is required when servicing the equipment within the arc flash boundary.
3. As a minimum, include the following in the report:
  - a. Assumptions made during the study.
    - 1) Estimated available fault current for each bus.
    - 2) Estimated arc fault current for each bus.

- 3) Trip settings for all circuit protective devices (protective relays, circuit breaker and fuses) upstream of any bus evaluated.
  - 4) Material, quantity, size, and length of each conductor of feeder and raceway material of each feeder.
- b. Reduced copy of the one line drawing.
  - c. Arc flash evaluations summary spreadsheet
    - 1) Bus name.
    - 2) Upstream protective device name, type, settings.
    - 3) Bus line to line voltage.
    - 4) Bus bolted fault.
    - 5) Protective device bolted fault current.
    - 6) Arcing fault current.
    - 7) Protective device trip/delay time.
    - 8) Breaker opening time.
    - 9) Solidly grounded column.
    - 10) Equipment type.
    - 11) Gap.
    - 12) Arc flash boundary.
    - 13) Working distance.
    - 14) Incident energy.
    - 15) Suggested electric arc rated PPE rating.
  - d. Arc flash warning labels printed in color on adhesive backed labels.
4. Provide the arc flash warning labels containing information suggested by NFPA 70E and affix warning labels to each piece of electrical equipment evaluated in the Arc Flash Study. In addition to the information suggested by NFPA 70E, the arc flash warning labels shall also indicate the report date and date of circuit protective device testing (as of the time of the arc flash study). Arc Flash Warning labels shall be installed prior to the Contractor energizing the equipment. The third party testing agency shall confirm the circuit protective devices (protective relays, circuit breakers and fuses) match as recommended in the arc flash study prior to equipment energization.
  5. The Contractor shall provide four hours (minimum) of arc flash training to the Owner at an Owner's designated facility prior to the Contractor energizing the electrical equipment. Arc Flash training shall include consultation with facility manager regarding plant

safety plan based on NFPA 70E, Handbook for Electrical Safety in the Workplace.

- a. Arc Flash training shall be based on the latest edition of NFPA 70E, Handbook for Electrical Safety in the Workplace.
- b. Training shall include site specific features, such as arc flash mitigation procedures, electrically safe procedures, Owner provided personal protective equipment (PPE) use and care procedures.

H. Previous System Study

1. A previous Electrical System Study Report was completed and is available for the Contractor to use to complete the report.
2. Provide analysis of the system from the distribution equipment in the new building back to the Utility Point of Service.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Make arrangements for and pay for necessary permits, licenses, and inspections.
- B. Equipment shall be installed in accordance with the requirements of the National Electrical Code, National Electrical Safety Code, and applicable state and local regulations and ordinances.
- C. Install equipment in accordance with the manufacturer's instructions and the NECA "NEIS" (National Electric Installation Standards).
- D. Provide on-site testing as listed in individual specification sections. Test results shall be in writing.
- E. Equipment Dimensions and Clearances:
  1. Dimensions indicated for electrical equipment and dimensions indicated for the installation of electrical equipment are restrictive dimensions. Verify that equipment will fit within the indicated locations and spaces. Do not use equipment that impinges upon the required clearance, reduces actual clearance, or exceeds the indicated dimensions:
    - a. Except as approved in writing by the Owner.
  2. Do not use arrangements of equipment that impinge upon the required clearance, reduce actual clearances or exceed the space allocation.

- F. Equipment Access:
1. Install equipment so it is readily accessible for operation and maintenance.
  2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.
  3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- G. Install materials and equipment in a manner, location and construction that does not produce galvanic action or any other materials corroding or eroding action. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
- H. Screen openings and seal all raceways into equipment to prevent the entrance of moisture, rodents and insects.
- I. Plans indicate the approximate location and arrangement of electrical equipment and the approximate location of other equipment requiring electrical work. The general arrangement of panelboards, outlets and other equipment is diagrammatic and approximate as to locations. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Where minor changes are required because of structural or finish conditions or for the convenience of the Owner, provide such changes without additional expense to the Owner. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Owner's approval. Minor adjustments are defined as a distance not to exceed:
1. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
  2. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.
  3. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.
  4. 1 FT on walls in a horizontal direction within the vertical plane.
  5. Changes in equipment location exceeding those defined above require the Owner's approval.
  6. Particular attention shall be paid to door swings, piping, radiation, ductwork, and structural steel:
    - a. In general, waste and vent lines and large pipe mains and ductwork shall be given priority for the locations and space shown.

- b. Electrical lighting fixtures shall, in general, be given priority for ceiling space.
- c. No additional compensation will be allowed for the moving of misplaced outlets, wiring, or equipment.

### **3.2 DEMONSTRATION**

- A. Demonstrate equipment in accordance with Section 01800.
- B. Demonstrate to the Owner that the electrical installation is working by operating all electrical systems and equipment. Simulate control and emergency conditions, artificially where necessary, for complete system tests. Adjust installed equipment for proper operation of all electrical and mechanical components.

### **3.3 ASSISTANCE**

- A. Provide assistance to the Owner during the demonstration or testing of equipment by operating devices and equipment, during construction observation by opening enclosures for inspection, checking record drawing information, and similar tasks, as necessary, in the Owner's judgment to verify all work provided.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 16050**

### **BASIC ELECTRICAL MATERIALS AND METHODS**

#### **PART 1 — GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Supporting devices.
  - 2. Electrical identification.
  - 3. Electrical demolition.
  - 4. Cutting and patching
  - 5. Cleaning and finish touchup painting.
  - 6. Testing

##### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of material specified.
  - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
  - 1. Testing Reports. (See section 3.8 for further information)

##### **1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.

#### **PART 2 — PRODUCTS**

##### **2.1 SUPPORTING DEVICES**

- A. Provide tubing, channel and angle support systems, hangers, sleeves, brackets, fabricated items, and fasteners for secure support of electrical equipment, devices, components and materials:

1. Material:
  - a. Wet locations (including outdoors and in below-grade structures): Stainless steel or hot-dipped galvanized.
  - b. Class I Hazardous locations and/or Corrosive areas: 304 stainless steel or 40 mil PVC coated galvanized steel.
  - c. Other locations: Steel, except as otherwise indicated, protected from corrosion with zinc coating, cadmium plating, or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
- B. Conduit clamps: one hole or beam clamps
  1. Rigid Steel Conduit: cast iron hot dipped galvanized clamps with cast iron hot dipped galvanized clamp back (AKA foot or spacer).
  2. PRMC: cast iron PVC coated or stainless steel clamps with cast iron PVC coated or stainless steel clamp back (AKA foot or spacer).
  3. EMT: stamped steel clamps – cad plated or galvanized.
- C. Anchors: stainless steel in wet, hazardous or corrosive areas; cadmium plated or galvanized steel in dry areas.
  1. lag screws or Type A tapping screws for wood.
  2. Toggle bolts with springhead for light loads in masonry.
  3. thru-bolt with fender washers for loads in masonry.
  4. toggle bolts with springhead for hollow partitions.
  5. epoxy set or self drilling anchors with threaded studs for concrete.
  6. clamps or U-bolts for structural steel.
  7. Epoxy set or self drilling anchors with extension rods for hollow tile over concrete.
  8. hanger rods: 1/4-inch diameter or larger threaded steel, except as otherwise indicated.
- D. Sleeves:
  1. Wet, hazardous or corrosive areas:
    - a. ASTM A 53, Type E, Grade A, Schedule 40, hot dipped galvanized steel, plain ends.
    - b. Hot dipped galvanized cast iron, with weep rings.
  2. Dry Areas:
    - a. PVC, schedule 40.
    - b. 0.0276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

## **2.2 ELECTRICAL ENCLOSURES**

### **A. Enclosures for use with Electrical Equipment:**

1. Standards:
  - a. NEMA ICS-6, Enclosures for Industrial Controls and Systems.
  - b. UL 508, Industrial Control Equipment.
  - c. UL 698, Industrial Control Equipment for Use in Hazardous Locations.
2. Provide NEMA enclosure types as indicated on the Contract Documents. Where the enclosure type is not indicated by the Contract Documents provide enclosures as follows:
  - a. NEMA 1: Use in electrical rooms and in dry indoor finished areas.
  - b. NEMA 12: Use in unclassified (non-hazardous and non-corrosive) indoor locations which are neither wet nor damp.
  - c. NEMA 4X: Use in all non-hazardous wet or corrosive locations.
  - d. NEMA 7: Use in all hazardous locations.

### **B. Shop or Factory Finishes:**

1. Exteriors of painted enclosures shall be ANSI gray.
2. Interiors of painted enclosures shall be either white or light gray.

## **2.3 ELECTRICAL IDENTIFICATION**

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Contractor's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NEC and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide.
- C. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  1. Size: Not less than 4 mils thick by 6 inches wide.
  2. Compounded for permanent direct-burial service.
- D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- E. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical

fasteners 1/16 inch minimum thick for signs up to 20 sq. in., 1/8 inch thick for larger sizes. Engraved legend in white letters on black face.

- F. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or stainless-steel No. 10/32 machine screws with nuts and flat and lock washers.
- G. Wire markers: machine printed, black ink, alpha-numerical identifiers on yellow polyolefin shrink tubing. Kroy K4350 Shrink Tube, or approved equal.
  - 1. Where it is not possible to use shrink tubing (i.e. on pre-terminated cables) it is acceptable to use the following:
    - a. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

## **2.4 TOUCHUP PAINT**

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Non-equipment Surfaces: Matching type and color of undamaged, adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with NECA's "Standard of Installation."
- B. Install the equipment and materials in a neat and workmanlike manner employing workmen skilled in the particular trade and in accordance with the manufacturer's instructions and industry standards. Maintain adequate supervision of the work by a person in charge at the site during any time that work under this division is in process or when necessary for coordination with other work.
- C. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at fifty-four inches above floors to centerline of controls.
- D. Install items level, plumb, parallel and perpendicular to other building systems and components, except where otherwise indicated.

- E. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- F. Give right of way to raceways and piping systems installed at a required slope.
- G. Make all penetrations of electrical work through floors, walls and roofs water, rodent, insect and weather-tight.

### **3.2 ELECTRICAL SUPPORTING METHODS**

- A. Support electrical equipment, devices and materials from framing members or structure with sufficient clearance for maintaining and servicing.
  - 1. Provide backing plates, and/or framing material to support equipment, devices and materials which are located between the framing members which are part of the building or facility structure.
  - 2. Provide metal structure fabricated of structural shapes such as C-channel or square tubing (not strut channels, unistrut, b-line, etc.) for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other equipment and devices except where components are mounted directly to structural features of adequate strength.
- B. Fastening and Supports: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building/structure/support.
  - 1. Use supports as detailed on the Plans and as specified:
    - a. Where not detailed on the Plans or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.
  - 2. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of the equipment supplier/manufacturer and the Owner. Do not mount safety switches or external equipment to other equipment enclosures, unless enclosure mounting surface is adequately reinforced structurally to accept mounting of external equipment.
  - 3. Base rating and size of supports and anchoring devices on dimensions and weights verified from approved equipment

- submittals. Attach wall mounted enclosures with a minimum of three fasteners, and more if the manufacturer so recommends.
4. Stand off outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls a minimum of one-quarter inch where enclosures are mounted on walls in wet areas (outdoors, below grades, etc.). Use corrosion resistant spacers such as neoprene, or fiberglass or plastic shim washers to maintain ¼ IN separation between the equipment and the wall.
  5. Do not cut, or weld to, building structural members without permission of the owner. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
  6. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- C. Raceway Supports: Comply with NEC and the following requirements:
1. Conform to manufacturer's recommendations for selecting and installing supports.
  2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
  3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
  4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
  5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
  6. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.
  7. Use double nuts or jam nuts with regular nuts on threaded rods and bolts.
  8. Trim rod ends to within ¼ inch after installation of last nut, clamp or similar hardware; smooth cut ends or install cap nut.
- D. Provide concrete foundations or pads required for electrical equipment:
1. Floor-mounted equipment shall be mounted on a concrete base except the concrete base shall be shortened in height by the thickness of the channel base when the equipment is provided with channel bases such as can be provided with control panels, motor

- control centers and switchboards. Pad shall be poured on top of the finished floor or slab.
2. Install concrete pads and bases according to requirements of Division 3 and per structural plans and specifications.
- E. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
  - F. Cable supports - provide cable ties and straps for clamping, tying, securing and banding wires and cables in all junction boxes, panelboards and terminal cabinets. Support each circuit independently; group phases of three phase circuits.

### **3.3 IDENTIFICATION**

- A. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Plans or required by codes and standards. Use consistent designations throughout the Project.
- C. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- D. Tag or label power circuits in enclosures using tags or adhesive marking tape. Identify source and circuit numbers in each cabinet, pull box, pull hole, vault, maintenance hole, junction box, and outlet box. Color coding may be used for voltage and phase indication.
- E. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches, use a single line marker.
- F. Provide engraved phenolic name plates (white with black background) on equipment enclosures giving the name and circuit identification (Panel/MCC/Enclosure served from and circuit location or ID) of the enclosed device/equipment in one-quarter inch letters.
- G. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

- H. Provide electrical danger, caution, warning or safety instruction signs including arc flash signs in accordance with WAC/RCW, WISHA/OSHA and other applicable state/federal safety requirements.

### **3.4 DEMOLITION**

- A. Demolish all existing electrical devices and circuits which are noted for demolition. Demolition includes, but is not limited to:
  - 1. Remove all conduit, conductors, fittings, device boxes, hangers, panels, devices, etc., which are not concealed in the building structure or below grade/slab.
- B. Do not remove or damage fireproofing materials. Repair or replace fireproofing removed or damaged.
- C. Locate, identify, and protect electrical equipment and materials to remain. Where existing work to remain is damaged in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality at no additional cost to the Owner.
- D. Remove existing conductors from conduits or other enclosures, unless otherwise indicated, where existing work is to be abandoned in place. Cut and remove buried cable or raceway indicated to be abandoned in place at the point where it stubs up or emerges from burial 12 inches below the surface of adjacent grade or construction; cap and patch surface to match existing finish.
- E. Remove demolished material from the Project site and legally dispose of demolished material by wastehaul to approved landfill or recycling facility.
- F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation and/or reconnection. Coordinate the process, mechanical, HVAC, and other equipment scheduled to be relocated and/or reused with other Divisions, and disconnect the equipment from and reconnect the equipment to the electrical systems.

### **3.5 TEMPORARY POWER**

- A. Provide temporary power to existing branch circuit panels, branch circuits, and/or directly to electrical devices as required to keep all portions of the existing facility, which are occupied by the Owner, or required for facility operation, in operation at all times. Obtain approval by all appropriate code authorities, including the Department of Labor & Industries Electrical Inspection Department, for any temporary connections provided.

### **3.6 CUTTING AND PATCHING**

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

### **3.7 CLEANING AND TOUCHUP PAINTING**

- A. Clean dirt and debris from all surfaces. Thoroughly vacuum the interior of enclosures to remove dirt and debris.
- B. Replace nameplates damaged during installation.
- C. Apply touch-up paint as required to repair scratches, etc. Field paint in accordance with Section 09900. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

### **3.8 TESTING**

- A. Testing shall be performed by a person currently certified by the InterNational Electrical Testing Association.
- B. Additional testing requirements specific to other sections are specified in those sections.
- C. Test electrical equipment as described in individual specification sections after installation but before it is energized and placed in service. All equipment shall be tested as recommended by the manufacturer. Report all test results in writing. Where tests disclose a defect in the work, rework or repair equipment which performs unsatisfactorily during or as a result of system testing at no additional expense to the Owner and retest to confirm the rework or repair until retesting confirms that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, IEEE, ISA, ANSI, or other) for the class of equipment. If equipment or system fails retest, replace it with products which conform with Contract Documents. Continue remedial measures and retests until satisfactory results are obtained. Remedial measures and retests will be done at no cost to the Owner.
- D. Test motor driven equipment motors before energization. Insulation test shall consist of megohmmeter check phase-to-ground, per IEEE Standard 43, and polarization index test per the manufacturer's recommendations.

1. Perform load tests of each motor and prepare a written report of the findings showing the following:
  - a. Nameplate Ratings (horsepower), (speed), (voltage), (phase), (ampere rating of motor at full load).
  - b. Measured Load in amperes on each phase at full speed.
2. For load tests for each pump/blower/ process equipment motor:
  - a. Note the operating conditions at the time of the test.
  - b. Note the suction and discharge conditions (pressure, water level, temperature, humidity, where such conditions affect load).

### **3.9 DEMONSTRATION**

- A. Demonstrate equipment in accordance with Section 16010.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 16060**

### **GROUNDING**

#### **PART 1 — GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 16120 for grounding conductor requirements.

##### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of component specified.
  - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.4 for further information)
- D. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
  - 1. Approved testing reports.
  - 2. Product Data

## **1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 Basic Electrical Requirements 1.7 Quality Assurance
- B. Comply with UL 467, "Grounding and Bonding Equipment".

## **PART 2 — PRODUCTS**

### **2.1 GROUNDING AND BONDING PRODUCTS**

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

### **2.2 WIRE AND CABLE GROUNDING CONDUCTORS**

- A. Comply with Section 16120 Conductors and Cables." Conform to NEC Table 8 (Conductor Properties), except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Insulated with green color insulation.

### **2.3 CONNECTOR PRODUCTS**

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items. Burndy, Thermoweld, or Cadweld.

## **PART 3 — EXECUTION**

### **3.1 APPLICATION**

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
  - 1. Install insulated equipment grounding conductor with circuit conductors for the items below.
    - a. Service and Feeders.

- 1) Bond the conductor full size to the equipment to which the circuit connects and to any portion of the raceway where it is metallic. Provide boxes or fittings suitable for connecting equipment grounding conductors where metallic conduit transitions to non-metallic.
  - b. Single or three-phase motor or appliance branch circuits.
  - c. Flexible raceway runs.
2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables. Bond the conductor at each end of non-metallic raceway to grounded metallic raceway or equipment.
3. Provide boxes or fittings suitable for connecting equipment grounding conductors where metallic conduit transitions to non-metallic.

### **3.2 INSTALLATION**

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Plans or Specifications exceed NEC requirements.
- B. Ground the secondary electrical system to the building structure, metallic piping systems and supplemental grounding electrodes. Coordinate grounding connections made to the water system with the mechanical work and install bonding jumpers wherever deemed necessary.

### **3.3 CONNECTIONS**

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Equipment Grounding-Wire Terminations: Make the grounding conductor connections to motors or equipment ten horsepower and above, or twenty amperes and above, with conductor termination and a

5/16 inch minimum bolt tapped to the motor frame or equipment housing. Ground connection to smaller motors and equipment may be made by fastening the conductor termination to a connection box.

- C. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal electrical enclosures without mechanical and electrical connection to electrical enclosures, terminate each conduit with a metallic, insulating grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in electrical enclosures. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- D. Connect discontinuous sections of metallic raceway using grounding (bonding) connections at each end of metallic raceway with equipment grounding conductor in the non-metallic portion of the raceway.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

### **3.4 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Engage an independent electrical testing organization to perform acceptance tests described below.
- B. Test installation of grounding electrodes and ground rods before electrical circuitry has been energized.
- C. Acceptance Tests:
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.13. Certify compliance with test parameters. Maximum grounding resistance value shall be 3 ohms.
  - 2. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical

treatment or other artificial means of reducing natural ground resistance.

3. Measure resistance of equipment grounding connections for service, feeder and motor circuits to ground at the load end with a Biddle ground ohmmeter.
- D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner. Check connections of affected equipment and conductors. Replace, repair, or correct defective connections or conductors. Provide additional ground rods or larger grounding electrode where the grounding electrode resistance is higher than specified. Revise and retest until resistance is within specifications.
- E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16120**  
**CONDUCTORS AND CABLES**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements for telephone cable, fiber optic cable, and twisted pair structured network cable are included in Section 16740.

**1.2 SUMMARY**

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

**1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of conductor or cable specified.
  - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
  - 1. NETA Testing Reports. (See section 3.5 for further information)
  - 2. Communications Cable Testing Reports. (See section 3.5 for further information)

**1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.

**PART 2 — PRODUCTS**

**2.1 BUILDING WIRES AND CABLES**

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

- B. Thermoplastic Insulation Material: Comply with NEMA WC 5.
- C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- E. Conductor Material: Copper.
- F. Stranding:
  - 1. Class B for power applications.
  - 2. Class C for control applications.
- G. Size and Type:
  - 1. Stranded conductor for No. 10 AWG and smaller gauge 120 VAC branch power circuits; except receptacle, lighting and switch leg circuits which shall be solid conductor.
  - 2. Stranded conductor for 277 or 480 VAC power circuits, and for any power circuit larger than No. 10 AWG.
  - 3. Stranded conductors for control circuits.
  - 4. Grounding conductors: solid conductor in sizes No. 6 AWG and smaller gauge; stranded in No. 4 AWG and larger gauge.
- H. Cords: Type SO, size No. 14 AWG or larger.

## **2.2 INSTRUMENTATION AND SPECIALTY WIRE**

- A. Low voltage instrument cable: 600 volt rated, multi-conductor cable with overall neoprene or PVC jacket. Individual conductors PVC or polyethylene insulated, with or without nylon overcoat.
  - 1. Unshielded instrument cable Belden 9486 (18 gauge), 9488 (14 gauge) or equal, Alpha or NEC.
  - 2. Shielded single pair instrument cable (2/C#18) Belden 9341 or equal, Alpha or NEC.
  - 3. Shielded three conductor instrument cable (3/C#18) Belden 3089A or equal, Alpha or NEC.
  - 4. Shielded multi-pair (#18 gauge) instrument cable Belden 1048A (2 pair), 1049A (4 pair), 1050A (8 pair), 1051A (12 pair) or equal, Alpha or NEC.
- B. Specialty wire: As specified in the section describing the system it serves.

## **2.3 CONNECTORS AND SPLICES**

- A. Provide UL-listed, factory-fabricated wiring connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- B. Conductor Connections, Splices or Taps:
  - 1. Solid Conductors size 18 through 10 AWG: Twist on insulated spring connectors.
  - 2. Stranded Conductors size 18 through 6 AWG: insulated, solid barrel, crimp type plated copper alloy connectors.
  - 3. Conductors size 4 AWG and larger: plated copper alloy compression splicing sleeves installed by high pressure compression tools and insulated with heat shrink Raychem sleeves.
  - 4. Outdoors or wet areas: wire splice kits, epoxy resin, hardener, and mold. 3M Scotchcast or equal.
- C. Terminations: suitable for 75 degree Celsius rated copper conductor.
  - 1. Service and feeder circuits: compression indent barrel connectors with one or two hole spade lug ends.
  - 2. Conductor size 18 through 10 AWG: insulated, solid copper barrel, crimp type, plated copper alloy spade tongue terminal, made for the wire size and terminal on which they are installed and crimped with an approved plier or tool for the connector.
  - 3. Conductor size 8 AWG and larger: compression, indent, solid copper barrel, one or two hole lugs.
- D. Motor connections: insulated, solid barrel, crimp type, ring tongue plated copper alloy.

## **2.4 INSULATING MATERIALS**

- A. Fillers: Scotchfill, or equal.
- B. Tape: 7 mil vinyl plastic tape, logo bearing, Scotch 33+, or equal.

## **PART 3 — EXECUTION**

### **3.1 EXAMINATION**

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 WIRE AND INSULATION APPLICATIONS**

- A. Service/Feeders: Type USE/RHW/RHH insulated, stranded conductors, in raceway.
- B. Branch circuits: Type USE/RHW/RHH insulated, stranded conductors, in raceway except Type THHN/THWN insulated, solid conductors, may be used indoors, above grade only, for 120 volt lighting and receptacle branch circuits in sizes #12 AWG and #10 AWG.
- C. Equipment Grounding Conductors: Same type insulation and conductor as the circuit conductors supplying the equipment to be grounded.
- D. Grounding Conductors (other than equipment grounding conductors): bare copper with varnish coat.
- E. Class 1 and 2 Control Circuits: Type USE/RHW/RHH, size #14 AWG or larger, in raceway; Type MTW/THWN, size #14 AWG or larger, in raceway may be used indoors above grade or above grade in weatherproof enclosures.
- F. Instrumentation Circuits: Shielded or unshielded instrument cable, as indicated on the Contract Plans.

### **3.3 INSTALLATION**

- A. Install wires and cables in raceway system, according to manufacturer's written instructions and NECA's "Standard of Installation", after raceway system is complete, and following "Examination" article of this section. Where existing conductors or cables are removed and later repulled through new or existing conduits, test the conductors after each pulling operation, and replace the conductors or cables with new conductors or cables if the test results are not acceptable per NETA standards.
- B. Provide individual neutral conductors for each 120 volt or 277 volt circuit. Common neutral conductors for multi branch circuits are not permitted unless specifically noted and shown on the plans.
- C. Install service, feeder, motor, control, instrumentation, communication and signaling circuits continuously without splices from equipment terminal to equipment terminal or motor lead. 120 and 277 volt single phase branch circuits may be spliced or connected at taps or connection for outlet devices. Do not splice circuits at other locations without written permission from the Owner.
- D. Color code conductors as follows:
  - 1. Grounding conductors: Green.

2. 480/277 volt, three phase systems:
  - a. Phase A - brown
  - b. Phase B - orange
  - c. Phase C - yellow
  - d. Neutral - gray
3. 208Y/120, three phase systems:
  - a. Phase A - black
  - b. Phase B - red
  - c. Phase C - blue
  - d. Neutral - white
4. Use control wiring of colors different than power wiring or supplied with a trace of color in addition to the basic color of the insulation. Number control wiring individually to match equipment number and terminal numbering or use wires of different colors with equipment number for each node or different function in each circuit but use the same color scheme throughout each system for any control or signal wires performing the same function.
5. Use wire with insulation of required color for conductors of No. 8 AWG and smaller. For wire larger than No.8 AWG which is not available in specified colors, use self-adhesive, wrap-around cloth type markers of solid colors to code the conductors. When conductors are marked in this manner, mark each conductor at all accessible locations such as panelboards, junction boxes, pullboxes, pullholes, auxiliary gutters, outlets, switches, and control centers.
6. Do not use white, gray, or green color for any power, lighting, or control conductor not intended for neutral or grounding purposes. Low voltage control circuits, or 18 AWG and smaller control conductors, may use gray, green or white as a trace color in addition to the base color of the conductor.
7. Connect power circuit conductors of the same color to the same phase throughout the installation. Viewing all equipment from the front, make connections so phase color sequence is in the same order as that for panelboards, switchboards, motor control centers, etc. If the phase order of the wires must be reversed to accommodate motor rotation, the adjustment shall be made at the motor terminal box or for cord connected equipment only, at the load side of the safety disconnect switch. Reversing the phase order at the motor controller or disconnect switch is not acceptable.

8. When connecting or reconnecting low voltage (600 volts or less) switchboards, motor control centers, and panelboards which serve existing loads, verify the phasing and rotation prior to the connection, and make connections to maintain the same phasing and rotation to the new switchboards, motor control centers, panelboards, and existing loads as existed prior to removal of the loads from the original (or temporary) distribution system. Verification of rotation alone is not acceptable. Phasing must also be verified. (This may be done by checking for presence of AC voltage between analogous phases of different devices/equipment. Presence of nominal AC voltage between analogous phases of different devices/equipment indicates incorrect phasing.)
- E. Install wiring to equipment neutral and grounding blocks on the bottom or furthest back row first. Leave unconnected blocks accessible for future neutral or grounding connections.
- F. Leave six inches or more of free conductor at each connected device or equipment terminal and nine inches of free conductors at each unconnected outlet. Tape free ends of conductors at unconnected outlets and coil neatly in outlet box.
- G. Install wires neatly in enclosures. Bend or form wires in neat runs from conduits to terminals. Arrange wires so that they may be grouped by conduit or function in the enclosure. Install cable ties and straps to support and bundle wires in enclosures. Arrange wires to allow wire tags and numbers to be easily read without bending or flexing wiring.
- H. Install grounding conductors according to Section 16060.
- I. Pulling Conductors:
  1. Make all cable pulls by hand. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, or wrapping extra conductor into an eye, that will not damage cables or raceway.
  2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Install pullboxes or pull fittings where necessary to prevent exceeding manufacturer's recommendations.
  3. Cut cable or conductor ends off after pulling and clean all lubricant and/or pulling compound from conductors before terminating.
- J. Support cables according to Section 16050.

- K. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping." with approved fire-stopping materials.
- L. Identify wires and cables according to Section 16050 "Basic Electrical Materials and Methods" and as follows:
  - 1. For power circuits:
    - a. At each connection, except at motors, tag for phase rotation and circuit number.
    - b. At each motor tag for winding lead numbers. Make all phase rotation changes for motor direction changes at the motor to maintain correct color phase sequence in equipment.
    - c. In each enclosure or box where more than one ungrounded power conductor is spliced or connected, tag for panelboard identification and pole number.
  - 2. For control circuits:
    - a. Tag at ends of wire. Both ends of the wire shall have the same wire label.
  - 3. Labels shall identify circuits and signals. In the description below, equipment tag ID refers to the motor driven device controlled by the motor controller such as a Neat Polymer Pump (16NPP01). The device tag ID refers to a piece of ancillary equipment associated with the equipment reference by the tag ID, such as a disconnect switch (1DS) or solenoid valve (1SV). Labels shall be identified as follows unless otherwise noted in the specifications:
    - a. Wires from motor control centers to devices shall be labeled with the device tag (MCC terminal #)(device terminal number) – for example, 05SV01(8)(3) - would reference a wire to solenoid valve 05SV01 landed on terminal 8 in the motor control center and landed on terminal 3 at the solenoid valve (the device end may not have a terminal number, in that case the wire label would only have one terminal label 05 SV01 (8) in the above example).
    - b. Wires from control panels to devices shall be labeled with the device tag (CP terminal #)(device terminal number) – for example, 05MFM01(0501)(1) - would reference a wire to magnetic flow meter 05MFM01 landed on terminal 0501 in the control panel and terminal 1 at the flowmeter.
    - c. Wires from motor control centers to control panel/MCC Remote I/O Sections shall be labeled with Equipment tag ID (MCC terminal #) (CP terminal #) – for example,

- 16NPP01(8) (0301) - would reference a wire for pump 16NPP01 landed on terminal 8 in the motor control center and continued to terminal 0301 in the control panel.
- d. Wires from device to device (i.e. disconnect switches to control stations) shall be labelled with Device #1 tag (device #1 terminal number)-device #2 tag (device #2 terminal number) – for example, 1DS(1)-1CS(4) would reference a wire landed on terminal 1 on a disconnect switch and continued to terminal 4 in a control station.
  - e. 2-conductor and 3-conductors cables to devices shall be labeled with the device tag located on a label on the outer insulation. The individual conductors will have only the motor control center/control panel terminal and the device terminal. As an example for a flowmeter circuit, “05MFM01” would be located on the outer insulation of the 2-conductor cable to flowmeter 05MFM01 and (S140)(1) would be located on one of the conductors, which would represent terminal S140 in the control panel and terminal 1 at the flowmeter.
  - f. Wires from motor control center I/O or PLC sections to individual MCC units shall be labeled with the MCC equipment tag (MCC terminal #)(I/O terminal #) – for example, 03TWP01(5)(C140) - would represent pump 03TWP01 MCC unit wire landed on terminal 5 in the MCC and landed on terminal C140 in the motor control center I/O section.

### 3.4 CONNECTIONS

- A. Use the proper high pressure compression tool for terminating indent type compression connectors or terminations on conductors of size #8 AWG or larger gauge. Use an approved pliers or tool for crimping connectors for conductors of size #10 AWG or smaller gauge.
- B. Make splices or tap connections with filler, and tape that possess equivalent or better mechanical strength and insulation ratings than conductors being connected. Insulate to same thickness as connectors being spliced or connected.
- C. Shielded cables used for analog signals shall be terminated with not greater than 1 inch of conductor left outside the shield. This applies to field wires entering the panel for termination, and to panel conductors. Conductor twist shall be maintained over the unshielded length to as close as possible to the point of termination. Where the overall jacket is

cut back to expose the individual conductors, provide a heat shrink sleeve over the jacket, the signal, and the shield (drain) conductors. Insulate the shield (drain) conductor where not covered by the jacket or the sleeve. Where shield (drain) conductors are not terminated, cut the conductor even with the jacket so that it is covered by the sleeve to prevent inadvertent contact with other devices, terminals, or conductors in the panel.

- D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer, and in compliance with other Sections of Division 16.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform field quality-control testing.
- B. Test installation of wires and cables before electrical circuitry has been energized.
  - 1. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system.
  - 2. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
  - 3. Remove and replace conductors with visible damage on conductor insulation ends due to installation in an incomplete or damaged conduit system such as, but not limited to, missing bushings or burrs on conduit ends.
- C. Test Category 5e Horizontal UTP Cable for compliance to ANSI/TIA/EIA 568A, ANSI/TIA/EIA TSB67, and ISO/IEC 11801 standards after installation but prior to start/commissioning of the network system. Test with building electrical systems powered on (i.e. Lights, HVAC, etc.)
  - 1. Test each end-to-end link, utilizing 100Mhz sweep tests, for continuity, polarity, NEXT, attenuation, installed length, wire map, impedance, resistance, and ACR. Each cable shall be tested in both directions.
  - 2. Testing device shall be a Level 2 testing instrument, re-calibrated within the last six months, with the most current software revision based upon the most current EIA/TIA testing guidelines, 100Mhz

rated, capable of storing and printing test records for each cable within the system. Device shall be a LANCAT, Microtest, Fluke, or equal.

3. Tests shall be conducted on cables terminated on a patch panel.
- D. Correct malfunctioning conductors, cables, and connections at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new materials and retest.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16130**  
**RACEWAYS AND BOXES**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
  - 1. Raceways include the following:
    - a. RMC.
    - b. PRMC.
    - c. EMT.
    - d. FMC.
    - e. LFMC.
    - f. PVC.
    - g. RTRC.
    - h. Wireways.
    - i. Surface raceways.
  - 2. Boxes, enclosures, and cabinets include the following:
    - a. Device boxes.
    - b. Outlet boxes.
    - c. Pull and junction boxes.
    - d. Cabinets and hinged-cover enclosures.
- B. Related Sections include the following:
  - 1. Section 16050 for raceway and box supports.
  - 2. Section 16120 for conductors installed in raceways and boxes.
  - 3. Section 16140 for devices installed in boxes.
  - 4. Section 16740 for communications device boxes.

**1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.

- D. RMC: Rigid metal conduit.
- E. PRMC: PVC coated rigid metal conduit.
- F. PVC: Rigid polyvinyl chloride conduit.
- G. RTRC: Reinforced thermosetting Resin Conduit (Fiberglass).
- H. NPT: National Pipe Thread
- I. NEMA: National Electrical Manufacturers Association
- J. ANSI: American National Standards Institute

#### **1.4 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type raceway and box specified.
  - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.

#### **1.5 QUALITY ASSURANCE**

- A. Refer to Section 16010 Paragraph 1.7.

#### **1.6 COORDINATION**

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- B. Coordinate conduit stub up locations with approved equipment shop drawing submittals prior to locating conduit stub ups in the slab. Locate conduit stub ups per equipment manufacturer's recommendations and the requirements of the Plans and Specifications.

### **PART 2 — PRODUCTS**

#### **2.1 METAL CONDUIT AND TUBING**

- A. RMC:
  - 1. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.
  - 2. Couplings: unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.
  - 3. Nipples: same as conduit, factory made through eight inches, no running threads.

- B. PRMC (PVC-Coated Rigid Steel Conduit and Fittings): NEMA RN 1.
  - 1. Minimum 40 mil exterior PVC coating, and 2 mil interior urethane coating.
  - 2. Manufacturers:
    - a. RobRoy Industries
    - b. Thomas & Betts Ocal
    - c. KorKap
- C. EMT:
  - 1. Conduit: Galvanized steel tubing meeting ANSI C80.3.
  - 2. Couplings: steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. No indent or setscrew type.
- D. FMC:
  - 1. Conduit: flexible, galvanized steel convolutions forming a continuous raceway.
  - 2. Connectors: galvanized steel, screw in or clamp style, approved for grounding.
- E. LFMC:
  - 1. Conduit: flexible, galvanized steel convolutions forming a continuous raceway, covered by a liquid tight PVC layer. Electri-Flex Type LA or American Sealtite, Type UA. The use of thinwall conduit is not permitted.
  - 2. Connectors: Hot-Dip galvanized steel or hot-dip galvanized malleable iron, screw in ferrule which covers the end of the conduit inside and out, insulated throat, approved for grounding. Provide with gland nut with integral ground lug for connectors to motors rated 10 horsepower and larger. O-Z/Gedney Type 4Q series, or approved equal.

## **2.2 RIGID NONMETALLIC CONDUIT (RNC)**

- A. Rigid nonmetallic conduit (RNC) includes PVC and RTRC per NEC Article 352 (Rigid Polyvinyl Chloride Conduit: Type PVC) and NEC Article 355 (Reinforced thermosetting Resin Conduit: Type RTRC) and as follows:
  - 1. PVC:
    - a. NEMA TC 2, Schedule 40 or 80 PVC.
    - b. Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2. RTRC:
  - a. NEMA TC 14
  - b. UL 1684

### **2.3 OUTLET AND DEVICE BOXES**

- A. Concealed in dry indoor locations, flush mounted in walls: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1, and with plaster or extension rings to suit construction and application.
- B. Exposed dry locations which are not hazardous or are not in process areas: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication. Covers shall be of the same material and finish as the device box.
- C. Exposed outdoors, below grade, wet locations, or exposed in indoor locations in process areas which are not hazardous: galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover (covers shall be of the same material and finish as the device box).
- D. Exposed corrosive locations: PVC coated cast iron or stainless steel boxes with threaded hubs, integral mounting lugs and PVC coated covers. Covers shall be of the same material and finish as the device box.
- E. Exposed hazardous locations (whether dry, wet, or corrosive): explosion proof, galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover. Covers shall be of the same material and finish as the device box.
- F. Masonry boxes where installed per the requirements of the specifications, are not required to be drawn one piece.

### **2.4 PULL AND JUNCTION BOXES**

- A. Concealed in dry indoor locations, flush mounted in walls: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1, and with plaster or extension rings to suit construction and application.

- B. Exposed dry locations which are not hazardous or are not process areas: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication. Covers shall be of the same material and finish as the device box.
- C. Masonry boxes where installed per the requirements of the specifications, are not required to be drawn one piece.
- D. Exposed outdoors, below grade, wet locations, or exposed in indoor locations in process areas which are not hazardous: Cast-Metal Boxes meeting NEMA FB 1, with gasketed screw down cover. Boxes 6"x6"x4" or larger may be code gauge fabricated stainless steel continuously welded at seams and with rubber gasketed covers. Hoffman or equal. Covers shall be of the same material and finish as the device box. Device boxes associated with control stations shall be the same material as the disconnect and control station enclosure.
- E. Exposed corrosive locations: PVC coated cast iron or stainless steel boxes with threaded hubs, integral mounting lugs and PVC coated covers.
- F. Exposed hazardous Locations: locations (whether dry, wet, or corrosive): explosion proof, galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover. Covers shall be of the same material and finish as the device box.
- G. Communication circuits: Conduit bodies are not permitted. Junction boxes shall be sized as follows:

Maximum Trade Size of Conduit	Box Size			For Each Additional Conduit Increase Width
	Width	Length	Depth	
1"	4"	16"	3"	2"
1-¾"	6"	20"	3"	3"
1-½"	8"	27"	4"	4"
2"	8"	36"	4"	5"

## 2.5

## **2.6 MAINTENANCE/PULL HOLES**

- A. Precast concrete structures with preformed knockout holes for conduit entrance.
1. One-piece, reinforced cast cement concrete with minimum compressive strength of 6,000 psi and suitable reinforcing for the size and construction.
  2. Minimum wall thickness 3 inches.
  3. Access provided by cast iron round covers traffic rated for H20 loading.

## **2.7 MISCELLANEOUS FITTINGS**

1. NEMA FB 1; compatible with conduit/tubing materials.
2. Deep socket PVC coupling for connecting RTRC to PVC conduit runs.
3. Conduit bodies shall be cast or malleable iron, hot dipped galvanized. Covers shall be of the same material and finish as the fitting. Appleton, Crouse Hinds, OZ Gedney, or equal.
4. Conduit bushings shall be malleable iron. Locknuts and sealing locknuts in sizes smaller than 2 ½" shall be steel. Locknuts and sealing locknuts in sizes 2 ½" and larger shall be malleable iron. Appleton, Cooper Crouse Hinds, OZ Gedney, Thomas Betts or equal.
5. Conduit sealing bushings shall be OZ Gedney Type CSM series. Cabinet sealing bushing shall be OZ Gedney Type GRK.
6. Conduit sealing fittings, drains and breathers shall be OZ Gedney Type EY and DB, or equal Appleton or Crouse Hinds.
7. Through wall and floor seals shall be OZ Gedney FS and WS series.
8. Cord grip connectors shall be OZ Gedney CGA, or equal Appleton or Crouse Hinds.
9. External Cable Grip (Kellum's Grip): Woven wire mesh type made of high-strength galvanized or stainless steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.
10. Conduit spacers for direct buried or encased in concrete raceways shall be Underground Devices, Inc. "Wunpeece Spacers" or equal.

## **PART 3 — EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 WIRING METHODS**

- A. Install RMC or PRMC unless other raceways are shown on the Contract Documents, are required by Code, or are permitted under these specifications.
- B. Where the manufacturer of equipment provided by the Contractor recommends or requires RMC for circuits associated with the equipment, provide RMC or PRMC for the entire circuit, even if other conduit types would otherwise be permitted under these specifications.
- C. Indoors: Use the following wiring methods:
  - 1. Exposed raceway runs in non-process areas which are dry and above grade: EMT or RMC.
  - 2. Exposed in process areas: RMC or PRMC.
  - 3. Exposed in corrosive areas: PRMC
  - 4. Exposed Wet or below grade Locations: RMC or PRMC.
  - 5. Concealed:
    - a. in wood frame walls: EMT or RMC.
    - b. in masonry walls: RNC or RMC.
    - c. In dry accessible building spaces (i.e. above dropped ceilings): EMT or RMC.
    - d. in concrete slab floors, walls or ceilings surrounded by dry areas or in slabs above basements which are not corrosive: PRMC, RMC, or RNC.
    - e. in concrete slab floors, walls or ceilings in contact with earth, water containing tank walls or corrosive areas: PRMC or RNC.
    - f. below slab-on-grade floors: PRMC, RMC or RNC.
      - 1) Use PRMC for underslab circuits where metal conduit is called out on plans. RMC may be used for indoor underslab circuits only where specifically noted on the Plans.

- 2) At stub up locations or other locations where the raceway changes from buried to exposed conditions, transition conduit as described in paragraph 3.3:
  6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except where RMC (or PRMC) is used, use LFMC. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.
- D. Outdoors: Use the following wiring methods:
1. Exposed: RMC or PRMC.
  2. Exposed in corrosive locations: PRMC
  3. Concealed in concrete slab: RNC or PRMC
  4. Below slab-on-grade, or in earth (backfill): RNC or PRMC.
    - a. Use PRMC where metal conduit is indicated on the Plans for underground circuits. It is not permissible to use RMC in outdoor, below grade locations.
    - b. At stub up locations and at entrances to buildings or other locations where the raceway changes from buried to exposed conditions, transition conduit as described in paragraph 3.3:
  5. Connection to Vibrating Equipment: LFMC. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.
- E. Concrete encased ductbank: RNC, or PRMC.
- F. Comply with additional requirements of Section 16740 Paragraph 3.3 for installation of raceways for communications circuits.

### **3.3 INSTALLATION**

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each circuit indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval. Do not group home runs or circuits without approval of the Owner.
- B. Minimum Raceway Size: 1 inch trade size for underground or imbedded circuits, 1 inch trade size for communications circuits, 3/4 inch trade size for other circuits.

- C. Provide PRMC or RTRC elbows for all RNC runs where conduit transitions horizontally or vertically. Where RTRC is used in PVC runs, provide elbows with factory attached socket PVC couplings. Coordinate the radius of all conduit bends, whether factory elbows or bends, or field bends, with the manufacturer's minimum bend radius for the installed cable or conductor.
- D. Provide long radius elbows (sweeps) for conduit runs containing multi-conductor VFD cables (sweeps shall also meet minimum bend radius requirements of VFD cables as described in Section 16120). Bend radius for conduits containing VFD cable shall not be less than the larger of (1) 12 times the nominal conduit size or (2) 10% greater than the VFD cable manufacturer's minimum bend radius for the installed cable.
- E. Install conduit as a complete, continuous system without wires, mechanically secure and electrically connected to all metal boxes, fittings and equipment. Blank off all unused openings using factory made knockout seals.
- F. Install conduit exposed unless shown otherwise on the Plans.
- G. Do not install raceway in the slab or below grade/slab unless specifically shown on the Plans as being installed in the slab or below grade/slab.
- H. Run parallel or banked raceways together, on common supports where practical. Use factory elbows where elbows can be installed parallel; otherwise, provide field bends for banked raceways. Make bends in parallel or banked runs from same centerline to make bends parallel.
- I. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.
- J. Exposed Conduit Installation:
  - 1. Install exposed raceways in lines parallel or perpendicular to the building or structural members or the structure lines except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the raceway in a different sequence or a uniform line. Provide adequate headroom.
  - 2. Where several circuits follow a common route, stagger pullboxes or fittings, or if shown grouped in one box, individually fireproof each conduit.

3. Support exposed raceways as specified in Section 16050.
  - a. Provide anchors, hangers, supports, clamps, etc. to support the raceways from the structures in or on which they are installed. Do not space supports further apart than ten feet.
  - b. Provide sufficient clearance to allow conduit to be added to racks, hangers etc. in the future.
  - c. Support raceway within three feet of every outlet box, junction box, gutter, panel, fitting, etc.
  - d. Raceway in "wet" areas shall have clamp backs (spacers) or other appropriate spacers to hold them a minimum of ½ inch off the surface. Horizontal runs on the roof surface shall be blocked at every 5 feet to hold them a minimum of 2 inches above roof surface.
- K. Raceway concealed above ceilings, in furred spaces, under slab, embedded in slab etc., which are normally inaccessible may be run at angles not parallel to the building lines.
- L. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above 40° C (104° Fahrenheit). Install horizontal raceway runs above water and steam piping.
- M. Where conduits cross building or structure expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper. For sizes one inch and smaller, a half-loop of flexible conduit between boxes or fittings may be used.
- N. Install concealed raceway in wall or ceiling construction and/or place below the slab in a shallow trench. Do not install conduit in slab unless shown to be installed in slab on Contract Document drawings. The top of conduits installed in the shallow trench shall be at least 3 inches below the bottom of the slab. Do not run conduit just below the slab or at the edge of the slab. Embed raceway in masonry in the hollow core. Horizontal runs in the joint are not permitted.
- O. Where conduit is shown on the plans or called for to be embedded or run in concrete walls or slabs, embed conduit in concrete walls or slabs a minimum of two inches from the exterior of the concrete and between steel reinforcing mats or to the center of the concrete with respect to the concrete. It is not permissible for conduit to be in direct contact with reinforcing mats.
  1. Do not place conduit in concrete less than five inches thick.

2. Sizes larger than one inch are not permitted embedded in concrete unless shown otherwise on the plans.
3. Conduit embedded in concrete may run at angles to the structure or slab line.
4. Crossovers in concrete are not permitted unless otherwise noted on the Plans.

P. Underground raceway runs

1. Run as straight as practicable. Make changes in direction and/or grade of sufficient length to allow a gradual change (three foot radius minimum). Make slight offsets with five degree couplings.
2. Run trench true, and clear of stones or soft spots. Place three inches of fine sand in the trench bottom and tamp into place. Provide preformed plastic spacers on top of sand spaced five feet on center where more than one conduit is placed in a trench. After the raceway is placed in the trench, backfill to six inches above top of conduits with sand, then with native earth backfill passing a No. 8 sieve, free of stones. Do not tamp on top of the conduit until the final backfill is placed. Tamp or water settle the final backfill to finish grade. Compact the backfill as specified under Division 2.
3. Mark direct buried conduit by an underground line warning tape as described in Section 16050.
4. Clean underground and embedded conduit two-inch size and above with a wire brush or swab, followed by a mandrel not less than twelve inches long and approximately one-quarter inch smaller in diameter than the conduit internal diameter.
5. Where raceway exits from grade or concrete, provide the following:
  - a. For runs exiting from grade, slabs or encasement, transition to one of the following for a minimum of 24" inches of raceway (including elbows) before exiting and for vertical runs, a minimum of 3" beyond the exiting point:
    - a) PRMC
    - b) RMC taped with a half lapped wrap of Scotchrap No. 51 plastic tape (40 mil total thickness). The conduit shall be wrapped a minimum of 3" above the exiting point and at least 24" of raceway below the exiting point (at a minimum, the rigid steel elbow and conduit located at/above the exiting point shall be fully wrapped).
    - c) RMC coated with Kopper's Bitumastic No. 505.

- d) RTRC (use for elbow only for PVC conduit runs)
- b. Do not extend plastic conduit (PVC or RTRC) into the slab, above grade, into buildings or into equipment.
- c. For equipment to be moved into place at a later date, install a coupling flush with the floor slab and a threaded flush plug.

Q. Under slab raceway runs

1. Install conduits under the slab in a trench. Place three inches of fine sand in the trench bottom and tamp into place. After the raceway is placed in the trench, backfill to three inches above top of conduits with sand, then with compacted backfill up to the compacted top course. Provide compacted top course per structural requirements. Do not tamp on top of the conduit until the final backfill is placed. Compact the backfill as specified under Division 2.
2. Where raceway exits from under slab runs, provide the following:
  - a. For runs exiting from under slab, transition to one of the following (including elbows) before exiting and for vertical runs, up to a minimum of 3" beyond the top of the exiting point:
    - a) PRMC
    - b) RMC taped with a half lapped wrap of Scotchrap No. 51 plastic tape (40 mil total thickness). The conduit shall be wrapped to a minimum of 3" above the exiting point and at a minimum, the rigid steel elbow and vertical conduit located below/above the exiting point shall be fully wrapped.
    - c) RMC coated with Kopper's Bitumastic No. 505.
    - d) RTRC (use for elbow only for PVC conduit runs)
  - b. Do not extend plastic conduit (PVC or RTRC) into the slab, above grade, into buildings or into equipment.
  - c. Arrange conduit so that no curved portion of conduit bends are installed in the slab. All conduit bends including elbows shall be installed below the slab.
  - d. For equipment to be moved into place at a later date, install a coupling flush with the floor slab and a threaded flush plug.

- R. Stub-ups into switchgear, motor control centers, floor standing switchboards, and similar open bottom equipment:
1. Coordinate conduit stub up locations with approved equipment shop drawing submittals prior to locating conduit stub ups in the slab. Locate conduit stub ups per equipment manufacturer's recommendations and the requirements of the Plans and Specifications.
  2. Do not extend the conduit, including end fittings, more than 3 inches above the bottom of the enclosure. Stub conduits to a uniform height (plus or minus 1/8 inch) and align conduits within plus or minus 1/4 inch in rows parallel or perpendicular to the building structure. Terminate conduit with an insulating, grounding type bushing bonded to the ground bus of the equipment.
  3. Locate stub-ups directly under the enclosure access point or section gutter into which the conductors they contain are to be routed.
  4. Arrange stub-ups so that no curved portion of conduit bends are installed in the finished slab. All conduit bends including elbows shall be installed below the finished slab.
  5. Protect stub-ups from damage where conduits rise through slabs or out of wall by installing a steel bushing or coupling on the threaded end before slab is poured.
- S. Bend and offset metal conduit with hickey or power bender, standard elbows, conduit fittings or pull boxes. Bending of PVC shall be by hot box bender and, for PVC two inches in diameter and larger, expanding plugs. Make elbows, offsets and bends uniform and symmetrical. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- T. Support conduit connections to motors or other equipment independently of the motor or equipment. Rise or drop vertically to the nearest practicable point of connection to the unit. Run vertical drops to the floor and fasten with a floor flange. Unsupported drops are not permitted. Horizontal runs on the floor or on equipment are not permitted. Drop or rise at the appropriate closest location. Run conduit on equipment frames or supports to closely follow the contours of the equipment. Locate conduit to maintain access to all equipment services and adjustment points and so as not to interfere with operation of the equipment.
- U. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type

bushings where connecting to concentric or eccentric knockouts. Connect to enclosures, boxes and devices from below in wet areas. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.

V. Penetrations for raceways:

1. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be one inch diameter maximum.
2. Penetrate through building or structure wall or surfaces with a PVC or sheet metal sleeve with at least ¼" greater interior diameter (ID) than conduit exterior diameter (OD), set flush with walls, pack with fiberglass and seal with silicone sealant and cover with escutcheon plate.
3. Penetrate through poured-in-place or below grade walls and free slabs, with a sleeve. Set sleeves flush with forms or edges of slab/wall. Pack around conduit with fiberglass and seal with silicone sealant. For penetrations below exterior grade, provide a floor or wall sealing fitting on the interior of the building wall.
4. Penetrate through roofs with core drill hole ½ inch to 1 inch larger than conduit, flash with neoprene, caulk conduit in place and seal with silicone sealant under flashing. Sleeve roof opening where non-concrete roof construction occurs.

W. Raceway terminations and connections:

1. Join raceways with fittings designed and approved for the purpose and make joints tight.
2. Make threaded connections waterproof and rustproof by application of a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.
3. PRMC: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
4. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
5. Cut ends of conduit square with hand or power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Make conduit threads which are cut in the field to have same effective length and same thread dimensions and taper as specified for factory-cut threads.

6. Flexible Connections: Use maximum of 18 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement, such as motors, transformers, generators or similar equipment or equipment such as instruments which must be removed for service. Install flexible conduit in a straight length. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to fixed equipment such as panels, enclosures or switches. With the Owner's approval, longer lengths of flexible conduit may be used for connection to items of equipment which require longer lengths for installation (i.e. 2" conduits and larger) and removal of the equipment for maintenance or replacement purposes. Recessed and semi-recessed lighting fixtures may use up to 6 feet of flexible conduit, or 11 feet of pre-manufactured lighting "whips". Use liquid-tight flexible metal conduit in wet or damp locations. Do not strap flexible conduit to structures or other equipment.
7. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts. In "wet" areas, use locknuts of the sealing type, use Myers hubs or O-Z/Gedney rain tight conduit hubs.
8. Connect conduits to enclosures at the location of the gutter or device to which the contained conductors will be routed. Route or stub conduits to motors and/or mechanical equipment directly to the connection and locate as close as possible to equipment terminals.
9. Where a device manufacturer requires a device or junction box to permit multiple conduit entries into the device from a single conduit, provide the device or junction box at no additional cost to the Owner.
10. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
11. Place conduits at panelboards in the rear line of knockouts where possible. Install spare conduits from flush-mounted panels up to accessible spaces. Install a minimum of one spare three-quarter inch conduit for every three single-pole spare breakers or spaces, or fraction thereof (three conduits minimum).

- X. Keep conduits clean and dry and close each end left exposed. When blowing through conduits, cover electrical components installed in enclosures to avoid blowing dirt or water into equipment. Use temporary closures to prevent foreign matter from entering raceways.
- Y. Install pull wires in empty raceways and in empty innerduct. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 8 inches of slack at each end of the pull wire.
- Z. Seal interior of raceways around conductors at (1) hazardous locations, (2) where conduits pass from warm to cold locations, such as the boundaries of air conditioned, heated or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs or (3) where otherwise required by NFPA 70.
  - 1. Methods used to seal interior of raceways around conductors shall be as follows:
    - a. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations. For hazardous locations, fill them with UL-listed sealing compound. For non-hazardous areas, fill with expansive foam or Ducseal. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Boxes that have electrical devices installed (switches, receptacles etc.) shall not be used in place of a dedicated steel box for installation of the fitting that will house the sealing material.
    - b. Seal conduits using expansive foam or Ducseal where conduits enter through the bottom of motor control centers, switchboards, panelboards and control panels.
    - c. Seal conduits using expansive foam or Ducseal for individual items of equipment where it is not practical to install raceway seal fittings such as building mounted lighting fixtures and convenience receptacles.
    - d. As otherwise required by NFPA 70.

- AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.
1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
  2. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

BB. Device and Outlet Boxes

1. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.
2. Recess boxes in the wall, floor, and ceiling surfaces in finished areas or where noted on the Plans. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Boxes shall be backed with box supports (Caddy Model TSGB, SGB, steel or wood stud backers) that span a minimum of two studs or joists to prevent rotation on studs or joists and to prevent twisting or deflection during wall, ceiling, or floor surface material installation. The use of supports that do not span a minimum of two studs are not permitted without permission from the Owner. Provide attachments to withstand a force of one-hundred pounds applied vertically or horizontally.
3. Use gang boxes in indoor areas wherever more than one device is used at one location. In wet, corrosive or hazardous areas, use multiple double gang boxes.
4. Boxes in wet areas shall be surface mounted on channel iron stanchions or set with spacers on walls and shall be attached with clamps or feet (drilling or punching enclosure to mount through side of box or enclosure is not permitted), and they shall have all conduit connections from below arranged to drain moisture away with suitable EYD drains installed at the bottom. It is not permissible to install conduits into the top and side of the boxes at exterior locations unless otherwise noted on Plans.
5. Attach exposed (surface mounted) boxes to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one-hundred pounds applied vertically or horizontally.

6. Set exposed device boxes four feet above the finished floor to top of the box unless otherwise noted on the Plans.
  7. Set exposed boxes for lighting switches at 44 inches above the finished floor and within one foot of the door opening on the strike or lock side of the door or on the side closing last.
  8. Set recessed boxes at the following heights to the bottom of the box, except where noted otherwise:
    - a. convenience outlet receptacles in finished areas at sixteen inches;
    - b. lighting switches, dimmers, etc. at forty-four inches above floor and within one foot of the door opening on the strike or lock side of the door or on the side closing last.
    - c. wall mounted telephones at sixty inches above floor.
    - d. Place boxes for outlets on cabinets, countertops, shelves, and similar electrical boxes located above countertops two inches above the finished surface or two inches above the back splash. Verify size, style, and location with the supplier or installer of these items before installation.
  9. Arrange boxes used in wet areas to drain moisture away from devices or enclosures for equipment and make conduit connections from below.
  10. Set floor boxes level and adjust to finished floor surface.
- CC. Install pullboxes for underground raceway systems true to line and grade. Provide a compacted foundation of fine sand or three-eighths minus crushed rock for the bearing surface edges of the pullboxes.
- DD. Install wall or surface mounted enclosures and cabinets plumb. Support at each corner.
- EE. Conduit entrances into communications junction boxes may be made from two parallel sides only. (Conduit entrances in perpendicular sides are not acceptable.) No cable may be routed to exit and enter the same side of the junction box. All cables must be routed from one side of the junction box to the opposite side. Cable routed so that the cable bend radius is less than the minimum bend radius allowed under Specification Section 16740 is not permitted.

### **3.4 PROTECTION**

- A. Provide protection and maintain ambient conditions (in a manner acceptable to manufacturer and Owner) that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.5 CLEANING**

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16140**  
**WIRING DEVICES**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes various types of receptacles, connectors, switches, and finish plates.

**1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of wiring device specified.
  - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
  - 2. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
  - 1. Maintenance and Repair Manuals (specified in Division 1).
  - 2. Product Data

**1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 Basic Electrical Requirements 1.7 Quality Assurance.

## **PART 2 — MATERIALS**

### **2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Wiring Devices:
  - a. Cooper Wiring Devices.
  - b. Bryant Electric, Inc.
  - c. Hubbell Inc.
  - d. Killark Electrical Mfg. Co.
  - e. Leviton Mfg. Co., Inc.
  - f. Pass & Seymour/Legrand.
  - g. Crouse-Hinds
  - h. Paragon
  - i. Mulberry
  - j. Square-D
2. Multi-Outlet Assemblies:
  - a. Wiremold Co.

### **2.2 WIRING DEVICES**

- A. Comply with NEMA Standard WD 1 “General Color Requirements for Wiring Devices” and NEMA Standard WD 6, "Wiring Devices – Dimensional Specifications"
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: white except as otherwise indicated or required by Code.
- D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification W-C-596, UL Standard 498, "Electrical Attachment Plugs and Receptacles". Receptacles shall be heavy duty specification grade. Provide NRTL labeling of devices to verify compliance.

1. General purpose Convenience Outlets
    - a. Duplex receptacle configuration
    - b. Nylon face
    - c. Staked screw terminals for line, neutral, and ground connections.
    - d. Provisions for split bus
    - e. NEMA 5–15R or 5–20R
    - f. Hubbell HBL 5262 or equal
  2. USB A/C 6A Tamper Resistant Receptacles
    - a. Duplex receptacle configuration
    - b. NEMA 5–15R or 5–20R
    - c. Tamper-resistant
    - d. 5 amp USB Type A and C ports
    - e. Hubbell model USB20ACWWR or equal
  3. Special Purpose Receptacles
    - a. Staked screw terminals for line, neutral, and ground connections.
    - b. NEMA configuration as indicated.
- E. Receptacles, Straight–Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," with integral NEMA 5-20R duplex receptacle arranged to protect only the connected receptacle and no other receptacles connected on the same circuit.
- F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Industrial Use."

- G. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
  - 1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.
  - 2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- H. Snap Switches: Quiet-type AC switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
  - 1. Lighting Switches: 120/277V ac only, rated 20 amperes.
  - 2. Motor rated switches: horsepower rated for application indicated.
- I. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
  - 1. Color: Matches wiring device except as otherwise indicated.
  - 2. Plate-Securing Screws: Metal with heads colored to match plate finish.
  - 3. For Architecturally finished areas with concealed electrical construction: Stainless steel, except as otherwise indicated.
  - 4. For Architecturally finished areas with exposed electrical construction: Stainless steel.
  - 5. For non-Architecturally finished areas, in process equipment areas, or electrical rooms: Stainless steel.
- J. Weatherproof exterior receptacle device covers shall be constructed entirely of cast aluminum material. The cover which encloses the cord set shall be opaque gray. Product shall be INTERMATIC Model WP1010MXD or equal.
- K. Device Box Covers: Cast iron to match box to which installed.
- L. Wall mounted occupancy sensors shall be passive infrared, with integral switch. Sensor shall have a minimum five year factory warranty. Switch models:
  - 1. Wattstopper - PW-100
  - 2. Cooper - ONW-P-1001-MV-W

3. or equal.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Except as otherwise indicated on Plans, surface mount, with long dimension vertical. Mount with grounding terminal of receptacles on bottom.
- B. Arrangement of Devices:
  1. Group adjacent switches in common boxes under single, multigang cover plates.
  2. See Section 16130 for mounting height of devices.
  3. Verify locations of outlets and switches in cabinetry with cabinet supplier and cabinetry shop drawings prior to installation.
- C. Install switches with the “Off” position down. Install three and four way switches so the load is de-energized when all switch handles are down.
- D. Connect phase, neutral, and grounding wires to devices with full loops around screws installed to tighten with tightening of the screw. The use of push-in terminals are not acceptable. Trim insulation to within one-eighth inch of screw terminal.
- E. Surface mounted devices and wall plates: Install devices and assemblies plumb, level and secure.
- F. Flush mounted devices and wall plates:
  1. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 inch where boxes are not flush with the wall surface.
  2. Protect devices and assemblies during painting.
  3. Install wall plates after painting is complete. Install with an alignment tolerance of 1/16 inch to plumb. Install at flush mounted devices so that all four edges are in continuous contact with finished wall surface without the use of mats or similar devices. Do not use plaster fillings.
- G. Use corrosion resistant devices outdoors.

### **3.2 GROUNDING**

- A. Connect receptacle or switch ground lug to device box.

### **3.3 FIELD QUALITY CONTROL**

- A. Acceptance Testing:
  - 1. Test wiring devices for proper connections, polarity and ground continuity. Perform this testing with testing equipment designed for testing polarity and connections.
  - 2. Operate each operable device at least 6 times.
  - 3. Test ground-fault circuit interrupter operation with local fault simulations, using a tester designed for such testing, and according to manufacturer recommendations. Testing with integral test switches on the receptacle is not sufficient for this testing.
- B. Replace damaged or defective components, and retest.

### **3.4 CLEANING**

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 16410**

### **ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

#### **PART 1 — GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes switches and circuit breakers, whether individually mounted or group mounted in switchboards, motor control centers, panelboards, and similar equipment.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 16440 for panelboards containing circuit breakers.
  - 2. Section 16445 for motor control centers containing circuit breakers.

##### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Submit circuit breaker information with or after the Electrical System Study Report (ESSR) as specified under Section 16010. Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Circuit breaker equipment shall not be approved or ordered until the ESSR has been reviewed and approved.
- C. Product Data: For disconnect switches, circuit breakers and accessories specified in this Section. This includes, but is not limited to:
  - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
  - 2. nameplate ratings
  - 3. mounting methods
  - 4. For units which are stand-alone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations.
  - 5. Enclosures which will not accept the quantities and sizes of conduits as shown on the Contract Plans will be rejected.

6. Lug configuration showing quantities and sizes of conductors equipment can accept. Lugs or connections for switches and circuit breakers which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. (See Section 3.2 for further information)
- E. Operation and Maintenance Manual: Shall include the following:
  1. Maintenance Manuals (specified in Division 1).
  2. Electrical System Study Report
  3. Field Test Reports (see Section 3.2 for further information)
  4. Product Data

#### **1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.
- B. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- C. Comply with NEC for components and installation.
- D. Comply with UL 98, "Enclosed and Dead-Front Switches" for safety switches.
- E. Comply with UL 1066 "Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures" for low voltage power circuit breakers.
- F. Comply with UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures" for molded case circuit breakers.
- G. Product Selection for Restricted Space: Space for installation of switches and circuit breakers is limited. The Plans indicate typical physical sizes or dimensions for switches and circuit breakers, including clearances between switches and circuit breakers and adjacent surfaces and items. Switches and circuit breakers with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the switches and circuit breakers with the available space and shall verify that the proposed switches and circuit breakers are capable of being

installed in the available space prior to making a submittal. Switches and circuit breakers of dimensions larger than the available space shall not be submitted, and if is submitted, shall be rejected. The decision of the Owner as to the acceptability of switches and circuit breakers with larger dimensions than as shown on the Plans will be final. If the larger equipment is deemed acceptable, it is the Contractor's responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.

- H. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with switch and circuit breaker access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.
- I. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 16010, equipment with frame sizes or trip settings other than as specified or shown on the plans that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.H 'Product Selection for Restricted Space'.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Disconnect switches, safety switches and circuit breakers:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution and Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

## **2.2 SWITCHES**

- A. Enclosed, non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.
- B. Enclosed, Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, Class R rejection fuse clips, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.
- C. Enclosure: NEMA KS 1, with enclosure types as described in Section 16050, unless indicated otherwise in the Contract Documents. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Enclosure shall use spring loaded latches to ensure environmental protection in any position of the switch; the use of screw or bolt type securing is not acceptable for NEMA 1, 3, 3R, 4, 4X or 12 rated enclosures.
- D. Lugs or connections shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.
- E. Accessories:
  - 1. Provide at least two auxiliary contacts for each switch. Where no auxiliary contacts are shown on plans, provide two normally open auxiliary contacts. Where one auxiliary contact is shown on the plans, provide indicated auxiliary contact and one additional normally open auxiliary contact. If two or more auxiliary contacts are shown on the plans, provide auxiliary contacts as shown.

## **2.3 ENCLOSED CIRCUIT BREAKERS**

- A. Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.
- B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated with interrupting rating to meet available fault current.
  - 1. Main circuit breakers and branch circuit breakers 200 amps and larger in switchboards, motor control centers, panelboards and individual enclosed circuit breakers shall have electronic trip units, with field-adjustable, short- and long-time trip units, each separately and individually adjustable for time and pickup. Where indicated, the electronic trip units shall be suitable for monitoring with a network. Circuit breakers greater than 800 amps shall have

- long term settings adjustable in 5-percent increments and shall have removable and sealable covers for the settings.
2. Feeder circuit breakers and main circuit breakers under 200 amps shall be molded case breakers with thermal magnetic trip unless otherwise noted.
  3. Motor circuit breakers shall be magnetic only trip with adjustable trip setting.
  4. Branch circuit breakers shall be molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.
- C. Application Listing: Appropriate for application, including switching lighting loads (SWD) or heating, air-conditioning, and refrigerating equipment (HACR).
- D. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under Divisions 11 through 15 and adjust the rating/trip size as needed to conform with the manufacturer's requirements for the trip rating. Revise the Electrical System Study Report as required to coordinate with circuit breaker requirements for equipment submittals for process, HVAC etc. equipment.
- E. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.
- F. Enclosure: per application, as described in Section 16050, unless otherwise specified or required to meet environmental conditions of installed location. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.
- G. Lugs: Compression lugs, mechanical lugs and power-distribution connectors suitable for conductors of the material, number and size provided. Lugs or connectors shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans. Provide compression lugs for circuit breakers for the following:
1. Circuit breakers installed in switchboards and motor control centers.
  2. Main circuit breakers installed in distribution and branch circuit panelboards.
  3. Branch circuit breakers larger than 200 amps in distribution or branch circuit panelboards.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Install equipment enclosures level and plumb in locations as indicated, according to manufacturer's written instructions.
- B. For wall mounted equipment enclosures located at walls, bolt units to wall or mount on structural-steel channels bolted to wall. For enclosures not located at walls, provide structural stanchion supports conforming to Section 16050.
- C. Install wiring between switches, circuit breakers, control, and indication devices.
- D. Connect switches and circuit breakers and components to wiring system and to ground as indicated and as instructed by manufacturer.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Identify each switch and circuit breaker according to requirements specified in Section 16050.

### **3.2 FIELD QUALITY CONTROL**

- A. Acceptance Testing: After installing switches and circuit breakers and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Provide services of a qualified independent testing agency as described in Section 16010 to perform specified testing for circuit breakers.
  - 2. Third party testing shall not commence until the Electrical System Study Report has been reviewed and approved.
  - 3. Procedures:
    - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5.1.1 for switches. Certify compliance with test parameters.
    - b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6.1.1 for molded-case circuit breakers. Certify compliance with test parameters.
  - 4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

### **3.3 ADJUSTING**

- A. Set field-adjustable circuit-breaker trip setting ranges as indicated.
  - 1. Where circuit breakers are included in the Electrical System Study Report, set the trip as recommended in the report.
- B. Provide fuses for fused disconnect switches to coordinate with manufacturer's listed maximum fuse size for equipment supplied by the disconnect switch.

### **3.4 CLEANING**

- A. After completing system installation, including fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16422**  
**MOTOR CONTROLLERS**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes ac motor-control devices rated 600 V and less that are supplied as enclosed units, or as individual units for mounting in equipment specified under other sections.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 16050 for general materials and installation methods.

**1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For motor controllers and accessories specified in this Section.
  - 1. For variable frequency drives (VFD), submittals shall be custom prepared by the VFD manufacturer for this specific application, and shall include the following:
    - a. Manufacturer's published installation, set-up and configuration, operation, and maintenance manuals.
    - b. Wiring diagrams specific to the application of the drive under this Contract.
    - c. Initial configuration and program parameters specific to the application of the drive under this Contract, including all parameters that will be set to other than manufacturer's default values, and that demonstrate the drive is capable of operating in the manner intended by the project design.
- C. Shop Drawings:
  - 1. Submit complete Elementary Wiring Diagrams and One Line Diagrams of control and power wiring, specific to the actual motor or item to be controlled, which clearly indicate and differentiate

- field wiring and field wired devices, and wiring provided as part of the manufacturer's assembled unit.
2. For units which are stand alone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
  3. Lug configuration showing quantities and sizes of conductors the equipment can accept. Lugs or connections for motor control equipment which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.
- D. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.7 for further information)
- E. Operations and Maintenance Manual: Shall include the following:
1. Field Testing Results (must be approved prior to energization of the system) (see Section 3.7 for further information).
  2. Maintenance Data
  3. Shop Drawings
  4. Wiring Diagrams
  5. Product Data
  6. VFD and soft starter configuration parameters summary: Compile after motors have been installed, tested and started up. Document the settings of configuration parameters and switch settings for each VFD or electronic soft start. Clearly indicate settings of each parameter and/or switch as of the time the driven equipment is placed in service. Marking the setting as "default" is not acceptable. Actual settings must be documented.

## **1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.
- B. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.
- C. Product Selection for Restricted Space: Space for installation of motor controllers is limited. The Plans indicate typical physical sizes or dimensions for motor controllers, including clearances between motor controllers and adjacent surfaces and items. Motor controllers with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate centers with larger dimensions in order to obtain approval

before a change is accepted. The Supplier/Contractor shall coordinate the size of the motor controllers with the available space and shall verify that the proposed motor controllers are capable of being installed in the available space prior to making a submittal. Motor controllers of dimensions larger than the available space shall not be submitted, and if submitted shall be rejected. The decision of the Owner as to the acceptability of motor controllers with larger dimensions than as shown on the Plans will be final. If the larger equipment is deemed acceptable, it is the Contractor's responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.

- D. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with motor controller access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.
- E. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report in Section 16010, equipment with frame sizes or trip settings other than as specified or shown on the plans that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.C 'Product Selection for Restricted Space'.

## **1.5 COORDINATION**

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.
- C. Coordinate the VFD with driven equipment. Specifically, size VFDs to supply at least the full load current of the driven equipment. It is not sufficient that the nominal horsepower rating of the VFD match the driven equipment.

## **1.6 EXTRA MATERIALS**

- A. Furnish extra materials including spare parts described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Spare Fuses and Indicating Lamps: Furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with additional requirements of the Contract, manufacturers offering motor controller products that may be incorporated into the Work include, the following:
  - 1. Allen–Bradley
  - 2. Eaton Electrical (Cutler Hammer)
  - 3. Square D Co.

### **2.2 MAGNETIC MOTOR CONTROLLERS**

- A. Description: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated. Minimum size NEMA 1. IEC rated devices are not allowed.
- B. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 50 percent spare capacity.
- C. Combination Controller: Factory–assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
- D. Lugs or connections for magnetic motor control equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.
- E. Overload Protection: Solid state electronic type configurable to provide Class 10 or 20 protection for the actual motor furnished. Units shall be manual reset type with an external reset mechanism provided in the starter enclosure front.

1. For non-networked overload protection, provide two separate auxiliary contacts with each overload protection unit.
  - a. One normally closed for use in the motor starting circuit.
  - b. One normally open for signaling overloads to plant control system.

## **2.3 VARIABLE FREQUENCY CONTROLLERS**

### **A. Variable Frequency Drives (VFDs) shall have the following features:**

1. The VFD shall be rated for 480 VAC. The VFD shall provide microprocessor-based control for three-phase induction motors.
2. The VFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage to a variable voltage and frequency output via a two-step operation. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section.
3. The VFD shall maintain the line side displacement power factor at no less than 0.95 regardless of speed and load.
4. The VFD shall have a one (1) minute overload current rating of 150% and a two (2) second overload current rating of 250% for constant torque drives. The VFD shall have a one (1) minute overload current rating of 110% for variable torque drives.
5. The VFD shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.
6. The VFD shall include a LCD type display with a keypad. The display shall be capable of remote mounting on the exterior of a Motor Control Center or an electrical enclosure containing the VFD.
7. Electronic circuits and circuit boards shall be conformally coated to resist degradation by hydrogen sulfide and other chemically corrosive agents which may be present in a wastewater treatment facility environment.
8. Lugs or connections for variable frequency controllers shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

### **B. Control Functions**

1. It shall be possible to configure all of the parameters for the VFD via the keypad on the LCD type display.
2. The VFD shall be capable of being controlled locally at the keypad, via discrete or analog inputs, or remotely via a communications bus.

3. The VFD shall have at least two analog inputs as follows:
  - a. A current loop analog input suitable for use with a 4-20 ma current loop.
  - b. A voltage loop analog input suitable for use with a potentiometer.
4. The VFD shall have discrete inputs suitable for wiring to dry contacts. The following functions shall be assignable to the discrete inputs:
  - a. Enable — This function may not be overridden when operating via the keypad or via a communications bus.
  - b. External Fault — This function may not be overridden when operating via the keypad or via a communications bus. It must be possible to automatically clear faults associated with power outages without clearing faults associated with the external fault. (A magnetically or mechanically held relay may be used to provide functionality if necessary.)
  - c. Force Local — This input will cause the VFD to ignore start and run signals from the keypad or a communications bus. This function may not be overridden when operating via the keypad or via a communications bus.
  - d. Start (3-wire)
  - e. Stop (3-wire)
  - f. Run (2-wire) — This function will be level triggered rather than edge triggered. If the VFD is ready and this input is asserted, the VFD will be called. It is not acceptable if the VFD is only called when this input transitions from de-asserted to asserted while the VFD is ready.
  - g. Reset Faults
  - h. Setpoint Selection — One or more discrete inputs allowing the selection of the setpoint from among the following sources:
    - 1) Fixed speed
    - 2) current loop analog input
    - 3) voltage loop analog input
    - 4) Keypad
    - 5) Communications Bus

5. The VFD shall have provisions for control via the communications bus.
  - a. The communications bus shall be capable of sending the following signals:
    - 1) Start
    - 2) Stop
    - 3) Reset Fault
    - 4) Speed Setpoint
  - b. It shall be possible to configure the VFD so that if the communications bus fails, the VFD will stop if and only if current control is via the communications bus. Units which stop the drive and/or lockout other control methods on bus communications failure are not acceptable.
  - c. While controlling the VFD, the communications bus shall be able to override the value of the Run (2-wire) discrete input.

C. Outputs and monitoring

1. A minimum of three (3) discrete programmable digital outputs shall be provided with the following function selectable:
  - a. Fault
  - b. Run
  - c. Ready
  - d. At speed
2. The VFD display shall be a LCD type capable of displaying at least the following status information:
  - a. Run
  - b. Stop
  - c. Ready
  - d. Alarm
  - e. Fault
  - f. Keypad
  - g. Bus/Communication
  - h. Local (LED)
  - i. Remote (LED)
  - j. Fault (LED)
  - k. Output frequency
  - l. Frequency reference
  - m. Motor speed
  - n. Motor current
  - o. Motor torque

- p. Motor power
  - q. Motor voltage
  - r. DC-bus voltage
  - s. Voltage level of analog input
  - t. Current level of analog input
  - u. Discrete inputs status
  - v. Fault codes and fault descriptions
3. All numerical status information available via the keypad shall be available via the communications bus.

D. Communications Bus

- 1. The communication bus media shall be suitable for ethernet communications.
- 2. The protocol shall be Ethernet/IP.

E. VFD Programming Software

- 1. Provide and license to the Owner one copy of the manufacturer's software application for uploading and downloading drive parameter programming, and for reading of electronic files containing parameter dumps.
- 2. If programming cannot be done via the Ethernet network used for drive communications, provide any adapters and drivers required to allow communications via a USB port on a Windows 8 computer.

F. Harmonic Mitigation

- 1. The VFD system shall consist of the following components. All components listed including power factor correction / harmonic filter and transformer shall be integral to the VFD lineup, factory wired and tested as a complete system.
  - a. a power factor correction / harmonic filter unit (if required to meet these specifications), consisting of (minimally) 3% input reactor
  - b. output inverter
  - c. control logic section.
- 2. VFDs shall meet all requirements as outlined in the 1992 edition of IEEE 519 for each individual and total harmonic current & voltage distortion and as indicated in this specification. As per Table 10.2 of IEEE 519-1992, individual or simultaneous operation of the VFDs shall not add more than 3% total harmonic voltage distortion

while operating at full load and speed from the utility source, or more than 5% while operating from standby generator. A harmonic analysis must be submitted with the VFD product data submittal. The analysis shall include all voltage and current harmonics up to the 99th.

3. The variable frequency drive(s) when installed and operating at the Owner's facility, shall not cause excessive voltage and/or current total harmonic distortion (THD) levels greater than allowed by the serving utility on the serving utility's electrical system at the point of common coupling. The point of common coupling for this requirement is defined as the utility's revenue metering equipment.
  - a. The voltage and current total harmonic distortion limits shall be as listed in IEEE 519 (1992), unless modified by the serving utility.
  - b. This item applies for any combination of controllers serving one unit of each type of process equipment (i.e. one influent pump of three, one aeration basin of 3, etc.) operating on the power distribution system, combined with not greater than
  - c. The drives shall be provided with necessary harmonic mitigation equipment including, but not limited to, line reactors, active or passive filtering components, and/or isolation transformers, as required to meet this specification.
4. The variable frequency drive(s) when installed and operating at the Owner's facility, shall not cause the generator set (provided by the Contractor) which supplies standby power to the drive, or the generator set controls, to exceed voltage regulation of 5% or frequency regulation of 3%, nor cause the generator set to oscillate, hunt, jump or otherwise operate in a manner which damages the generator set, generator set components, or equipment to which the generator set provides power.

- G. Spare Parts: Provide spare parts for each drive consisting of (at a minimum) the manufacturer's recommended spare parts, plus (if not included in the manufacturer's recommendations) one spare controller main board for each different type of board, one set of power output semiconductor devices (IGBTs) for each different type of drive, one spare base driver board for each different type of board, one set of power semiconductor devices (diodes, SCRs, or similar) used in the power conduction path (AC to DC conversion), and spare fuses for each type of fuse in the units. If these items are not available on the smaller

horsepower drives, provide a spare drive for each size or type of unit when they are not available.

- H. Provide complete documentation of each drive including operation and maintenance manuals, as shipped drawings specific to the drive with non-applicable information clearly marked as non-applicable, and a listing of the configuration/programming parameters as programmed in the drive at the time of project acceptance.
- I. Any modifications of the standard drive which are necessary to meet the requirements of this specification shall be provided at the factory. Third party or distributor modifications are not allowed.
- J. The variable frequency drive shall be UL or ETL listed and labeled and shall comply with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electrical Code.

## **2.4 ENCLOSURES**

- A. Description: Surface-mounted enclosures per the application as described in Section 16050 unless the unit is mounted in a motor control center. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

## **2.5 ACCESSORIES**

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Provide auxiliary devices meeting the requirements of Section 16050.

# **PART 3 — EXECUTION**

## **3.1 APPLICATION**

- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.
- D. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers where indicated for motors started and stopped by automatic controls or interlocks with other equipment.

## **3.2 INSTALLATION**

- A. Install independently mounted motor–control devices according to manufacturer's written instructions.
- B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.
- C. For control equipment at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Section 16050.
- D. Install freestanding equipment on concrete housekeeping bases conforming to Section 03300.
- E. Motor–Controller Fuses: Install indicated fuses in each fusible switch.

## **3.3 IDENTIFICATION**

- A. Identify motor–control components and control wiring according to Section 16050.

## **3.4 CONTROL WIRING INSTALLATION**

- A. Install wiring between motor–control devices according to Section 16120.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand–off–automatic switch and other automatic control devices where available.
  - 1. Unless shown otherwise, connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
  - 2. Unless shown otherwise, connect selector switches with motor–control circuit in both hand and automatic positions for safety–type control devices such as low– and high–pressure cutouts, high–temperature cutouts, and motor overload protectors.

## **3.5 CONNECTIONS**

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field–connected connectors and terminals, including screws and bolts, according to manufacturer's published torque–tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.6 STARTUP AND TRAINING SERVICES**

- A. Provide the services of the manufacturer's factory authorized representative for startup of variable frequency drives and training of the Owner's personnel for operation and maintenance of the drives for each drive as it is connected, started up and placed in service. Inspect the installation of each drive for conformance with the manufacturer's recommended installation practices. Provide a minimum of 2 days per drive on site startup services. These days shall be coordinated with the start-up of each portion of the plant.
  - 1. The representative shall be specifically trained in the VFD model provided for this project.
- B. Requirements for setting drive parameters:
  - 1. The following shall be completed by the manufacturer's factory authorized representative at the equipment shop test prior to delivering the drive to the site:
    - a. Program motor parameters such as motor horsepower, voltage, current, code letter, full load amps, and similar items. Program and/or configure each drive to properly operate the actual motor to which it is connected.
    - b. Coordinate with the operational requirements of the process equipment and program drive with equipment parameters such as acceleration/deceleration and maximum/minimum speed ramp times, span and range of analog inputs, and similar items.
    - c. Program communications parameters such as precedence between local and bus communications and protocol settings.
    - d. Verify inputs to and outputs from drive and make appropriate settings or programs for motor overtemperature, seal leaks, motor safeties, switch statuses etc.
    - e. Test and verify drive performance with dummy loads.
  - 2. Test the operation of each drive at the site after fully programming/configuring the drive. Verify all settings with actual motor installed, driven equipment with driven equipment supplier and communications settings with actual communications and control equipment installed. Reprogram and/or reconfigure and then retest as required to obtain proper operation of the driven equipment and control of the process. Document the final configuration and programming parameters after successful startup and provide in

hard copy and electronic form the documentation to the Owner at the job site.

3. Provide a minimum of eight hours training to the Owner, at the Owner's facility, prior to start-up or placing into operation the first drives. Training shall cover installation, maintenance, operation, and problem troubleshooting for each type of drive provided, and shall delineate differences between individual drives where configuration, programming, or control functions are different for otherwise similar model drives. Demonstrate use of the drive programming software specified elsewhere in these specifications and train Owner's personnel in its use.

C. Provide training as follows:

1. Provide a minimum of eight hours additional training, program revisions, and maintenance at the Owner's facility approximately one to three months after completion of the project.
2. Provide a minimum of eight hours additional training, program revisions, and maintenance at the Owner's facility approximately 12 months after completion of the project, but prior to expiration of the warranty.

### **3.7 FIELD QUALITY CONTROL**

A. Prepare for acceptance tests as follows:

1. Test controllers and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
2. Make insulation-resistance tests of each component and connecting supply or feeder circuit. Megger bus work and circuits phase-to-phase and phase-to-ground disconnecting and reconnecting equipment which cannot be meggered as required. The minimum acceptable steady-state value is 50 megohms. Record ambient temperature and humidity during testing.

B. Acceptance Testing: After installing motor controllers, before electrical circuitry has been energized, and prior to startup, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency as described in Section 16010 to perform specified testing for motor controllers.

2. Procedures:
  - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.16.1.1 for motor starters other than variable frequency drives. Certify compliance with test parameters.
  - b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.17 for variable frequency drives. Certify compliance with test parameters.
3. Remove and replace malfunctioning units with new units, and retest.

### **3.8 CLEANING**

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 16440**

### **PANELBOARDS**

#### **PART 1 — GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.
- B. Section Includes:
  - 1. Panelboards specified under this Section include:
    - a. Solids Handling Building Panelboard “SHBHC”
- C. Related Sections include the following:
  - 1. Section 16050 for additional materials and installation information.
  - 2. Section 16410 for circuit breakers installed in panelboards.

##### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Submit panelboard information with or after the Electrical System Study Report (ESSR) as specified under Section 16010. Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Panelboard equipment shall not be ordered until the ESSR has been reviewed and approved.
- C. Product Data: For each type of panelboard, accessory item, and component specified in this Section.
- D. Shop Drawings:
  - 1. Shop Drawings shall include, but not be limited to, the following::
    - a. Enclosure (including front, door, etc.) type and mounting.
    - b. Bus configuration, voltage and current ratings.
    - c. Short-circuit current rating.
    - d. Circuit breaker quantities, types and layout.

- e. Dimensioned plans (showing available conduit entry locations), sections, and elevations. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
  - f. Lug configuration showing quantities and sizes of conductors the panelboard can accept. Lugs or connections panelboards which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.
- E. Panelboard Schedules: Submit circuit breaker layout as scheduled on the "Panelboard Circuit Schedule" located on the drawings.
- F. Operations and Maintenance Manual: Shall include the following:
- 1. Testing Results (must be approved prior to energization of the system) (see Section 3.4 for further information).
  - 2. Maintenance Data: Include manufacturer's written instructions for testing circuit breakers.
  - 3. Panelboard Schedules: Include approved final versions of panel schedules only.
  - 4. Electrical System Study Report
  - 5. Shop Drawings
  - 6. Product Data

#### **1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.
- B. Comply with NEMA PB 1.
- C. Comply with UL 67, "Standard for Panelboards".
- D. Product Selection for Restricted Space: Space for installation of panelboards is limited. Contract Document plan drawings indicate typical physical sizes or dimensions for equipment, including clearances between panelboards and adjacent surfaces and items. Panelboards with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate equipment with larger dimensions. The Contractor shall coordinate the size of the panelboards with the available space and shall verify that the proposed equipment is capable of being installed in the available space prior to making a submittal. Equipment of dimensions larger than the available space shall not be submitted, and if submitted, will be rejected. The decision of the Engineer as to the acceptability of equipment with larger dimensions than as shown on the Contract Document plan drawings will be final. If the larger equipment is

deemed acceptable, it is the Contractor's responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.

- E. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with panelboard access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.
- F. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 16010, equipment that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.D 'Product Selection for Restricted Space'.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store equipment per requirements of Section 16010 paragraph 1.11.
- B. Remove equipment protection only after equipment is safe from hazards such as dirt and moisture and damage from construction operations. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

## **1.6 EXTRA MATERIALS**

- A. Keys: Provide 3 spares of each type for panelboard cabinet lock.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Eaton Corp.; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Div.

3. Siemens Energy & Automation, Inc.
4. Square D Co.

## **2.2 PANELBOARD FABRICATION**

- A. Enclosures: Flush- or surface-mounted enclosures as indicated on the Plans. NEMA PB 1, 20" minimum width, of NEMA type complying with Section 16050 for the location installed.
- B. Front: Secured to enclosure with concealed trim clamps or screws. Front for surface-mounted panelboards shall be same dimensions as enclosure. Fronts for flush panelboards shall overlap enclosure, unless otherwise indicated. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.
- C. Directory Frame: Metal, mounted inside each panelboard door.
- D. Bus: Hard drawn copper of 98 percent conductivity. Insulated, bondable, full size neutral bus unless otherwise indicated.
- E. Main and Neutral Lugs: Compression type. Lugs or connections for panelboard equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.
- F. Main Breaker: Vertically mounted.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to enclosure.
- H. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.
- I. Special Features: Include the following features for panelboards:
  1. Provide same size enclosures for multi-section panelboards.
  2. Feed-through Lugs: Sized to accommodate feeders indicated.
  3. For panelboards with NEMA 1 enclosures, panel fronts shall be stretcher leveled steel with piano hinged door-to-box construction. The entire panel front shall be hinged to allow access to the interior of the panelboard enclosure when opened (the second door allows access to the circuit breakers only). Door-to-box construction shall not increase the width of the panelboard to a dimension greater than what is shown on the Contract Drawings.
  4. Provide skirts for surface mounted panelboards located in building or structures.
- J. Future Devices and Circuit Breakers: Equip for future installation of devices and circuit breakers with mounting brackets, bus connections,

and necessary appurtenances, for the overcurrent protective device ampere ratings indicated.

## **2.3 OVERCURRENT PROTECTIVE DEVICES**

- A. In accordance with Section 16410, except as modified herein. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under Divisions 11 through 15 as described in Section 16410.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Install panelboards and accessory items according to NEMA PB 1.1.
  - 1. Setup, adjust and fasten in place flush trim and interiors.
  - 2. Install circuit breakers as shown on the "Circuit Schedule" for each panelboard except where deviations are necessary to accommodate changes in loads or equipment served.
- B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish. Mount surface panelboards with spacers of neoprene or fiberglass to shim out from irregular surfaces or from damp surfaces.
- D. Circuit Directory: Prepare panelboards directories neatly typewritten in the same pole sequence as the panelboard stamping. Send a copy to the Owner for his records. Prior to typing the final directories, verify room and equipment names and numbers with the Owner and modify circuit descriptions of areas/spaces to conform with the Owner's desires. Obtain approval before installing. Record all circuit breaker installation deviations from the "Circuit Schedule" and show on the Record Drawings the actual size and pole position of all circuit breakers installed.
- E. Do not remove knockouts for breaker positions unless a breaker is to be installed. Where twistouts or knockouts are removed in error, provide a circuit breaker (one pole, twenty ampere) to fill each position removed.

- F. Provision for Future Circuits: Install panelboards in such a manner as to leave access to the box, building chases, knockouts, etc. for future circuit additions.

### **3.2 IDENTIFICATION**

- A. Panelboard Nameplates: Label each panelboard with engraved nameplates per the requirements of Section 16050 paragraph 3.3 .

### **3.3 CONNECTIONS**

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.4 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test panelboards and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
  - 2. Make insulation-resistance tests of each panelboard bus, component, and connecting supply or feeder circuit. Megger bus work, breakers and circuits phase-to-phase and phase-to-ground disconnecting and reconnecting equipment which cannot be meggered as required. The minimum acceptable steady-state value is 50 megohms. Record ambient temperature and humidity during testing.
- B. Acceptance Testing: After installing panelboards and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements:
  - 1. Provide services of a qualified independent testing agency as described in Section 16010 to perform specified testing for circuit breakers.
  - 2. Testing shall not commence until the short circuit and coordination study has been reviewed and approved.
  - 3. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6.1.1 for molded-case circuit breakers. Testing of circuit breakers shall only be

required for circuit breakers 200 amperes and larger. Certify compliance with test parameters.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

- C. Take load readings on each panelboard after loads are connected and panel has been energized. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads, connected to the panels in service.

### **3.5 ADJUSTING**

- A. Set field-adjustable circuit-breaker trip ranges as indicated, or requested by the Owner.

### **3.6 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16447**  
**CONTROL STATIONS**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes control stations used for motor or other control, but mounted external to motor starters or motor control center.
- B. Related Sections include the following:
  - 1. Section 16050 for additional materials and installation information.

**1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of control station specified in the section. This includes, but is not limited to:
  - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
  - 2. Pilot devices
  - 3. Enclosures
  - 4. Auxiliary components.
- C. Operation and Maintenance Manual: Shall include the following:
  - 1. Maintenance Manuals (specified in Division 1).
  - 2. Product Data

**1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.
- B. Source Limitations: Obtain similar control station devices through one source from a single manufacturer.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store equipment per requirements of Section 16010 paragraph 1.11.

- B. Remove equipment protection only after equipment is safe from hazards such as dirt and moisture and damage from construction operations. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with additional requirements of the Contract, provide products by one of the following:
  - 1. Allen–Bradley
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D Co.
  - 4. Eaton Corp.; Cutler-Hammer Products.

### **2.2 COMPONENTS**

- A. Control stations shall consist of selector switches, pushbuttons, pilot lights, potentiometers, and similar devices, individually or group mounted in a single enclosure.
- B. Pilot devices:
  - 1. Selector switches:
    - a. Heavy duty, oiltight type.
    - b. Contact block quantity and arrangement as indicated on wiring diagrams, and required for specified functionality.
      - 1) Dry and indoor locations: standard contact blocks rated for 10 A continuous current.
      - 2) Wet or outdoor locations: Hermetically sealed contact blocks.
    - c. Maintained contact type for selector switches, unless shown otherwise.
    - d. Knob type operators, black in color.
    - e. Legend plate, marked as indicated on the Plans.
  - 2. Pushbuttons
    - a. Heavy duty, oil tight type.
    - b. Contact block quantity and arrangement as indicated on wiring diagrams, and required for specified functionality.
      - 1) Dry and indoor locations: standard contact blocks rated for 10 A continuous current.

- 2) Wet or outdoor locations: Hermetically sealed contact blocks.
  - c. Maintained contact type for selector switches, unless shown otherwise.
  - d. Flush type operators, with half shroud.
  - e. Green colored buttons for START or ON and red color for STOP or OFF. Black in color for other functions, unless otherwise indicated.
  - f. Legend plate, marked as indicated on the Plans.
3. Pilot lights
- a. Heavy duty, oiltight type.
  - b. Lamps
    - 1) LED, or incandescent type.
    - 2) Allows replacement of lamp without removal from enclosure.
    - 3) 120 volt lamp
    - 4) Push to test type.
    - 5) Glass lens
    - 6) Color as indicated on the Plans.
4. Potentiometers
- a. Heavy duty type.
  - b. One turn type, with linear adjustment throughout range, 1% resolution or better.
  - c. 3 wire interface.

C. Enclosures:

- 1. Formed of sheet steel and continuously welded with screw on or clamped covers. Enclosures may be hinged.
  - a. NEMA 1 and 12: Painted Steel.
  - b. NEMA 4X: Stainless Steel.
  - c. NEMA 7: Cast Iron.
- 2. NEMA type per location as stated in Section 16050 “Basic Materials and Methods”, unless indicated otherwise.

## 2.3 IDENTIFICATION

- A. Provide each control station with an engraved nameplate per the requirements of Section 16050 paragraph 3.3 and as follows:
  - 1. Nameplate is Lamacoid or equal plastic laminate or engraved metal plate. Lettering is white, 3/8”; backgrounds are black. No

abbreviations are permitted unless approved by the Owner.

Engraving is subject to the Owner's approval.

2. Provide individual legend plates for each pilot device.
3. Identify conductors at each termination by yellow sleeve wire markers heat-shrink or stretch-on type with indelible black letters and numbers at each termination or splice.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Mounting: Level, plumb and rigid without distortion of enclosure.
  1. Provide bushings on conduits entering from above or at the sides.
  2. Provide metallic, insulating grounding bushings on conduits entering from below.

### **3.2 GROUNDING**

- A. Provide ground continuity to facility electrical ground system.

### **3.3 CONNECTIONS**

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.4 FIELD QUALITY CONTROL**

- A. Acceptance Testing:
  1. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
  2. Test all operating controls for proper operation.
  3. Make continuity tests of each circuit.
  4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16448**  
**INDICATOR DEVICES**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes indicator devices used for visual and/or audio-visual notification of status.
- B. Related Sections include the following:
  - 1. Section 16050 for additional materials and installation information.

**1.3 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of control station specified in the section. This includes, but is not limited to:
  - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
  - 2. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes made during the course of construction. The Operation and Maintenance Manual shall include the following:
  - 1. Maintenance Manuals (specified in Division 1).
  - 2. Product Data

**1.4 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.

- B. Source Limitations: Obtain similar control station devices through one source from a single manufacturer.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store equipment per requirements of Section 16010 paragraph 1.11.
- B. Remove equipment protection only after equipment is safe from hazards such as dirt, moisture, and damage from construction operations. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with additional requirements of the Contract, provide products by one of the following:
  - 1. Edwards Signaling
  - 2. Approved equal.

### **2.2 COMPONENTS**

- A. Multi-status indicator lights shall consist of multi-color LED indicators group mounted in a single enclosure.
  - 1. 120 VAC
  - 2. Red/Blue/Amber LED light
  - 3. Suitable for Class 1 Division 2 locations
  - 4. Programmable flash rate to differentiate status urgency.
    - a. Red – 240 FPM
    - b. Amber - 120 FPM
    - c. Blue – Steady
  - 5. Edwards Signaling model 105XBRIRBA120A
  - 6. Accessories:
    - a. Mounting bracket: 105BM
    - b. Outlet box attachment: 105BX
- B. Alarm Horns shall be
  - 1. Indoor horns - Edwards 874-N, or equal.
  - 2. Outdoor horns - Edwards 876-N, or equal.
- C. Momentary Push Button shall consist of a normally open, protruding center, and spring return.
  - 1. White

2. AC or DC
3. Edwards Signaling model 695-W
4. Accessories:
  - a. Mounting plate: 147-1

D. Held Push Button shall consist of a normally closed and normally open contacts as required, turn to reset.

1. Polycarbonate housing
2. Rounded cover to prevent inadvertent activation.
3. Safety Technology International (STI) model SS2xx1ZA-EN,
  - a. Color noted on plans
  - b. Message noted on plans
4. Accessories:
  - a. Weatherproof shield: STI-6517

## **2.3 IDENTIFICATION**

- A. Provide each Multi-status indicator light and horn with an engraved nameplate per the requirements of Section 16050 paragraph 3.3 and as follows:
1. Nameplate is Lamacoid or equal plastic laminate or engraved metal plate. Lettering is white, 2" height or as noted; backgrounds are black. No abbreviations are permitted unless approved by the Owner. Engraving is subject to the Owner's approval.
  2. Identify conductors at each termination by yellow sleeve wire markers heat-shrink or stretch-on type with indelible black letters and numbers at each termination or splice.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Utilize manufacturer's accessory mounting devices appropriate for mounting location designated on the Plans.

### **3.2 GROUNDING**

- A. Provide ground continuity to facility electrical ground system.

### **3.3 CONNECTIONS**

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.4 FIELD QUALITY CONTROL**

#### **A. Acceptance Testing:**

1. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
2. Test all operating controls for proper operation.
3. Test all indicating devices (lamps, horns, etc...).
4. Make continuity tests of each circuit.
5. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16510**  
**INTERIOR LIGHTING**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes interior lighting fixtures (including fixtures normally mounted on the building), lamps, ballasts, emergency lighting units, and accessory materials such as frames, lenses, diffusers, hangers, spacers, stems and canopies, auxiliary junction boxes and other miscellaneous hardware as required for complete installation of all lighting equipment.

**1.3 DEFINITIONS**

- A. LED luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.
- B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.
- C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.
- D. CRI: Color Rendering Index.
- E. CCT: Correlated Color Temperature.
- F. SSL: Solid State Lighting (or LED)

**1.4 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.

- B. Product Data describing fixtures, lamps, drivers, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:
  - 1. Outline drawings indicating dimensions and principal features of fixtures.
  - 2. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
  - 3. Battery and charger data for emergency lighting units.
- C. Provide one of the following sets of data regarding the output of the Luminaire over time:
  - 1. LM-79-08 report at T=0 and at T=6000 hours with a summary table showing the percentage lumen output change and percent input power change.
  - 2. LM-80-08 test data for the LEDs at the three temperatures per LM-80-08. Provide extrapolation data using an exponential decay function to show the output at 50,000 hours. Provide the Ts value from the LM-79-08 ad where the point falls in relation to the LM-80-08 extrapolated data. Interpolate between the LM-80-08 data for the Ts temperature.
- D. Operation and Maintenance Manual: Shall include the following:
  - 1. Maintenance Manuals for the lighting fixtures (specified in Division 1).
  - 2. Field Acceptance Test Reports (see section 3.3 for further information)
  - 3. Product Data

## **1.5 QUALITY ASSURANCE**

- A. Electrical Component Standard: Provide components that comply with NEC and that are listed and labeled by UL.
- B. Refer to Section 16010 paragraph 1.7.
- C. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.
  - 1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.
- D. Coordinate fixtures, mounting hardware, and trim with ductwork, insulation, sprinkler system, ceiling system and other items, including

work of other trades, required to be mounted on ceiling or in ceiling space.

## **1.6 EXTRA MATERIALS**

- A. Furnish extra materials including spare parts as described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Two spare LED luminaires of each type being provided on the project as described on the lighting fixture schedule.
  - 2. LED Lamps: 10% of each type and rating installed. Furnish at least one of each type.
  - 3. Plastic Diffusers and Lenses: 1% of each type and rating installed. Furnish at least one of each type.
  - 4. LED Drivers: 2% of each type and rating installed. Furnish at least one of each type.
  - 5. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products specified in the Lighting Fixture Schedule.

### **2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL**

- A. No visible labels, trademarks or monograms on the exterior of the lighting fixtures or on lens or diffusers
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating without the use of tools, intended for finger operation; free from light leakage at seams, joints or junctions visible in the installed condition under operating conditions; and arranged to permit maintenance without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position. Spring loaded latches for frames.

- E. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- F. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.
  - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Lens Thickness: 0.125 inch minimum; except where greater thickness is indicated.
  - 3. Pattern for plastic lenses: K12 prismatic refractors. Pattern No. 12 is not acceptable.
  - 4. Approved manufacturers:
    - a. Holophane
    - b. KSH Plastics
    - c. Carolite Plastics
    - d. Plaskolite, Inc.
- G. Provide gaskets on all trims and housings of "wet" location fixtures. Provide non-corrosive type plaster rings, hangers, trim and hardware in wet locations.
- H. Fixture Supports
  - 1. Provide hook hangers for fixtures where indicated or specified consisting of an integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking type plug.
- I. LED Drivers: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
  - 1. Certification by Electrical Testing Laboratory (ETL). Can be UL recognized, but Listed when part of a fixture assembly.
  - 2. Drivers shall have a minimum efficiency of 85%.
  - 3. Sound Rating: "A" rating.
  - 4. Voltage: Match connected circuits.
  - 5. Starting Temperature: -30 deg. C to 50 deg C.
  - 6. Minimum Power Factor: 90 percent.

7. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
8. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
9. Lamp-Driver connection method does not reduce normal rated life of lamps.

## **2.3 LAMPS AS PART OF FIXTURE**

- A. Provide lamps for each fixture which comply with ANSI C78 series that is applicable to each type of lamp.
- B. Color Temperature and Minimum Color-Rendering Index (CRI): 4000-4100 K and minimum CRI listed on fixture schedule.
- C. LED Lamp Life: Rated average is a minimum of 50,000 operating hours before reaching L70 lumen output degradation point with no catastrophic failures.

## **2.4 FUSES**

- A. Provide fuses in fixtures mounted more than eight feet above floor or operated at 277 volts.
- B. Fast acting, current limiting fuses, coordinated with the ballast and lamp operating characteristics, so as to avoid false tripping, yet provide fault clearing before damage occurs to the fixture. Bussman Type HFL in-line fuse holder and Bussman Type GLR fuse, sized at two-hundred percent of the ballast current rating.

## **2.5 FINISHES**

- A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

# **PART 3 — EXECUTION**

## **3.1 INSTALLATION**

- A. Coordination with other work.
  1. Coordinate lighting fixture size and design, frame requirements, and hanging or mounting devices for project ceiling conditions before ordering lighting fixtures. Refer to the Plans for details of ceiling and wall construction; provide lighting fixtures suitable for the particular type of ceiling or wall at each location.
  2. Adjust light fixtures as required - near piping, equipment, etc., to protect from physical damage and provide sufficient clearance to install lamps and to maintain lens, reflectors, ballasts, etc. Where

pendant mounted fixtures are in conflict with ducts and piping, coordinate the location and mounting heights of the fixtures to the available space left between the various ducts and piping.

3. Locate fixtures so that doors and other equipment will not damage them at any time.
4. Adjust stem or chain lengths to suit actual field conditions where indicated mounting heights to bottom of fixtures are not possible or conflict with other trades' work. Brace pendants and rods over 48 inches long to limit swinging.
5. Prepare irregular surfaces for mounting.

B. Fixture support

1. Install fixtures with supports, brackets and trim as recommended by the fixture manufacturer to suit the particular building construction and use. Align each fixture to ceiling structure.
2. Provide clips on fixtures installed in grid type ceiling with exposed T-bar construction to hold fixture to T bars which prevent any relative lateral movement between fixture and the suspension system at any point on the fixture.
3. Provide a minimum of four extra iron wires per fixture, anchored securely to the fixture at each corner and independently anchored to the structural system above, for fixtures mounted in grid type ceilings. Size wires the same as wires which support the ceiling structure.
4. Install surface mounted fixtures tight to the ceiling construction. Provide shims or spacers as required to keep surface mounted fixture from warping or twisting due to uneven surfaces. For suspended fixtures, use stems and chain attachments that cannot be displaced from hangers by an upward force.
5. Provide fixture hangers and attachments on pendant or bracket mounted fixtures in addition to raceway connections. Provide a minimum of two per fixture at the quarter points for fixtures of eight feet or less. Provide a minimum of four per fixture, equally spaced at the ends and on third points for fixtures over eight feet in length. Provide a minimum of one stem or chain per eight feet plus one for fixtures in a continuous row. Maximum spacing of stems not to exceed nominal length of each fixture. Install additional stems or hangers where recommended by the fixture manufacturer.
6. Secure surface and pendant fixtures to ceiling system, roof structure or slabs with a fastener such as lag screw, lag bolt, toggle bolt, cinch anchor or stud to support the fixture plus one-hundred

pounds at each support. Nails or similar fasteners are not approved for lighting fixture support.

7. Do not support fixtures from ceiling material other than structural or framing material. Provide supports, spacers, channels, etc., necessary to support lighting fixtures where fixtures are located so that they cannot be connected directly to structure members. Provide additional framing to directly support fixtures where construction is such that mounting channels, strongbacks or bridging is required to support fixtures. Provide additional support material which matches the structure material.
  8. Provide outlet boxes or other supports for lighting fixtures which are of sufficient strength to support at least four times the weight of fixture or one-hundred pounds, whichever is greater. Support all fixtures weighing more than fifty pounds independently of outlet box.
  9. Do not support LED fixtures with forty-eight inches or longer lamps from outlet box ears. Provide suitable fixture stud in box for each fixture.
  10. Support all surface mounted fixtures more than eighteen inches wide at or near each corner, in addition to support from outlet box.
  11. For heavy pendant mounted fixtures, where support independent of box is required and where conduit and outlet boxes are installed on surface, use safety swivel hanger with fixture stud. For fixtures suspended indoors from sloping surfaces, provide suitable aligners.
- C. Install fixtures in rows or grids true to line. Install fixtures in a common area at the same level or grade. Install continuous runs of fixtures straight and true with joining straps, couplings, and nipples. Maintain spacing for fixtures as dimensioned or shown on the reflected ceiling plan and do not arbitrarily change because of ceiling pattern, etc. Symbols on the Plans which are undimensioned show approximate locations and care shall be used to locate fixtures on centers of spaces, at the quarter points, or as indicated. Any changes in fixture layout must be approved in writing by the Owner.

### **3.2 CONNECTIONS**

- A. Ground the lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.3 FIELD QUALITY CONTROL**

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

- B. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.
- C. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- D. Report results of tests in writing.
- E. Replace fixtures that show evidence of corrosion during Project warranty period.
- F. Provide replacement lamps for all lamps which fail prior to completion of the work.

### **3.4 ADJUSTING AND CLEANING**

- A. Clean fixture lens, diffusers and enclosures on fixtures. Dirty enclosures, lens or diffusers shall be removed, washed and rinsed as recommended by fixture manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

### **3.5 INTERIOR LIGHTING FIXTURE SCHEDULE**

- A. Lighting Fixture Schedule is shown on the Contract Plans.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16520**  
**EXTERIOR LIGHTING**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes exterior lighting fixtures, LED drivers, lamps, pole standards, and accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 16510 for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; also for exterior fixtures normally mounted on buildings.

**1.3 DEFINITIONS**

- A. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads. See also LED luminaire.
- B. Lighting Unit: A fixture or an assembly of fixtures with a common support, including a pole or bracket plus mounting and support accessories.
- C. LED luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.
- D. Luminaire: A fixture.

#### **1.4 LM-80 – LUMEN MAINTENANCE.DEFINITIONS**

- A. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.
- B. CRI: Color Rendering Index.
- C. CCT: Correlated Color Temperature.
- D. SSL: Solid State Lighting (or LED)

#### **1.5 SUBMITTALS**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data describing fixtures, lamps, drivers, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:
  - 1. Outline drawings indicating dimensions and principal features of fixtures.
  - 2. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
  - 3. Battery and charger data for emergency lighting units.
- C. Provide one of the following sets of data regarding the output of the Luminaire over time:
  - 1. LM-79-08 report at T=0 and at T=6000 hours with a summary table showing the percentage lumen output change and percent input power change.
  - 2. LM-80-08 test data for the LEDs at the three temperatures per LM-80-08. Provide extrapolation data using an exponential decay function to show the output at 50,000 hours. Provide the Ts value from the LM-79-08 ad where the point falls in relation to the LM-80-08 extrapolated data. Interpolate between the LM-80-08 data for the Ts temperature.
- D. Operation and Maintenance Manual: Shall include the following:
  - 1. Maintenance Manuals for the lighting fixtures (specified in Division 1).
  - 2. Field Acceptance Test Reports (see section 3.2 for further information)
  - 3. Product Data

## **1.6 QUALITY ASSURANCE**

- A. Electrical Component Standard: Provide components that comply with NFPA 70.
- B. Refer to Section 16010 paragraph 1.7 .

## **1.7 STORAGE AND HANDLING OF POLES**

- A. General: Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

## **1.8 EXTRA MATERIALS**

- A. Furnish extra materials including spare parts as described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Two spare LED luminaires of each type being provided on the project as described on the lighting fixture schedule.
  - 2. LED Drivers: 10% of each type and rating installed. Furnish at least one of each type.
  - 3. LED Lamps: 10% of each type and rating installed. Furnish at least one of each type.
  - 4. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1% of each type and rating installed. Furnish at least one of each type.
  - 5. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products specified in Lighting Fixture Schedule.

### **2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL**

- A. Metal Parts: Free from burrs, sharp edges, and corners.

- B. Sheet Metal Components: Corrosion-resistant aluminum, except as otherwise indicated. Form and support to prevent warping and sagging.
- C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit maintenance without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.
- E. Exposed Hardware Material: Stainless steel.
- F. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.
- I. LED Drivers: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
  - 1. Certification by Electrical Testing Laboratory (ETL). Can be UL recognized, but Listed when part of a fixture assembly.
  - 2. Drivers shall have a minimum efficiency of 85%.
  - 3. Sound Rating: "A" rating.
  - 4. Voltage: Match connected circuits.
  - 5. Starting Temperature: -30 deg. C to 50 deg C.
  - 6. Minimum Power Factor: 90 percent.
  - 7. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
  - 8. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.

9. Lamp-Driver connection method does not reduce normal rated life of lamps.

## **2.3 LAMPS AS PART OF FIXTURE**

- A. Provide lamps for each fixture which comply with ANSI C78 series that is applicable to each type of lamp.
- B. Color Temperature and Minimum Color-Rendering Index (CRI): 4000-4100 K and minimum CRI listed on fixture schedule.
- C. LED Lamp Life: Rated average is a minimum of 50,000 operating hours before reaching L70 lumen output degradation point with no catastrophic failures.

## **2.4 FIXTURE SUPPORT COMPONENTS**

- A. Pole-Mounted Fixtures: Conform to AASHTO LTS-3.
- B. Wind-load strength of total support assembly, including pole, arms, appurtenances, base, and anchorage, is adequate to carry itself plus fixtures indicated at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mi/h with a gust factor of 1.3.
- C. Arm, Bracket, and Tenon Mount Materials: Match poles' finish.
- D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant items compatible with support components. Use materials that will not cause galvanic action at contact points. Use mountings that correctly position luminaire to provide indicated light distribution.
- E. Pole Bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts, and bolt covers.
- F. Metal Pole Grounding Provisions: Welded 1/2-inch threaded lug, accessible through handhole.
- G. Concrete for Pole Foundations: Comply with Division 3. Use 3000-psi strength, 28-day concrete.

## **2.5 FINISHES**

- A. Metal Parts: Manufacturer's standard finish, except as otherwise indicated, applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects.
- B. Other Parts: Manufacturer's standard finish, except as otherwise indicated.

## **PART 3 — EXECUTION**

### **3.1 INSTALLATION**

- A. Set units plumb, square, level, and secure according to manufacturer's written instructions and approved Shop Drawings.
- B. Fixture Attachment: Fasten to indicated structural supports.
- C. Lamp fixtures with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

### **3.2 FIELD QUALITY CONTROL**

- A. Inspect each installed unit for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.
- E. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until all units operate properly.

### **3.3 ADJUSTING AND CLEANING**

- A. Clean units after installation. Use methods and materials recommended by manufacturer.

### **3.4 LIGHTING FIXTURE SCHEDULE**

- A. Lighting Fixture Schedule is shown on the Contract Plans.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16740**  
**COMMUNICATIONS CIRCUITS**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

**1.2 SUMMARY**

- A. Provide all materials and labor for the installation of a TIA/EIA 568A and ISO/IEC 11801 compliant Communications Structured Cabling System (CSCS — see DEFINITIONS below). The system is intended to integrate voice and data communications onto a common media.

**1.3 REFERENCES**

- A. ANSI/TIA/EIA - 568A: *Commercial Building Telecommunications Cabling Standard*
- B. ANSI/TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*
- C. ANSI/TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*
- D. ANSI/TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*
- E. TIA/EIA -TSB67: *Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems*
- F. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

**1.4 DEFINITIONS**

- A. “CSCS” shall mean *Communications Structured Cabling System*. The CSCS is defined as all required equipment and materials including (but not limited to) TIA/EIA 568A and ISO/IEC 11801 compliant Category 6 and fiber optic cable, communications outlets, termination jacks, termination blocks, patch panels and patch cables, racks/enclosures (such as EIA standard equipment racks, enclosures, cable runway, and vertical and horizontal cable management hardware), and pathway/raceway materials (such as sleeves, D-rings, surface metal and surface plastic raceway), and other incidental and miscellaneous equipment and materials

as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

## **1.5 CONTRACTOR QUALIFICATIONS**

- A. Prior to bidding the project, the Contractor:
1. Shall be trained and certified by the Manufacturer to install, test, and maintain the CSCS and shall be certified by the Manufacturer to provide the Manufacturer's 15-year product, performance, and application Warranty. The Contractor shall bid only one manufacturer and shall only bid a manufacturer for which the Contractor is certified. The Contractors shall be certified as at least one of the following:
    - a. AMP NetConnect Design & Installation Contractor (ND&I)
    - b. Ortronics/Berk-tek Netclear Contractor
    - c. Leviton Premier Network Installer Contractor
  2. Shall have employees whose duties are to apply firestopping material trained and certified by the specified firestopping manufacturer.
  3. Shall have a list of references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor under the Contractor's current business name within the past three years. The reference list shall detail, for each project:
    - a. Project name and location
    - b. Construction cost
    - c. A brief description of the project and the components involved (fiber, Cat 6 UTP, etc.)
    - d. Number of workstation drops
    - e. Contact names, phone numbers, and addresses

## **1.6 QUALITY ASSURANCE**

- A. The Contractor shall have only manufacturer trained and certified Installation Supervisors/Project Foremen, Test Technicians, and Installation Technicians on the job site.

## **1.7 WARRANTY**

- A. The Contractor shall provide a Manufacturer endorsed and backed extended 15-year product, performance, application, and labor warranty which shall warrant:
  - 1. Against defects in materials and workmanship (extended product warranty) for a period of 15 years.
  - 2. That all cabling components of the installed system will meet or exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801 (performance warranty) for a period of 15 years.
  - 3. That all unshielded/shielded twisted pair cabling links/channels will meet or exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC 11801 (performance warranty) for a period of 15 years.
  - 4. That the system shall be application independent and shall support both current and future applications that use the TIA/EIA 568A or ISO/IEC 11801 component and link/channel specifications for cabling (application warranty), for a period of 15 years.
  - 5. That all labor attributable to and required by the above shall be supplied at no cost to the Owner for a period of 15 years.
- B. Active electronics for the Communications system shall have at least 3 years coverage of Cisco SmartNet 8x5 Next Business Day coverage for each device covered in this section. The Owner shall be listed on the Contract as the End User on the SmartNet agreement.
- C. The warranty period shall begin at the Owner's acceptance of the work.

## **1.8 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7 .

## **1.9 SUBMITTAL INFORMATION**

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. The Contractor shall submit their statement of qualifications. The statement of qualifications shall include all documentation verifying compliance with Paragraph 1.5A (Contractor Qualifications), above.

- C. Product Data: For each type of system components specified in the section. This includes, but is not limited to:
1. Specification sheets (cut sheets) of all proposed cables (indicate the exact cables that are to be supplied).
  2. The Contractor shall provide submittal information for review before materials are delivered to the job site.
    - a. Provide material and equipment submittals for each item of equipment as follows:
      - 1) For items, which are being provided exactly as specified, do not provide submittal information. Instead, provide written documentation stating that the items are to be provided as specified.
      - 2) For those items noted as allowing “or equal,” and which are not being provided as specified, provide standard manufacturer's cut sheets or other descriptive information and a written description detailing the reason for the substitution.
  3. Provide a list of proposed test equipment for use in verifying the installation of the CSCS.
    - a. Provide for each testing device:
      - 1) Manufacturer and product number.
      - 2) Manufacturer documentation showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the last six months
      - 3) Manufacturer documentation showing software revision. Software revision shall be most current revision available for device and based upon the most current TIA/EIA testing guidelines.
    - b. Provide proposed UTP cable and fiber optic cable test forms
  4. If materials requiring pre-approval by the manufacturer for inclusion into the manufacturer 15-year product, performance, and application warranty will be utilized, provide manufacturer written pre-approval (see PART 1 - WARRANTY above, PART 2 - PRODUCTS, GENERAL below).

5. The operating and maintenance (O&M) instructions shall be provided at the time of submittal review for each device in the system. These instructions shall detail how to install and service the equipment and shall include all information necessary for rough-in in preparation for the building facilities to receive the materials.
- D. Shop Drawings:
1. Provide a cable routing and grouping plan as follows:
    - a. Where cable routing and grouping is to be exactly as shown on the Drawings, do not provide a cable routing and cable-grouping plan.
    - b. Where changes in cable routing and grouping are proposed, provide a complete building floor plan showing the proposed routing, junction box locations, raceway sizes and cabling within raceway in a manner equal to that of the Drawings.
- E. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.13 for further information)
- F. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
1. Component Maintenance and Repair Manuals (specified in Division 1).
  2. Spare Parts List
  3. Field Test Reports
  4. Product Data
  5. Record Drawings: At the completion of the project, the drawings shall be updated to reflect any changes during the course of construction.

## **PART 2 — PRODUCTS**

### **2.1 GENERAL**

- A. CSCS equipment and materials shall be manufactured by a single manufacturer. For a given manufacturer, CPCS equipment and materials shall be of a single CPCS product line unless stated otherwise in this Specification or in the Drawings. Equipment and components shall not be intermixed between different manufacturers. Equipment and components shall not be intermixed between different product lines unless otherwise noted. Substitution of manufacturer and/or CPCS product line is not acceptable.
  - 1. The manufacturer and CPCS product line shall be:
    - a. AMP Netconnect
    - b. Ortronics / Berk-tel Netclear
    - c. Leviton / Superior Essex (NextLAN) or Mohawk (NetSync)
  - 2. All CPCS Category 6 equipment and materials not required by the Contractor selected CPCS Manufacturer to be manufactured by the CPCS manufacturer, shall be pre-approved by the CPCS Manufacturer for use in the CPCS and shall be covered by the Manufacturer's 15-year product, performance, and application Warranty (see PART 1 — WARRANTY above, PART 1 - SUBMITTALS above).
- B. Racks, rack cable distribution hardware, cable runway/ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification or in the Drawings. Equipment and components shall not be intermixed between different manufacturers. Substitution of manufacturer is not acceptable. The manufacturer for rack/distribution equipment shall be:
  - 1. Ortronics/Cablofil
  - 2. Chatsworth Products, Inc. (CPI)
- C. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified or shown on the Plans required for a fully operational, tested, certified and warranted system.

- D. Unless otherwise noted, items shall be provided as specified. “Or equal” or equivalent items are not acceptable unless manufactured by manufacturer listed under section 2.1.
- E. The Contractor shall physically verify the following materials on site, prior to purchase and delivery of the materials:
  - 1. Underground and overhead conduit pathway lengths to be used for backbone cabling.

## **2.2 RACEWAY**

- A. Installation and materials for the raceway and boxes for the CSCS shall be as provided under Section 16130 except where noted below.
  - 1. Surface Metal Raceway shall be listed by UL under Section 5 and shall be:
    - a. Wiremold
- B. Backboards: Provide backboards which are ¾” A-C plywood, void free, 2440-mm (8-ft) high unless otherwise noted, capable of supporting attached equipment, and painted with one coat of primer and one or more coats of fire-retardant light gray or off-white semi gloss paint.
- C. Sleeves: Provide sleeves where required for cable pass-thru. Provide core drilling where required for sleeve installation. Sleeves shall be EMT conduit and shall be provided with insulated throat bushings for each end. Sleeve sizing shall be as noted on the Drawings. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569 cable capacity standards, plus an additional 100% for future expansion.
- D. Innerduct: Provide bright orange innerduct as necessary for pathway for fiber optic cables from fiber patch panels to conduit or plenum entrances and as shown on the Plans. Innerduct installed in plenum rated ceilings shall be plenum rated.

## **2.3 EQUIPMENT RACKS/ENCLOSURES**

- A. Hinged Wall Mount Patch Panel Bracket
  - 1. 19” Patch Panel Hinged Swing Rack
  - 2. 4” to 6” inches deep
  - 3. 2 units
  - 4. This product need not be supplied by the vendor from 2.1 part B.

## **2.4 PATCH PANELS**

- A. Workstation Patch Panels: Provide workstation patch panels to terminate all ports of workstation communication outlet ports. Patch panels shall be 4-pair Category 6 high density T568B wired patch panels with modular UTP 8-position/8-conductor IDC jacks on the front of each panel and 110 style termination blocks on the back of the panel. Patch panels shall meet or exceed TIA/EIA 568A Category 6 specifications for performance. Patch panels shall be manufactured by the selected CSCS Manufacturer and shall be:

1. Ortronics: See plans for part numbers.
2. AMP equal
3. Leviton equal

- B. Fiber Patch Panels. Provide fiber patch panels/distribution enclosures/termination cabinets as shown on the Drawings. Fiber termination enclosures shall consist of enclosures pre-assembled with LC style adapter plates for multimode fiber. Connectors shall be ceramic or stainless steel connectors, strain relief, rack mountable or wall mountable as shown on the Drawings, and sized and installed as shown on the Drawings. Fiber termination enclosures shall be sized to accommodate the quantity of fiber to be terminated and shall be sized with a minimum of 3 additional spare ports for future use. Fiber termination enclosures shall be manufactured by the selected CSCS Manufacturer and shall be:

1. Ortronics
2. AMP
3. Leviton

## **2.5 NETWORKING EQUIPMENT:**

- A. Managed Layer 2 Switch (1 plus spare)
1. 16 (or more) 10 /100 /1000 Ethernet Port
  2. SFP Uplink Ports
    - a. Provide uplink module with 2 usable SFP bays.
    - b. Provide one 1000 Base SX SPT module
    - c. Cisco GLC-SX-MM or equal
  3. Cisco Catalyst 1000-16P-E-2G-L

- B. Equipment Service Contract
  - 1. Cisco SMARTnet service or equal for each piece of active network equipment supplied including appurtenances or modules.
    - a. 3 years of 8x5 Next Business Day service
- C. Wireless Access Points
  - 1. Cisco Aironet 1815i with accessories as required for surface mounting on a ceiling.

## **2.6 WORKSTATION COMMUNICATIONS OUTLETS**

- A. Modular 8-position IDC Jacks: Provide modular UTP 8-position/8-conductor IDC jacks for workstation communications outlets. Jacks shall utilize T568B wiring and shall meet or exceed TIA/EIA 568A Category 6 specifications for performance. Top jack of each communications outlet shall be blue, bottom jack shall be black. Jacks shall be manufactured by the selected CSCS Manufacturer.
  - 1. Ortronics #OR-TJ600-88 (white), or
  - 2. AMP equal.
- B. Provide keystone 2-hole baseplate rectangular wallplate insert for stainless steel wall plates provided as required in 16140 2.2 M (Wall Plates).
  - 1. Ortronics #OR-KSDS2-88 (white), or
  - 2. AMP equal
  - 3. Leviton equal
- C. Provide single port surface mount box:
  - 1. Ortronics #OR-404TJ1-88 (White), or
  - 2. AMP equal
  - 3. Leviton equal
- D. Provide two port surface mount box:
  - 1. Ortronics #OR-404TJ2-88 (White), or
  - 2. AMP equal
  - 3. Leviton equal
- E. Blank Insert Covers shall be provided for unused workstation and workstation patch panel ports, color shall match.

## 2.7 CABLE

- A. Indoor Cable: Cable used indoors shall be rated for indoor use. Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise. All cabling shall bear plenum or riser rated markings for the environment in which they are installed. Any cable installed below grade or in cement must be rated for outdoor use (OSP).
  - 1. Category 6 Cable: Provide Category 6 cable for all workstation outlets, for both voice and data ports. Provide one cable per 8-position communications jack on a given workstation outlet. Category 6 cable shall exceed TIA/EIA 568B Category 6 specifications for performance, shall be part of the UL LAN Certification and Follow-up Program, and shall be defined by the Manufacturer as an “extended performance Category 6 cable.” Cable shall be 4-pair with 23 AWG solid copper conductors. Cable shall be UL Type CMP (plenum) or CM/CMR (non-plenum). For plenum cable, all 4 cable pairs shall be insulated with FEP. Cable shall be manufactured by or approved for use in the performance warranted/certified CSCS by the selected CSCS Manufacturer. Cable shall be:
    - a. Berk-Tek LANmark OR
    - b. AMP NetConnect
    - c. Leviton
    - d. Provide 1000 foot reel/box to Owner for spare.
- B. Outdoor Cable: Cable used outdoors shall be rated for outdoor use and rated for duct or direct burial installation (depending upon the application).
  - 1. Fiber Cable: Indoor/outdoor rated, all dielectric, multimode, 850 nm, laser optimized, plenum rated, water blocking fillers encased in a buffer tube surrounded by water blocking strength members, meeting or exceeding ANSI/TIA/EIA standards for 10 Gigabit Ethernet. Cables and fanout kits shall be manufactured by the selected CSCS and be provided in the strand counts shown in the Plans.
    - a. OM3

## **2.8 PATCH CABLES**

- A. Fiber Patch Cords: Provide fiber patch cords for connection to network electronics. Patch cords shall be 50/125 laser optimized multimode duplex LC cords, pre-manufactured by the CSCS, and shall be:
  - 1. Provide 4 fiber patch cords
- B. Modular Data Patch Cables: Provide data patch cables for data cross-connects. Patch cables shall be pre-manufactured Category 6 UTP modular 8-position/8-conductor to modular 8-position/8-conductor plugs. Patch cables shall meet or exceed TIA/EIA 568A Category 5e specifications for performance.
  - 1. Patch cables shall be manufactured by the selected CSCS Manufacturer.
  - 2. Provide 20 patch cables for use at the communications backboard and in equipment. Cables shall be sized at 5 feet.
  - 3. Provide 4 patch cables for use at the workstations. Cables shall be sized at 10 feet.
  - 4. Provide four Velcro cable straps for each group of eight (or fewer) patch cables. Velcro cable straps shall be SIEMON VCM-100-060-2 (white).

## **2.9 LABELING AND ADMINISTRATION**

- A. Labels shall be as recommended in TIA/EIA 606. Labels shall be permanent/legible typed and created by a Brady LS-2000 label maker or equivalent system. Handwritten labels are not acceptable. Labels are required for communications closets, riser cables, communications jacks, termination block columns for workstation and riser cables, termination strip pairs, and grounding bus bars.

## **PART 3 — EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall install all components strictly to manufacturers recommendations.
- B. All work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, and the National Electrical Code as well as the ANSI/TIA/EIA and ISO/IEC standards listed in Part 1 — References, above.

1. Where questions arise regarding which standards apply, the more stringent specification or policy shall prevail.
- C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.
- D. If raceway or pathway (conduits, sleeves, cable pathway etc.) is installed after walls are installed and/or after finish to walls has been applied, wall penetrations shall be sealed, patched and painted to match condition and finish of undisturbed wall.

### **3.2 COPPER CABLE PROTECTION/BUILDING ENTRANCE TERMINALS (BET'S)**

- A. Install building entrance terminals (BET's) per manufacturer's instructions. Coordinate with the Owner the configuration of standard protectors vs. special protectors and install protectors for each pair. Connect each BET to building ground with a #6 AWG copper bonding conductor between the protector ground lug and the building ground point.

### **3.3 RACEWAY**

- A. D-Rings installed in communications closet shall be mounted at 12" intervals. D-Rings used for raceway in open access environments shall be mounted at 4' intervals.
- B. Cable runway shall be installed with ends of cable runway cut square. Ream cut ends to remove burrs and sharp edges. Cap cut ends with manufacturer's recommended caps. Mount retaining posts as required. Affix cable radius drop outs as required.

### **3.4 EQUIPMENT RACKS/ENCLOSURES**

- A. Install EIA racks and hardware according to locations, elevations, and plan views as shown on the Plans and Specifications.

### **3.5 PATCH PANELS**

- A. Install patch panels and horizontal wire management on racks according to locations, elevations, and plan views as shown on the Plans and Specifications.

### **3.6 GROUNDING AND BONDING**

- A. All grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467,

and ANSI/TIA/EIA standards listed in Part 1 — References above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond all metallic raceway, racks, cable runway, enclosures, and other metallic hardware used for communications distribution to the nearest approved building ground. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

### **3.7 TERMINATION BLOCKS**

- A. Workstation and/or riser cable shall enter termination block wall field from the bottom. Cable shall route horizontally along base of backboard until it reaches the termination block column on which it is to terminate and then route vertically to termination block.
- B. Install termination block punch downs for riser cable as follows:
  1. Punch down riser cable sequentially across the termination strips.
- C. Punch down workstation and/or riser cable using only the selected CSCS Manufacturer-approved impact tool.

### **3.8 WORKSTATION COMMUNICATIONS OUTLETS**

- A. Provide one cable per 8-position communications jack on a given workstation outlet.

### **3.9 FIELD CONNECTIONS**

- A. For permanently installed control panels, install a surface mount enclosure within the panel as near to the entry of UTP cable as practical. The UTP cable shall be routed to the control panel in raceway. In lieu of raceway, the UTP cable may be routed via a suitable cord grip bushing if indicated on the drawings. Within the control panel, connect the equipment with a patch cord from the equipment to the surface mount enclosure.

### **3.10 CABLE**

- A. Outdoor:
  1. Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.

- a. Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.
2. Install cables in compliance with ANSI/TIA/EIA requirements, BICSI practices, and manufacturers recommendations. Adhere to the requirements detailed in the manufacturer's recommendations and ANSI/TIA/EIA Standards relating to bending radius, pulling tension, other mechanical stresses, and pulling speed.
  - a. Monitor pulling tension on runs of 300 feet or longer. Acceptable monitoring devices are:
    - 1) Winch with a calibrated maximum tension
    - 2) Breakaway link (swivel)
    - 3) In-line tensiometer
3. Set up cable reels on the same sides of maintenance holes and hand holes as the conduit sections in which cables are to be placed. Level and align reels with conduit sections to prevent twisting of cables during installation into conduits. Pull cables into conduits from tops of reels in long smooth bends. Do not pull cables into conduits from bottoms of reels. Use a cable feeder guide (shoe) of suitable dimensions between the cable reel and the face of the duct to protect the cable and to guide it into the duct. Carefully inspect the cables for sheath defects as the cables are payed off the reel. If defects are found during the pulling operation or if the cable on the reel binds, twists, or does not pay off freely, stop the pulling operation immediately and notify the Owner.
4. Cables of 1-¼ inch diameter or larger shall be equipped with factory installed pulling eyes, or install a core hitch on site. Use pulling grips for cables smaller than 1-¼ inches in diameter. Do not pound grips into the cable sheath to prevent the grips from slipping. Use a ball-bearing based swivel between the pulling-eyes or grips and the pulling strand.
5. Once pulling begins, and tension is applied to the cable, continue the pull at a steady rate. If it is necessary to stop the pull at any point, the tension shall not be released unless it is necessary to do so.
6. Do not splice cables unless specifically noted on the Plans.

7. For new ductbank, install cables in the lowest available conduit in a duct bank, working up as additional cables are installed. For existing ductbanks, do not place cables in ducts other than those indicated on the Plans.
8. Where cables are pulled through maintenance holes or handholes, select the same duct at both sides of maintenance holes or handholes unless specifically noted on the Plans. Avoid changes in duct selections, especially in elevations, to ensure that no damage occurs to the cable sheaths and that pulling tensions are kept as low as possible.
9. Maintain a sufficient length of cable in each maintenance hole or handhole to properly rack the cable. Rack cables in maintenance holes and handholes as soon as practicable, but within one week after cable installation. Route cables in maintenance holes and handholes to avoid blocking duct access.
10. When more than one cable is being installed in a conduit, pull all cables through the conduit simultaneously.
11. Where practicable, feed cables into ducts from the end of the duct that creates the least sidewall pressure on a bend during installation (i.e. feed cable from the end closest to the bend).
12. Use pulling compound or lubricant where necessary. Use lubricants that are compatible with the cable jacket material and in accordance with the manufacturer's recommendations. Do not use soap-based lubricants. Where cable is pulled through a maintenance hole or handhole, re-lubricate the cable prior to feeding into the next duct. Immediately after cables have been installed, clean lubricant from exposed cables in maintenance holes and handholes and at termination points using dry rags.
13. Seal cable ends with end caps immediately after installation and until terminated in a termination enclosure to prevent moisture entry into the core of filled cables and to prevent damage during installation.
14. Provide a service loop long enough in the ER/TR's to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 15 feet in the ER and 25 feet at each TR.

15. Comply with the NEC 50-ft rule when installing outdoor-rated cable (i.e. do not exceed 50 feet of exposed outdoor-rated cable length within a building).
  16. Cable at the backboards:
    - a. Lay and dress cables to allow future cabling to enter raceway (conduit or otherwise) without obstruction by maintaining a working distance from these openings.
    - b. Route cable as close as possible to the ceiling, floor or other corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
    - c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Tie-wrap together similarly routed and similar cables and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.
  17. Cable in the Telecommunications Rooms:
    - a. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals.
  18. Building Entrances: Seal conduits (both in-use and spare) that enter the building from the outside plant to prevent intrusion of water, gases, and rodents.
- B. Outdoor Fiber Cable:
1. Provide fiber optic cable in quantities, strand counts, and types (singlemode, multimode, or composite multimode/singlemode (hybrid)), as shown on the Plans. Provide cable with fan-out kits for both ends.
  2. Test fiber optic cable on the reel upon delivery to the job site, prior to installation. Permanently affix test results to the reel and provide a copy to the Owner prior to installation. Do not install cables that fail. Replace failing cables at no additional expense to the Owner.

- a. Conform to the test procedures as outlined in the paragraph entitled TESTING at the end of this specification.
  - b. Demonstrate that the test results are similar to the factory test results as shipped with the reel.
3. Terminate all fiber strands within a fiber cable. The installation of “dark fiber” is not acceptable.
4. For shielded cable, bond the shield at both ends to the TGB.
5. Fiber splices are not acceptable.
- C. The service slack stored inside the fiber patch panel cabinets shall be a minimum of 3 m (10 ft). For all cable:
- D. Cable at the backboards:
  1. Lay and dress all cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.
  2. Cable shall be routed as close as possible to the ceiling, floor or other corners to ensure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
  3. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Tie-wrap all similarly routed and similar cables together and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.
  4. See TERMINATION BLOCKS above for details on routing workstation and riser cabling to termination blocks.
- E. Install Category 6 UTP Cable as shown on the Plans.
  1. Exposed cable and cable not in conduit shall be routed to comply with TIA/EIA-569 rules for unshielded copper voice and data system cables from potential EMI sources and as follows:
    - a. Provide clearances of 18 inches for light fixtures.
    - b. Provide clearances of 12 inches for conduit and cables for electrical power distribution.
    - c. Provide clearances 4 feet for motors and transformers.

- d. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.
- 2. Provide service loops with a minimum of 12 inches in the device box and 36 inches in the communications closet.
- 3. Do not terminate cable until wall finish has been applied.
- F. Install copper riser cable as shown on the Plans.
  - 1. Provide a minimum 10' service loop at each end.

### **3.11 PATCH CABLES**

- A. Install patch cables. Connect the patch panel ports to the Ethernet Switch ports.

### **3.12 LABELING AND ADMINISTRATION**

- A. Racks: Racks shall be labeled sequentially within a given closet and shall be of the form "RX" where "R" stands for "Rack" and "X" is the sequential rack number within a given closet.
  - 1. Example: The first rack in a given communications closet would have the label "R1", the second "R2" and so on.
- B. Workstation Patch Panels: Workstation patch panels shall be labeled sequentially within a given closet within a given rack and shall be of the form "WX" where "W" stands for "Workstation" and "X" is the sequential fiber patch panel within a given rack.
  - 1. Example: The first voice patch panel in a given rack would have the label "W1", the second "W2" and so on.
  - 2. Workstation patch panel ports shall be labeled sequentially within a voice patch panel.
- C. Workstation Communications Jacks: Communications jacks shall be of the form "FC-RX-WX.Y" where "FC" is the closet at which the cable terminates, "RX" is the rack at which the cable terminates, "WX" is the workstation patch panel at which the cable terminates, and "Y" is the sequential port number at which the cable terminates.
  - 1. Example: A two port outlet has its cables terminating in closet 1A, rack R2, workstation patch panel W3, on ports 1 and 25. The two jacks would have the labels "1A-R2-W3.1" and "1A-R2-W3.25"

- D. Workstation Cables: Workstation cables shall be labeled with the same label as the workstation communication jack, which terminates the cable. Workstation cables shall have labels affixed at each end.

### **3.13 TESTING**

- A. Test records shall be provided on a form approved by the Owner and Engineer. The form shall include test results for each cable in the system. Each cable tested must be submitted on the form with identification as discussed under LABELING AND ADMINISTRATION above. The form shall include the ID, outcome of test, indication of errors found, cable length, retest results, and signature of technician completing the tests. Test results shall be provided to the Owner for review and acceptance.
  - 1. Test records for each cable within the system shall be printed directly from the tester and shall be submitted in a binder and on diskette to the Owner for review. Handwritten test results will not be accepted.
- B. Test the CSCS after installation for compliance to all applicable standards as follows:
  - 1. Test Category 6 Horizontal UTP Cable for compliance to ANSI/TIA/EIA 568A, ANSI/TIA/EIA TSB67, and ISO/IEC 11801 standards. Test with building electrical systems powered on (i.e. Lights, HVAC, etc.).
    - a. Test each end-to-end link, utilizing 250Mhz sweep tests, for continuity, polarity, NEXT, attenuation, installed length, wire map, impedance, resistance, and ACR. Each cable shall be tested in both directions.
    - b. Testing device shall be a Level 2 testing instrument, re-calibrated within the last six months, with the most current software revision based upon the most current EIA/TIA testing guidelines, 250Mhz rated, capable of storing and printing test records for each cable within the system. Device shall be a LANCAT, Microtest, Fluke, or equal.
  - 2. Copper Backbone Distribution: Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.
    - a. Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the

presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 3 standards.

- b. Test entire channel, from termination block to termination block.
  - c. Use a TIA/EIA Level III testing instrument, re-calibrated within the manufacturer's recommended calibration period, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.
    - 1) Fluke DSP-4000 with latest software and hardware releases, or equal.
3. Fiber: Test fiber cable on the reel upon delivery to the job site, again prior to installation, and again after installation.
- a. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:
    - 1) For Backbone Distribution:
      - a)  $\text{Max Loss} = [(\text{allowable loss/km}) * (\text{km of fiber})] + [(.3\text{db}) * (\# \text{ of connectors})]$
      - b) A mated connector to connector interface is defined as a single connector for the purposes of the above formula.
      - c) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).
  - b. Test all strands using a bi-directional end-to-end Optical Transmission Loss Test Instrument (OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to-end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B, and the Avaya Communication SCS Field Testing Guidelines (latest edition).
    - 1) Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.

- 2) Provide test measurements as follows:
  - a) For Multimode Cable: Test at both 850 and 1300nm.
  - b) For Singlemode Cable: Test at both 1310 and 1550nm.
- c. Test results shall conform to:
  - 1) The criteria specified in ANSI/TIA/EIA-568-B
  - 2) The Contractor's calculated loss budget above
  - 3) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)
    - a) In addition to the above, perform tests both recommended and mandated by Avaya. Tests shall confirm/guarantee compliance to Avaya Ethernet GigaSPEED 1000B-X performance, and IEEE 802.3z for a maximum end-to-end dB loss of 2.5 dB.
  - 4) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)
- C. Identify cables and equipment that do not pass to the Owner. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials at no additional expense to the Owner. Provide new test results to the Owner in the same manner as above.
- D. Damaged cables which are replaced shall be subject to the testing procedures above.

### **3.14 FOLLOW UP**

- A. After the system and facility has been placed in operation, provide technical assistance for the first two weeks of operation on a standby call basis for troubleshooting, education, and problem solving. At a period, no less than one month and no more than three months after startup, provide a one day service and operation review for the Owner. Provide any technical services required, assistance on the use of the system and the use of any special features, which may require time to become familiar with. At a period of time, no less than six months and no greater than one year

after startup, provide a second one day service and operation review for the Owner.

- B. After each service and operation review, provide a written statement to the Engineer, outlining who visited the site, which of the Owners were present, what issues were discussed/services provided, and the response to all questions.

**\*\*\* END OF SECTION \*\*\***

## **SECTION 16910**

### **PROGRAMMABLE LOGIC CONTROLLERS**

#### **PART 1 — GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Programmable logic controller (PLC) control system(s), including:
    - a. Hardware, installation, field testing, and training.
- B. Related Sections include the following:
  - 1. Division 11 for Programmable Logic Controllers provided with process equipment specified in Division 11.
  - 2. Division 13 for Programmable Logic Controllers provided with special equipment specified in Division 13.
  - 3. Division 14 for Programmable Logic Controllers provided with conveying equipment specified in Division 14.
  - 4. Division 15 for Programmable Logic Controllers provided with equipment specified in Division 15.
  - 5. Section 16940 for control panels housing PLC equipment.
- C. PLC Programming will be provided by others unless the PLC is being provided as part of a package system as specified in Division 11.

##### **1.3 REFERENCES**

- A. Referenced Standards:
  - 1. National Electrical Manufacturers Association (NEMA):
    - a. ICS 1, General Standards for Industrial Control and Systems.
    - b. ICS 1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid State Control.
    - c. ICS 4, Terminal Blocks for Industrial Use.

- d. ICS 6, Enclosures for Industrial Controls and Systems.
- e. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).
- 2. National Fire Protection Association (NFPA):
  - a. National Electric Code (NEC).

## **1.4 SYSTEM DESCRIPTION**

- A. Design Requirements
  - 1. The system includes racks, central processing units (CPUs), input/output (I/O) modules, communication modules, power supplies, and associated accessory items to provide a complete and functional control system.
- B. The PLCs will function to monitor and control site operation and communicate with other locations via Ethernet or a spread spectrum radio link.
- C. The Contractor shall download the provided PLC program into each PLC, and shall start up the PLC and equipment monitored and/or controlled by the PLC.
- D. Performance Requirements
  - 1. The installed system performs the functional and operational algorithms required for control of the process.

## **1.5 SUBMITTALS**

- A. A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data
  - 1. Manufacturer's data sheets for each hardware component including specific model numbers for each device, and size of memory provided in each CPU.
  - 2. Manufacturer's installation manual, operation and maintenance manual(s) for each component and/or device.
- C. Shop Drawings:
  - 1. Drawings
    - a. See Section 16940 for requirements.

2. Schedule of system I/O including the following data:
    - a. I/O point, with name, tag number, and indication of type and the characteristics of the I/O signal.
  3. Listing of spare parts provided with the system.
- D. Operation and Maintenance Manuals:
1. See Section 01300.
  2. Provide specific information including:
    - a. Manufacturer's published operation and maintenance manual, and troubleshooting guide.
    - b. Information for obtaining assistance and troubleshooting, parts ordering information, and field service personnel requests.
  3. Include final system drawings, and final I/O lists.
  4. Include testing reports. (see Section 3.1 for further information)

## **1.6 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7.

## **PART 2 — PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with the requirements, provide products by the following manufacturers:
  1. Allen–Bradley
- B. Allen Bradley is the basis of design for this project. The Contractor shall be responsible for all costs related to providing a different system. The modules shall be equivalent to the Allen Bradley part numbers shown on the drawings.

### **2.2 EQUIPMENT**

- A. Conform to NEMA ICS 1.1 for installation and application of the PLC system.
- B. The equipment consists of fully integrated microprocessor units specifically designed for operation in unconditioned audible noise and high vibration areas.

1. Includes analog, digital, and communications interfaces for interface directly with ISA or other industry standard transducers, actuators, and communications equipment without the need for intervening conditioning devices.
- C. Equipment operates in 32 to 140 Degrees F temperature and 0 to 95 percent relative humidity. Equipment does not require cooling fans or other heating or conditioning equipment to operate within this environmental range.
- D. Include the following minimum safety measures:
  1. Watchdog function to monitor:
    - a. Internal processor clock failure.
    - b. Processor memory failure.
    - c. Loss of communication between processor and I/O modules.
    - d. Failure to execute logic program.
  2. Safe wiring:
    - a. Equipment failure mode is such that the loss of power or control signal to the equipment results in the equipment either shutting down or operating safely.
    - b. Stopping of equipment results from the de-energization of control circuits, rather than the energization of control circuits.
  3. PLC fault relay:
    - a. Opening of PLC fault contact occurs with the following conditions:
      - 1) Loss of memory.
      - 2) Processor fault.
      - 3) Power supply fault.
      - 4) Isolation failure.
      - 5) Communications failure.
      - 6) Scan time overrun.
      - 7) Module failure.

4. Monitoring of internal faults and display:
  - a. Internal PLC system status and faults shall be monitored and displayed on the processor module or rack. Monitored items shall include:
    - 1) Processor ok/processor fault.
    - 2) Battery ok/battery low.
    - 3) Power supply ok/power supply fault.
    - 4) Module failure.

E. Monitoring of Internal Processor Faults:

1. An internal watchdog shall time out and shut down the processor upon detection of a problem. Problems include:
  - a. Processor fails to correctly address input modules.
  - b. Processor ceases to execute the logic program.
  - c. Input modules fail to read current status values of inputs.
  - d. Processor memory failure.

F. Firmware

1. All programmable components shall use the latest, stable firmware and software versions.

## **2.3 COMPONENTS**

- A. Provide components as indicated.
- B. Provide all incidental materials and equipment required for a complete, functional, and successfully operating PLC system. These items include, but are not limited to:
  1. power supplies
  2. chassis racks
  3. interconnecting cables
  4. slot covers for unused chassis slots
  5. other items ordinarily furnished as part of a complete system

- C. PLC System Central Processor Unit (CPU):
  - 1. PLCs provided in motor control centers
    - a. Accepts IEC 61131-3 including at least Ladder Diagram, Function Block Diagram, and Structured text
      - 1) Allows the creation of user defined data structures
      - 2) Allows the creation of user derived function blocks
  - 2. PLC in Telemetry Control Panel
    - a. Supports Ladder Logic
    - b. Supports acting as a Modbus/RTU slave via RS-232
- D. Input/output (I/O) Modules.
  - 1. Discrete I/O modules:
    - a. Input module:
      - 1) 24 VDC or 120 VAC input modules for typical I/O
      - 2) 24 VDC input modules to monitor transistor inputs, for any inputs sharing conduit pathway with analog loops, or typical I/O.
    - b. Output Module
      - 1) Relay
      - 2) 24 VDC with interposing relays for each point.
      - 3) 120 VAC triac with interposing relays for each point.
        - a) An interposing relay is not required for circuits starting motor starters in the same MCC.
  - 2. Analog I/O modules:
    - a. Input modules.
      - 1) 4-20 ma
    - b. Output modules.
      - 1) 4-20 ma

- E. Power Supply Units:
  - 1. Each unit sized to supply the connected PLC system components operating at full capacity, plus an additional 20% spare capacity, minimum.
  - 2. Input is 120 VAC, 60 HZ, single phase.
- F. Communications Modules:
  - 1. 10 Base T / 100 Base TX Ethernet port using the following protocol: Ethernet/IP (CIP).

## **2.4 ACCESSORIES**

- A. Provide all accessories required, whether indicated or not, for a complete PLC control system to accomplish the requirements of the Plans and Specifications.

## **2.5 SOFTWARE**

- A. Provide the most recent versions of software required to program the PLC, OI, Protocol Bridges, Specialty or Fieldbus Converters, and serial device servers (as necessary) to the Owner. Turn all licenses, software keys, activation codes, and any other digital usage rights identifier (including dongles, USB keys, etc.) over to the Owner. The Owner shall retain these rights to the software in perpetuity.
- B. Provide the Owner with the most recent versions of software required to program the PLC, OI, Protocol Bridges, Specialty or Fieldbus Converters, and serial device servers (as necessary). Arrange for the Owner to receive the software and any required licenses, software keys, activation codes, and any other digital usages rights identifiers within 60 days of notice to proceed.

## **2.6 EXTRA MATERIALS**

- A. Provide the following extra materials:
  - 1. Provide one spare processor module for each type of processor module furnished.
  - 2. Provide one spare I/O card for every 10 cards, or fraction thereof, of each type of card installed.
  - 3. Provide one spare power supply for each type of power supply furnished.

4. Provide one spare communications module for each type of module furnished.
5. Provide two spare cables for each type of cable furnished.
6. Provide a list of the manufacturer's recommended spares for maintenance purposes. Include in the list any special tools and test equipment necessary or recommended by the manufacturer for the maintenance of the complete system. Provide any recommended spares not supplied above along with the recommended special tools and test equipment.

### **PART 3 — EXECUTION**

#### **3.1 TESTING**

- A. Shop test PLCs in the presence of the Owner prior to shipment to project site. Notify the Owner at least ten working days before testing.
  1. Provide a test plan at time of notification of testing. Coordinate the time of testing of the panels with the Construction Schedule.
  2. Each assembled panel shall be meggered and tested to be free from grounds and shorts before the shop test.
  3. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped. Each device and control loop shall be tested and demonstrated to function properly in each mode (such as "hand", "local", "automatic"). Discrete input signals shall be tested in both the "on" and "off" state. Analog signals (4-20 milliamp, or similar type) shall each be tested at not less than three values (4.08 mA or 0.5%, 12 mA or 50%, and 19.92 mA or 99.5%). Test results shall be documented. Test discrete outputs by forcing the output on and off via the programming software. Measure the resistance (for relay outputs) or voltage (for active outputs) between the output terminals. Document proper operation of each output.
  4. Test analog inputs by applying voltage or current to the input at not less than three values, including at or just above minimum range, at or just below maximum range, and midrange. Document actual register values for each applied input value at each input.
  5. Provide signal generators, multimeters, and other test equipment as required to verify proper operation of the assembled panel.

Simulate input signals, both discrete and analog, to verify operation of control and monitoring circuits.

6. Demonstrate that:
  - a. The PLC is fully operational. In no case shall testing be performed without an operating program functioning in the unit under test. Test discrete inputs by shorting across the input terminals. Document that each input performs properly.
  - b. Each I/O module is recognized by the base unit and is fully functional.
  - c. Communications ports on the base unit are fully functional.
7. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation.
8. Provide updated and complete 'as shipped' drawings at the time of final testing. The Owner shall review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Owner against the actual construction prior to shipment of the panel to the job site. 'As shipped' drawings which require revisions shall be submitted to the Owner for review at testing notification, prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment.
9. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the panel wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or 'as-shipped' drawings that cannot be affected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Owner at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor shall be required to reimburse the Owner for the Owner's costs for the third and each subsequent shop test/review.
10. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test

results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test

11. After each control panel has been installed at the jobsite:
  - a. Conduct a field test of the panel. Testing shall be conducted by physically actuating signaling devices (where possible), installing temporary jumpers, or artificially imposing signals on the field wiring. The purpose of the test is to establish proper operation of the field devices, the integrity of the field wiring, and proper connection of field devices to the panel. The Contractor shall make corrections or repairs to the wiring and/or devices as necessary to provide proper operation of the system. If testing indicates that field devices require modifications to connectors or contact action, the Contractor shall make the wiring or connection modifications as necessary to coordinate with the PLC program and contract documentation.
  - b. If testing indicates that the equipment functions properly but that changes to the PLC program are required, the Owner will revise the program(s) and provide the new program(s) for installation in the PLC. The Contractor shall be prepared to install up to 3 revised programs into each PLC during startup/commissioning without additional cost to the Owner.
  - c. Submit the results of all tests in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test.

### **3.2 CONFIGURATION**

- A. Configuration and programming of the Protocol Bridge
  1. Configure the IP address and network setting to allow device to be used on network. This may include configuring device in a different VLAN range than the default.
  2. Program Modbus/TCP register to other protocol value mappings.
  3. Configure serial port parameters to match devices connected to serial port. Test serial parameters by issuing a command to the

serial connected device and recording the request and response from the serial connected device.

B. Configuration and programming of the Serial Device Server

1. Configure the IP address and network setting to allow device to be used on network. This may include configuring device in a different VLAN range than the default.
2. Configure serial port parameters to match devices connected to serial port. Test serial parameters by issuing a command to the serial connected device and recording the request and response from the serial connected device.

C. Configuration and programming of the Specialty Protocol or Fieldbus protocol converter

1. Configure the IP address and network setting to allow device to be used on network. This may include configuring device in a different VLAN range than the default.
2. Configure specialty device or fieldbus signaling profiles.
3. Program Modbus/TCP register to specialty or fieldbus connected value mappings. Configure value mappings such that the variables are word aligned, and contiguous to minimize the number of message transactions required to retrieve status from the associated devices.
4. Configure serial port parameters to match devices connected to serial port. Test serial parameters by issuing a command to the serial connected device and recording the request and response from the serial connected device.

### **3.3 INSTALLATION**

- A. Install PLC control system in accordance with manufacturer's written instructions.
- B. Test, verify and demonstrate access to and functionality of PLC system as per the requirements of Section 16940.

**\*\*\* END OF SECTION \*\*\***

**SECTION 16940**  
**CONTROL PANELS**

**PART 1 — GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Control panels (whether provided under Division 16, or provided, or specified to be provided, with equipment specified under other Divisions).
- B. Section Includes:
  - 1. Control panels specified under this Section include:
    - a. Operations Building Control Panel “OBCP”
    - b. Operations Building Interface Panel
  - 2. Installation of control panels specified in other Divisions or furnished with the equipment. This includes (but is not limited to) the following:
    - a. Chlorine Scrubber System Control Panel
- C. Related Sections: The following Sections contain requirements that relate to this Section
  - 1. Division 11 for Control Panels provided with process equipment specified in Division 11.
  - 2. Division 13 for Control Panels provided with special equipment specified in Division 13.
  - 3. Division 14 for Control Panels provided with conveying equipment specified in Division 14.
  - 4. Division 15 for Control Panels provided with equipment specified in Division 15.
  - 5. Section 16910 for PLC equipment located in control panels.

### **1.3 REFERENCES**

#### **A. Referenced Standards:**

1. National Electrical Manufacturers Association (NEMA):
  - a. ICS 1, General Standards for Industrial Control and Systems.
  - b. ICS 4, Terminal Blocks for Industrial Use.
  - c. ICS 6, Enclosures for Industrial Controls and Systems.
  - d. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).
2. National Fire Protection Association (NFPA):
  - a. National Electric Code (NEC).
  - b. Standard for Electrical Safety in the Workplace
3. Joint Industrial Council
  - a. JIC-EMP-1.
4. International Society of Automation

### **1.4 SYSTEM DESCRIPTION**

#### **A. Control Panels**

1. The system includes control panels for control and/or monitoring of the process equipment. Control panels, whether provided under Division 16 or other Divisions, shall meet the requirements of this Section.

### **1.5 SUBMITTALS**

#### **A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.**

1. The Owner shall supply the process control portions of the PLC program based upon the configurations provided by the Contractor.
2. Provide the configuration and programming, as required, to allow communications to fieldbus devices using digital signaling. Field devices include variable frequency drives.

#### **B. Product Data: For each type of system components specified in the section. This includes, but is not limited to:**

1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied). Including manufacturer name, catalog descriptions, ratings, wiring and piping diagrams, dimensional drawings, anchoring details, installation instruction, and test results.

C. Shop Drawings:

1. Shop Drawings shall include, but not be limited to, the following:
  - a. Panel Layout Drawings:
    - 1) Shall be dimensioned and to-scale.
    - 2) Shall include nameplate text.
    - 3) Shall indicate conduit and wiring access locations. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
  - b. Materials of construction.
  - c. Elementary wiring diagrams and terminal block drawings, differentiating between panel and field wiring.
  - d. Bill of Materials including the reference name or number, quantity, complete English language description, manufacturer, model number, local supplier and wiring or piping reference.
  - e. Loop diagrams with all components connected per ISA standards.
  - f. The terminal designation (designations for terminals may be chosen by the panel builder unless noted otherwise on contract drawings) shall be shown on the elementary wiring diagrams, analog loop diagrams, and terminal block drawings.

D. Testing Materials and Documentation:

1. Provide configuration in electronic file format suitable for directly loading into PLC least ten days prior to desired Owner witnessed test date.
  - a. The PLC program shall show all of the connected devices directly on the PLC backplane and Ethernet connections.

- 1) Devices which receive commands from the PLC (for example, VFDs, valve actuators, motor overload relays) shall each be configured with at least two PLC-to-device, “write” command registers and at least ten device-to-PLC, “read” feedback registers.
  2. Supply descriptions in native electronic file format.
    - a. The native file format shall be suitable to directly load into the devices, such as Variable Frequency Drive, etc. without need for transcribing or other editing.
    - b. The native file format shall be able to be decoded using the manufacturer’s configuration software suite to a human readable format. It is acceptable to send a PDF or similar file in addition to the native file for annotations or other notes.
  3. Provide register layouts detailing where each device stores data relevant to the protocol shown. For example, if Modbus/RTU is the field bus protocol, show the Modbus/RTU registers, units, range, etc. for each device.
  4. Provide the sequence of testing plan, including the steps noted as required and the testing steps which are a part of the control panel supplier’s standard procedure.
- E. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
1. Component Maintenance and Repair Manuals (specified in Division 1).
  2. Spare Parts List
  3. Product Data
  4. Record Drawings: At the completion of the project, the drawings shall be updated to reflect any changes during the course of construction.

## **1.6 QUALITY ASSURANCE**

- A. Refer to Section 16010 paragraph 1.7 .

- B. Control panels and work supplied under this Section shall be provided by a single manufacturer, except those provided with equipment specified under Division 11, 13, 14, or 15. Control panel manufacturer shall be one of the following:
  - 1. Total Energy Management (Richland)
  - 2. TSI (Lynnwood)
  - 3. Quality Controls Corporation (Lynnwood, WA)
  - 4. L2 Systems (Everett, WA)
- C. Comply with UL 508 “Standard for Industrial Control Equipment”.
- D. Provide control panels bearing the label of a recognized testing laboratory, or otherwise acceptable to the State of Washington Department of Labor and Industries.
- E. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with panel access locations.
- F. Shop testing of the panel is required. Refer to the “Testing” section below for shop test information.
- G. Product Selection for Restricted Space: Space for installation of control panels is limited. The Plans indicate typical physical sizes or dimensions for control panels, including clearances between control panels and adjacent surfaces and items. Control panels with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the control panels with the available space and shall verify that the proposed control panels are capable of being installed in the available space prior to making a submittal. Control panels of dimensions larger than the available space shall not be submitted. The decision of the Owner as to the acceptability of control panels with larger dimensions than as shown on the Plans will be final. If the larger equipment is deemed acceptable, it is the Contractor’s responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.

- H. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with control panel access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.

## **1.7 STORAGE AND HANDLING**

- A. Store equipment per requirements of Section 16050 paragraph 1.10 and as follows:
  - 1. After completion of shop assembly and testing, enclose panels in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Place dehumidifiers inside the polyethylene covering.
  - 2. Skid-mount the equipment for final transport. Show shipping weight on shipping tags, together with instructions for unloading, transporting, storing, and handling on job site.
  - 3. Remove equipment protection only after equipment is safe from hazards such as dirt and moisture and damage from construction operations. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

## **PART 2 — PRODUCTS**

### **2.1 MATERIALS**

- A. Control panel enclosures shall be factory UL labeled enclosures fabricated into a rigid, self-supporting structure unless otherwise noted. Panels shall be of NEMA type construction as required for the location indicated on the Plans. Free standing panels shall be provided with channel sills where shown on the Plans. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.
  - 1. Welded construction
  - 2. Completely enclosed, self-supporting, and gasketed dust-tight.
  - 3. Seams and corners welded and ground smooth.
  - 4. Provide full length piano hinges rated for 1.5 times the weight of the door and door mounted instruments

5. Furnish doors with keyed alike locking handles and three point catch.
  6. Provide each panel with lifting eyebolts. Furnish stainless steel base channels.
  7. Provide slotted bolt holes in the base, 1 1/2 inches long for field adjustment.
- B. The Communications enclosures shall use the parts and components shown on the Plans.
- C. Hinges: Stainless steel.
- D. Nameplates: Phenolic.

## **2.2 COMPONENTS**

- A. Fuses
1. Control power fuses are FRN for ratings above ten amperes and FNQ for ten amperes and below. FRN fuses are mounted in phenolic blocks with a fuse puller mounted adjacent to them. FNQ fuses are mounted in a Buss CHM1I modular fuse holder with indicator light. Label all fuse holders with fuse identification number and fuse size and type. Provide three spare fuses of each type and size in each panel. Provide box mounted on panel interior marked "SPARE FUSES" to hold the spares.
  2. Control power fuses connected to non-signaling circuits (for example, solenoids, actuators, relay coils, network switches, PLC power supplies) less than 10 amperes and less than 250 volts shall be 13/32" x 1-1/2" (10.3 x 38.1 mm) midget or CC type, dual element time delay, supplementary protection fuses. Cooper-Bussmann LP-CC dual element series or Littlefuse CCMR series unless otherwise noted or required by Manufacturer of connected equipment.  
Provide finger-safe modular, insert style fuse holder with blown fuse indicators, Cooper Bussman EH series or equal. Plug-in fuse holders mounted to terminal blocks or lever style fuse holders are not acceptable.
  3. Signal power for reference voltage (for example, PLC Input Signals, VFD control circuits, and similar) shall be fast acting fuses 1/4" x 1-1/4" AGC or 13/32" x 1-1/2" Midget MCL or CC type fuses. The 1/4" x 1-1/4" AGC type fuses shall be rated at a

minimum of 1 amperes and meet MIL-STD-202, Method 207 (Hi Shock) standard. Fuses shall be manufactured by Cooper Bussmann or Littelfuse.

Provide finger-safe terminal block, insert style fuse holder without blown fuse indicators, Cooper Bussman EH series or equal. Plug-in fuse holders mounted to terminal blocks or lever style fuse holders are not acceptable.

4. 5mm x 20mm fuses (for example, Cooper Bussmann GAS) are not acceptable for any application.
5. Provide three spare fuses of each type and size in each panel. Provide box secured to panel door interior for signal power fuses marked "SPARE FUSES".  
Provide specialty fuse holder for fuses, Cooper Bussmann 5TPM or similar for control power fuses. Mount to panel door interior. Label above each position the ampere rating of the fuse.

B. Pilot devices (control units and stations): heavy duty, oil-tight type per NEMA ICS-1; pilot lights push-to-test universal voltage, LED type.

1. Allen-Bradley
2. Cutler-Hammer
3. General Electric
4. Square D

C. Relays

1. Control relays for switching 120 VAC power circuits or motor starting circuits shall be electro-mechanical machine tool, heavy-duty type per NEMA ICS Standard with 120 volt coils and a minimum of SPDT contacts rated B-300 by NEMA standards: Allen-Bradley 700 N, General Electric CR 120, Square D Company Class 8501, Type G or equal, Eaton. Equip relays with surge suppressers. IEC rated relays are not permitted. Provide SPDT, DPDT, or 4PDT sets of contacts as required to install circuits as shown on drawings.
2. Control relays for logic control circuits shall be permitted to be mini-ice cube style type relays. Coils shall be rated 120 VAC or 24 VDC (as required). Relays shall provide minimum SPDT contacts which shall be rated B300 by NEMA standards. The coil terminals and contact terminals shall be on opposite sides of the

relay base. Relays shall have indicator flags, screw clamp terminals and surge suppressors or zeiner diodes across the coil. Provide Allen-Bradley 700-HK series, or equal. Provide SPDT, DPDT, or 4PDT sets of contacts as required to install circuits as shown on drawings.

3. Relay bases shall have all terminals for relay coils located on opposite side of the base as all terminals for contacts.

D. Terminals:

1. Provide DIN rail mounted terminal blocks with screw clamp connections. The terminal blocks shall be Entrelec MA 2,5/5 or equal.
2. Provide all accessories such as jumper bars, end stops, and end sections needed for a complete and functional system of terminal blocks.

E. Power supplies

1. 120 VAC to 24VDC: shall be 120 VAC input, with adjustable 24 VDC output. The DC Common bus shall be suitable to connect to the panel ground. Sola Hevi-Duty SDN 2.5-24-100P, or equal.
2. 24VDC, Class 2 power supply shall accept 24VDC and provide 24VDC output power unless otherwise noted. Power supply shall have NEC Class 2 rating and shall be SELV rated.
3. 120 VAC to 12 VDC Power Supply / Battery Charger
  - a. Shall supply 15 amps at 12 VDC nominal (14 VDC max)
  - b. Shall provide floating-charge to connected battery when battery is fully charged.
  - c. Shall be IOTA Engineering DLS-15 or equal.

F. Uninterruptible Power Supplies (UPS) shall be Sola Hevi-Duty, or equal. UPS shall supply at least three C-Form (common, normally open and normally closed) dry contacts to indicate at least a “low battery”, “on battery” and “UPS or battery failure”.

G. Conductors:

1. Class C stranded copper conductors of SIS or MTW insulation (for 120 VAC or 24 VDC power or discrete signal circuits).

2. Stranded #18 AWG copper conductor with thermoplastic insulation, foil or stranded wire shielding, and overall gray PVC jacket (for analog instrumentation circuits).

H. Wireways

1. shall be a minimum of one inch wide and three inches deep
2. shall have removable snap on covers and perforated walls for easy wire entrance
3. shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein.
4. shall be Panduit Type G, Panel Channel, or equal.

- I. Surge Protective Device shall be DIN rail mountable without a separate kit, shall have a listed surge current capacity of 45,000 amps, provide transient protection in all modes for a 20 ampere, 120 volt alternating current power circuit, and provide a form C relay output to signal surge arrester problem. Provide Sola/HEVI-Duty STFE Elite DIN Rail STFE200-10N or equal.

- J. Miniature Circuit Breakers. Provide Rockwell Automation 1492-SPM or equal.

## 2.3 ACCESSORIES

A. Panel Nameplates and Identification:

1. Identify each item on the control panel with rectangular nameplates.
2. Provide nameplates of rigid phenolic plastic laminate with engraved lettering or engraved metal plate with filled lettering. Use black background with white lettering.
3. Minimum letter height is ½ inch for instrument description and ¼ inch height for instrument tag number.
4. Provide each panel with a 2" by 10" (minimum) main nameplate with 1 inch high lettering with panel identification.
5. Abbreviations are not permitted unless approved by the Owner or specifically shown on the nameplates, schedules, or drawings.
6. Install nameplates plumb and parallel to the lines of doors or structure to which they are attached. Attach to the sheet metal structure by a thin coat of adhesive and sheet metal screws. Make

adhesive and screw application in a manner to avoid buckling or distorting nameplates due to use of excessive adhesive or over tightening of screws.

- B. Provide SELV or NEC Class 2 power supplies for devices shown mounted within or connected to the Control Panel for devices specified without a NTRL listing.

## **PART 3 — EXECUTION**

### **3.1 FABRICATION**

#### **A. General:**

1. Control panels shall be factory or shop fabricated units completely assembled, wired and tested before shipment to the job site.
2. Panel construction, in general, shall meet JIC EMP-1 standards and applicable NEMA and IEEE standards.
3. The panels shall be constructed in accordance with electrical testing laboratory standards and shall be so labeled (the standards of a recognized electrical testing laboratory).
4. Size panels for the enclosed equipment and the available space for mounting of the panel, but not smaller than as shown on the Contract Documents.
5. Panels shall be descaled, cleaned and primed in preparation for painting. Painting shall consist of one coat of flat white enamel in the interior and two coats of hard finish exterior enamel, gray in color for the exterior. Paint shall be suitable for field touch-up. Spare paint (one quart) shall be provided for touch-up purposes.

#### **B. Component Installation.**

1. Minimize welding to panel fronts and avoid distortion of panel metal.
2. Reinforce around areas of the enclosure weakened by openings or mounting of heavy equipment/components.
3. Accurately and cleanly cut or nibble cut-outs, and finish free of sharp edges or burrs. Make cutouts plumb, level, and on-line vertically or horizontally within 1/32 of an inch where components are in rows or columns.

4. Provide minimum 1-5/8 inches spacing between horizontal rows of externally mounted components; 1-1/2 inches minimum between vertical columns of components.
5. The distance from the bottom row of components to the floor shall be not less than 36 inches, unless specifically shown as less. In general, all indicating lights, pushbuttons, and similar control devices, shall be mounted in accordance with the sequence of operation from left to right and top to bottom.
6. Provide minimum 1/4 inch spacing between components mounted on the panel sub-plate, Provide minimum spacing between the component and the wire duct of 1-1/2 inches above and one inch below. Provide additional space if required to access terminals, adjusting screws, and similar items.
7. Components mounted in the interior shall be fastened to an interior subpanel using machine screws plus adhesive to insure vibration-free attachment.
8. Interior component mounting and wiring shall be grouped as much as possible by function and then by component type. Interiors shall be so arranged that control relays, terminal blocks, fuses, etc., can be replaced or added without disturbing adjacent components.
9. Install only one antenna feedline per support, do not stack.

C. Panel Wiring:

1. Color coding of insulation shall be black for power, white for 120V neutrals, red for AC controls which derive their source from within the panel, yellow for AC controls which derive their source external to the panel, blue for low voltage DC controls, green for grounding conductors.
2. Shop or factory wire panels to identified terminal blocks equipped with screw type lugs.
3. Raceways for panel wiring.
  - a. Size raceways per the requirements of NEC.
  - b. Provide panel wireways between each row of components, and adjacent to each terminal strip.
4. Provide wire bending space per NEMA ICS 6.

5. Label wiring within the panel with wire numbers and run in wiring duct neatly tied and bundled with tie wraps or similar materials. Identify each wire termination, including all jumpers, with permanently marked, heat shrink type wire markers. Arrange wire labels to permit reading of identification when installed. Apply heat per manufacturer's instructions to create a tight fit of the label to the wire.
6. Connect wiring internal to the panel to the "inside" of the terminal strip. Connect field wiring to the "outside" of the terminal strip. Wires to enclosure door mounted components are considered as internal wires. Connect no more than two wires to any one control terminal point. Provide terminal jumpers where more than two wires terminate at the same point.
7. Arrange wiring inside the panel to separate low voltage control signals of the milliamp, millivolt or other low energy type from inductive power circuits
8. Connect grounds and shields of circuits which derive power internal to the panel to a panel common ground bus which shall be grounded by the electrical contractor in the field.
9. Physically separate signals entering controllers for amplification as control outputs from all line voltage wiring and shield with continuous foil shielding or enclose them in metal raceway.
10. Provide necessary power supplies for control equipment.
11. Termination requirements:
  - a. Terminate panel wiring on device or terminal block screw terminals using slip-on spade tongue insulated crimp (compression) terminators, slip-on stud insulated crimp (compression) terminators, or stripped and tinned conductor ends. Stranded conductors shall not be terminated bare to terminals or devices.
  - b. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices.
  - c. Terminals shall facilitate wire sizes as follows:
    - 1) VAC applications: Wire size 12 AWG and smaller.
    - 2) Other: Wire size 14 AWG and smaller.

- d. Label each I/O terminal to indicate tag number of the conductor and connected device. Locate terminals for termination of multiconductor shielded cables adjacent to each other to minimize lengths of unshielded conductor at the terminations.
- e. Provide terminals for individual termination of each signal shield. Locate the terminal adjacent to the terminals for the signal conductors.
- f. Provide 20 percent excess terminals for future expansion.
- g. In general, mount terminal strips on the bottom horizontal edge of the sub-plate. Mount additional terminal strips, if required, on a thirty degree angle bracket at the bottom of the sub-plate. Where terminal strips are mounted side-by-side, elevate one set of terminals 1-1/2 inches above the sub-plate to allow wire to pass underneath.
- h. Provide a minimum of two inches between terminal strips and wireways or between terminal strips.
- i. Shielded cables used for analog signals shall be terminated with not greater than 1 inch of conductor left outside the shield. This applies to field wires entering the panel for termination, and to panel conductors. Conductor twist shall be maintained over the unshielded length to as close as possible to the point of termination. Where the overall jacket is cut back to expose the individual conductors, provide a heat shrink sleeve over the jacket, the signal, and the shield (drain) conductors. Insulate the shield (drain) conductor where not covered by the jacket or the sleeve. Where shield (drain) conductors are not terminated, cut the conductor even with the jacket so that it is covered by the sleeve to prevent inadvertent contact with other devices, terminals, or conductors in the panel.

### **3.2 SOURCE QUALITY CONTROL**

#### **A. Control Panel Testing**

- 1. The entire assembled panel shall be meggered and tested to be free from grounds and shorts.
- 2. Circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.

3. Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

### **3.3 CONFIGURATION**

### **3.4 INSTALLATION**

- A. Install free-standing panels on concrete pads where shown on the Plans. Install with channel sills where shown on the Plans. Provide stainless steel shims to level units.
- B. Install wall or stanchion mounted panels level and plumb.
- C. Anchor panels rigidly in place with approved anchorage devices.

### **3.5 TESTING**

- A. Notify the Owner and provide the documentation and testing materials (e.g., PLC Program, gateway and protocol converter configuration) submittal at least ten working days before testing. If the submittal is rejected, then the shop test shall be rescheduled for no less than 10 days after the resubmittal (and so on until the testing notification submittal is accepted).
  1. Provide a test plan at time of notification of testing. Coordinate the time of testing of the panels with the Construction Schedule. The testing plan shall include fieldbus communications between devices associated with panel and communications to and from the PLC.
  2. Provide the PLC program at time of notification of testing. The Program shall be sufficient to establish communications between all fieldbus connected devices, such as Remote I/O and motor controllers. The PLC program must have all the I/O modules connected to it, including connected through fieldbus. The PLC program shall be in a format that is suitable for loading directly into a PLC without needing to re-create the program.
  3. Provide configurations, programming files, or both for gateways and protocol converters at time of notification of testing. The configuration and programming files must be in a format suitable for loading directly into the devices without needing to re-create the program.
- B. Shop test panels in the presence of the Owner prior to shipment to project site. Testing shall be performed at the panel fabricator's shop. The testing shall include field instruments, PLCs, remote I/O units, motor controllers

(motor starter overloads, variable frequency drives, soft-starters, etc.), network switches valve actuators, panel displays, radios, alarm dialers, etc. Provide factory authorized representatives able to program, configure, and modify the field instrument and motor controllers as needed to demonstrate functionality of the equipment. The testing shall use wiring similar to the connections shown on the contract drawings. The shop test shall include all the standard testing by the control panel builder in addition to the following items:

1. The Contractor shall make the control panel electrically safe such that the Owner shall be able to inspect the wiring within the panels. The control wire labeling shall match the wire labeling shown on the shop drawings.
2. If the wiring appears to be acceptable to the Owner, the Contractor shall energize the components of the control panel, starting with the network switch, to allow the Owner to verify the IP settings and communications interfaces are configured correctly.
3. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly. Test results shall be documented. It is acceptable to use the end devices to measure signals (e.g., the analog input speed reference of an VFD) or a multi-meter testing device. Each device and control loop shall be tested and demonstrated to function properly in each mode (such as “hand”, “local”, “automatic”).
  - a. Test discrete outputs by forcing the output on and off via the programming software. Measure the resistance (for relay outputs) or voltage (for active outputs) between the output terminals.
  - b. Discrete input signals shall be tested in both the “on” and “off” state.
  - c. Analog output signals (4-20 milliamp, or similar type) shall each be tested at not less than three values (4.08 mA or 0.5%, 12 mA or 50%, and 19.92 mA or 99.5%) for both the analog input signal from an analog signal generator as well as the output signals sourced from the PLC.
  - d. Test analog inputs by applying voltage or current to the input at not less than three values, including at or just above minimum range, at or just below maximum range, and

midrange. Document actual register values for each applied input value at each input.

4. Provide signal generators, multimeters, and other test equipment as required to verify proper operation of the assembled panel. Simulate input signals, both discrete and analog, to verify operation of control and monitoring circuits.
5. Demonstrate that:
  - a. The PLC is fully operational. The Contractor will provide to the Owner the PLC testing program at the time of notification. The Control Panel Fabricator shall load the PLC programs into the respective PLC and demonstrate proper operation of the PLC. In no case shall testing be performed without an operating program functioning in the unit under test.
  - b. Each I/O module is recognized by the base unit and is fully functional.
  - c. Communications ports on the base unit are configured and fully functional.
  - d. Backup power systems operate to maintain PLC function during limited (45 seconds) main or primary power failure.
  - e. Motor controllers (motor starter overloads, variable frequency drives, soft-starters, etc.) continue to operate if, when called to run while in manual or hard-wired control, the network connection is interrupted by disconnecting the Ethernet cable or similar device failure.

- C. The Contractor shall conduct a rehearsal of the shop test prior the arrival of the Owner and shall verbally certify that they believe there are no readily apparent obstacles to performance of the test. (In this case, some examples of readily apparent obstacles would be panel mounted equipment lacking power wiring, equipment not configured with IP addresses or panel mounted equipment inadvertently wired to work under either primary or backup power, but not both.) If any readily apparent obstacles are encountered during panel testing, the Owner shall, at his or her option, declare the entire test failed and require notification of a new test time no less than 10 working days after the failed test.

1. Each assembled panel shall be meggered and tested to be free from grounds and shorts before the shop test.

2. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation. Do not ship panels to the site until testing has demonstrated satisfactory operation of the panels.
- D. Provide updated and complete ‘as shipped’ drawings at the time of final testing. The Owner will review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Owner against the actual construction prior to shipment of the panel to the job site. ‘As shipped’ drawings which require revisions shall be submitted to the Owner for review at testing notification, prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment. Do not ship panels to the site until the ‘as-shipped’ drawings are updated, complete, and reflect the actual ‘as-shipped’ status of the panel.
- E. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the panel wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or ‘as-shipped’ drawings that cannot be effected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Owner at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor shall be required to reimburse the Owner for the Owner’s costs for the third and each subsequent shop test/review.
- F. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test
- G. After each control panel has been installed at the jobsite:
1. Conduct a field test of the panel. Testing shall be conducted by physically actuating signaling devices (where possible), installing temporary jumpers, or artificially imposing signals on the field wiring (for example, diagnostic mode of a field instrument). The purpose of the test is to establish proper operation of the field devices, the integrity of the field wiring, and proper connection of field devices to the panel. The Control Panel Fabricator shall

coordinate with the Owner to provide for as complete a testing of the control and monitoring systems as is practical prior to placing the panel on line for actual control and/or monitoring of the process. The Contractor and/or Control Panel Fabricator shall make corrections or repairs to the wiring and/or devices as necessary to provide proper operation of the system. If testing indicates that field devices require modifications to connectors or contact action, the Contractor shall make the wiring or connection modifications as necessary to coordinate with the PLC program and contract documentation.

2. Control Panel Fabricator shall verify with each Manufacturer's field representative that devices connected to the control panel are configured to be correctly connected to the control panel. The control panel shall not be started up in the field until the configuration of all devices connected to it has been verified. Device verification shall include at a minimum the below settings.

- a. Magnetic flowmeters

- 1) 4-20ma scaled from minimum flow to maximum flow designated by Engineer.
- 2) Pulse output scaled to value designated by Engineer.
- 3) Pulse length configured to at least 100 ms.

- H. If testing indicates that the equipment functions properly but that changes to the PLC program are required, the Owner will revise the program(s) and provide the new program(s) for installation in the PLC. The Contractor and/or Control Panel Fabricator shall be prepared to install up to 3 revised programs into each PLC during startup/commissioning without additional cost to the Owner.

1. Submit the results of all tests in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test.

### **3.6 STARTUP**

- A. The Control Panel Fabricator shall provide a minimum of 10 man-days on site time for startup of the control system prior to, during and following the Contractor's installation and testing. On site time shall be coordinated

with the Owner on site time during startup, but may include additional time when the Owner is not present.

- B. Revise all drawings upon completion showing “as built” conditions including the labeling of field wiring connections.
  - 1. Submit primary copy of these drawings for inclusion into the Operations and Maintenance Manual.

### **3.7 CLEANING**

- A. On completion of installation, inspect interior and exterior of control panels. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

**\*\*\* END OF SECTION \*\*\***

## **PART 6**

### **WAGE RATES**

## **WASHINGTON STATE PREVAILING WAGE RATES**

State of Washington  
Department of Labor & Industries  
Prevailing Wage Section - Telephone 360-902-5335  
PO Box 44540, Olympia, WA 98504-4540

### Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

#### Journey Level Prevailing Wage Rates for the Effective Date: 11/09/2021

<a href="#">County</a>	<a href="#">Trade</a>	<a href="#">Job Classification</a>	<a href="#">Wage</a>	<a href="#">Holiday</a>	<a href="#">Overtime</a>	<a href="#">Note</a>	<a href="#">*Risk Class</a>
Douglas	<a href="#">Asbestos Abatement Workers</a>	Journey Level	\$44.12	<a href="#">5D</a>	<a href="#">1H</a>		<a href="#">View</a>
Douglas	<a href="#">Boilermakers</a>	Journey Level	\$70.79	<a href="#">5N</a>	<a href="#">1C</a>		<a href="#">View</a>
Douglas	<a href="#">Brick Mason</a>	Journey Level	\$53.34	<a href="#">5A</a>	<a href="#">1M</a>		<a href="#">View</a>
Douglas	<a href="#">Building Service Employees</a>	Janitor	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Building Service Employees</a>	Shampooer	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Building Service Employees</a>	Waxer	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Building Service Employees</a>	Window Cleaner	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Cabinet Makers (In Shop)</a>	Journey Level	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Acoustical Worker	\$51.25	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Bridge, Dock And Wharf Carpenters	\$64.94	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Floor Layer & Floor Finisher	\$51.25	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Form Builder	\$51.25	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	General Carpenter	\$51.25	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Heavy Construction Carpenter	\$56.71	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">9E</a>	<a href="#">View</a>
Douglas	<a href="#">Carpenters</a>	Scaffold/Shoring Erecting & Dismantling	\$56.71	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>
Douglas	<a href="#">Cement Masons</a>	Journey Level	\$46.83	<a href="#">7B</a>	<a href="#">1N</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Bell/Vehicle or Submersible Operator (Not Under Pressure)	\$118.80	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Dive Supervisor/Master	\$81.98	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Diver	\$118.80	<a href="#">7A</a>	<a href="#">4C</a>	<a href="#">8V</a>	<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Diver On Standby	\$76.98	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Diver Tender	\$69.91	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Manifold Operator	\$69.91	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Manifold Operator Mixed Gas	\$74.91	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Remote Operated Vehicle Operator/Technician	\$69.91	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Divers &amp; Tenders</a>	Remote Operated Vehicle Tender	\$65.19	<a href="#">7A</a>	<a href="#">4C</a>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Assistant Engineer	\$73.62	<a href="#">5D</a>	<a href="#">3F</a>		<a href="#">View</a>

Douglas	<a href="#">Dredge Workers</a>	Assistant Mate (Deckhand)	\$73.05	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Boatmen	\$73.62	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Engineer Welder	\$75.03	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Leverman, Hydraulic	\$76.53	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Mates	\$73.62	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Dredge Workers</a>	Oiler	\$73.05	<u>5D</u>	<u>3F</u>		<a href="#">View</a>
Douglas	<a href="#">Drywall Applicator</a>	Journey Level	\$51.25	<u>7E</u>	<u>4X</u>	<u>8N</u>	<a href="#">View</a>
Douglas	<a href="#">Drywall Tapers</a>	Journey Level	\$46.18	<u>7E</u>	<u>1P</u>		<a href="#">View</a>
Douglas	<a href="#">Electrical Fixture Maintenance Workers</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Inside</a>	Cable Splicer	\$81.21	<u>7H</u>	<u>1E</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Inside</a>	Construction Stock Person	\$40.04	<u>7H</u>	<u>1D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Inside</a>	Journey Level	\$76.12	<u>7H</u>	<u>1E</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Motor Shop</a>	Craftsman	\$15.37		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Motor Shop</a>	Journey Level	\$14.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Cable Splicer	\$82.39	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Certified Line Welder	\$75.64	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Groundperson	\$49.17	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Heavy Line Equipment Operator	\$75.64	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Journey Level Lineperson	\$75.64	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Line Equipment Operator	\$64.54	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Meter Installer	\$49.17	<u>5A</u>	<u>4D</u>	<u>8W</u>	<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Pole Sprayer	\$75.64	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electricians - Powerline Construction</a>	Powderperson	\$56.49	<u>5A</u>	<u>4D</u>		<a href="#">View</a>
Douglas	<a href="#">Electronic Technicians</a>	Electronic Technicians Journey Level	\$47.28	<u>5B</u>	<u>1B</u>		<a href="#">View</a>
Douglas	<a href="#">Elevator Constructors</a>	Mechanic	\$100.51	<u>7D</u>	<u>4A</u>		<a href="#">View</a>
Douglas	<a href="#">Elevator Constructors</a>	Mechanic In Charge	\$108.53	<u>7D</u>	<u>4A</u>		<a href="#">View</a>
Douglas	<a href="#">Fabricated Precast Concrete Products</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Fabricated Precast Concrete Products</a>	Journey Level - In-Factory Work Only	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Fence Erectors</a>	Fence Erector	\$41.44	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Fence Erectors</a>	Fence Laborer	\$41.44	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Flaggers</a>	Journey Level	\$41.44	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Glaziers</a>	Journey Level	\$35.56	<u>7L</u>	<u>4L</u>		<a href="#">View</a>
Douglas	<a href="#">Heat &amp; Frost Insulators And Asbestos Workers</a>	Journey Level	\$82.02	<u>15H</u>	<u>11C</u>		<a href="#">View</a>
Douglas	<a href="#">Heating Equipment Mechanics</a>	Journey Level	\$61.36	<u>6Z</u>	<u>1B</u>		<a href="#">View</a>
Douglas	<a href="#">Hod Carriers &amp; Mason Tenders</a>	Journey Level	\$46.42	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Industrial Power Vacuum Cleaner</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>

Douglas	<a href="#">Inland Boatmen</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Inspection/Cleaning/Sealing Of Sewer &amp; Water Systems By Remote Control</a>	Cleaner Operator, Foamer Operator	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Inspection/Cleaning/Sealing Of Sewer &amp; Water Systems By Remote Control</a>	Grout Truck Operator	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Inspection/Cleaning/Sealing Of Sewer &amp; Water Systems By Remote Control</a>	Head Operator	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Inspection/Cleaning/Sealing Of Sewer &amp; Water Systems By Remote Control</a>	Technician	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Inspection/Cleaning/Sealing Of Sewer &amp; Water Systems By Remote Control</a>	Tv Truck Operator	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Insulation Applicators</a>	Journey Level	\$51.25	<u>7E</u>	<u>4X</u>	<u>8N</u>	<a href="#">View</a>
Douglas	<a href="#">Ironworkers</a>	Journeyman	\$65.91	<u>7N</u>	<u>1O</u>		<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Erosion Control Worker	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Air, Gas Or Electric Vibrating Screed	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Airtrac Drill Operator	\$45.42	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Ballast Regular Machine	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Batch Weighman	\$41.44	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Brick Pavers	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Brush Cutter	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Brush Hog Feeder	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Burner	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Caisson Worker	\$45.42	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Carpenter Tender	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Cement Dumper-paving	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Cement Finisher Tender	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Change House Or Dry Shack	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Chipping Gun (30 Lbs. And Over)	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Chipping Gun (Under 30 Lbs.)	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Choker Setter	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Chuck Tender	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Clary Power Spreader	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Clean-up Laborer	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Concrete Dumper/Chute Operator	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Concrete Form Stripper	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Concrete Placement Crew	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Concrete Saw Operator/Core Driller	\$44.87	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Crusher Feeder	\$41.44	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Curing Laborer	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Demolition: Wrecking & Moving (Incl. Charred Material)	\$44.12	<u>7A</u>	<u>4V</u>	<u>8Y</u>	<a href="#">View</a>

Douglas	<a href="#">Laborers</a>	Ditch Digger	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Diver	\$45.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Drill Operator (Hydraulic, Diamond)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Dry Stack Walls	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Dump Person	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Epoxy Technician	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Faller & Bucker Chain Saw	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Fine Graders	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Firewatch	\$41.44	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Form Setter	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Gabian Basket Building	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Gaurdrail Erector	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	General Laborer	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Grade Checker & Transit Person	\$46.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Grinders	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Grout Machine Tender	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Groutmen (Pressure) Including Post Tension Beams	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Hazardous Waste Worker (Level A)	\$45.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Hazardous Waste Worker (Level B)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Hazardous Waste Worker (Level C)	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	High Scaler	\$45.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Jackhammer	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Laserbeam Operator	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Maintenance Person	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Manhole Builder-Mudman	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Material Yard Person	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Motorman-Dinky Locomotive	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Nozzleman (Concrete Pump, Green Cutter When Using Combination Of High Pressure Air & Water On Concrete & Rock, Sandblast, Gunite, Shotcrete, Water Blaster, Vacuum Blaster)	\$46.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pavement Breaker	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pilot Car	\$41.44	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pipe Layer (Lead)	\$46.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pipe Layer/Tailor	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pipe Pot Tender	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pipe Reliner	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pipe Wrapper	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Pot Tender	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Powderman	\$45.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Powderman's Helper	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>

Douglas	<a href="#">Laborers</a>	Power Jacks	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Railroad Spike Puller - Power	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Raker - Asphalt	\$46.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Re-timberman	\$45.42	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Remote Equipment Operator	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Rigger/Signal Person	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Rip Rap Person	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Rivet Buster	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Rodder	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Scaffold Erector	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Scale Person	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Sloper (Over 20")	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Sloper Sprayer	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Spreader (Concrete)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Stake Hopper	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Stock Piler	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Tamper & Similar Electric, Air & Gas Operated Tools	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Tamper (Multiple & Self-propelled)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Timber Person - Sewer (Lagger, Shorer & Cribber)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Toolroom Person (at Jobsite)	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Topper	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Track Laborer	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Track Liner (Power)	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Traffic Control Laborer	\$43.92	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">9C</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Traffic Control Supervisor	\$46.86	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">9C</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Truck Spotter	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Tugger Operator	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Tunnel Work-Guage and Lock Tender	\$46.52	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Tunnel Work-Guage and Lock Tender	\$46.52	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Vibrator	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Vinyl Seamer	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Watchmen	\$37.80	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Welder	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Well Point Laborer	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers</a>	Window Washer/Cleaner	\$37.80	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers - Underground Sewer &amp; Water</a>	General Laborer & Topman	\$44.12	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Laborers - Underground Sewer &amp; Water</a>	Pipe Layer	\$44.87	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Landscape Construction</a>	Landscape Construction/landscaping Or Planting Laborers	\$37.80	<a href="#">7A</a>	<a href="#">4V</a>	<a href="#">8Y</a>	<a href="#">View</a>
Douglas	<a href="#">Landscape Construction</a>	Landscape Operator	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Landscape Maintenance</a>	Groundskeeper	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Lathers</a>	Journey Level	\$51.25	<a href="#">7E</a>	<a href="#">4X</a>	<a href="#">8N</a>	<a href="#">View</a>

Douglas	<a href="#">Marble Setters</a>	Journey Level	\$53.34	5A	1M		<a href="#">View</a>
Douglas	<a href="#">Metal Fabrication (In Shop)</a>	Fitter	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Metal Fabrication (In Shop)</a>	Laborer	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Metal Fabrication (In Shop)</a>	Machine Operator	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Metal Fabrication (In Shop)</a>	Painter	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Metal Fabrication (In Shop)</a>	Welder	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Millwright</a>	Journey Level	\$71.07	5A	1B		<a href="#">View</a>
Douglas	<a href="#">Modular Buildings</a>	Journey Level	\$14.11		1		<a href="#">View</a>
Douglas	<a href="#">Painters</a>	Commercial Painter	\$40.26	6Z	1W		<a href="#">View</a>
Douglas	<a href="#">Painters</a>	Industrial Painter	\$46.97	6Z	1W	9D	<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Crew Tender	\$69.91	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Crew Tender/Technician	\$69.91	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	\$80.76	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 30.01 - 44.00 PSI	\$85.76	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	\$89.76	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	\$94.76	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	\$97.26	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	\$102.26	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	\$104.26	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	\$106.26	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	\$108.26	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Pile Driver</a>	Journey Level	\$65.19	7A	4C		<a href="#">View</a>
Douglas	<a href="#">Plasterers</a>	Journey Level	\$46.51	7K	1N		<a href="#">View</a>
Douglas	<a href="#">Playground &amp; Park Equipment Installers</a>	Journey Level	\$13.69		1		<a href="#">View</a>
Douglas	<a href="#">Plumbers &amp; Pipefitters</a>	Journey Level	\$86.69	6Z	1Q		<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Asphalt Plant Operators	\$70.49	7A	3K	8X	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Assistant Engineer	\$66.30	7A	3K	8X	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Barrier Machine (zipper)	\$69.87	7A	3K	8X	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Batch Plant Operator: concrete	\$69.87	7A	3K	8X	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Bobcat	\$66.30	7A	3K	8X	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Brokk - Remote Demolition Equipment	\$66.30	7A	3K	8X	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators</a>	Brooms	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Bump Cutter	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cableways	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Chipper	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Compressor	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Concrete Finish Machine - Laser Screed	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Conveyors	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes friction: 200 tons and over	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: 20 Tons Through 44 Tons With Attachments	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: 300 tons and over or 300' of boom including jib with attachments	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: A-frame - 10 Tons And Under	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: Friction cranes through 199 tons	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Cranes: through 19 tons with attachments, A-frame over 10 tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Crusher	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Deck Engineer/Deck Winches (power)	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Derricks, On Building Work	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Dozers D-9 & Under	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Drill Oilers: Auger Type, Truck Or Crane Mount	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Drilling Machine	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Elevator And Man-lift: Permanent And Shaft Type	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Finishing Machine, Bidwell And Gamaco & Similar Equipment	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators</a>	Forklift: 3000 Lbs And Over With Attachments	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Forklifts: Under 3000 Lbs. With Attachments	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Gradechecker/Stakeman	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Guardrail Punch	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Horizontal/Directional Drill Locator	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Horizontal/Directional Drill Operator	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Hydralifts/Boom Trucks Over 10 Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Hydralifts/Boom Trucks, 10 Tons And Under	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Loader, Overhead 8 Yards. & Over	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Loader, Overhead, 6 Yards. But Not Including 8 Yards	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Loaders, Overhead Under 6 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Loaders, Plant Feed	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Loaders: Elevating Type Belt	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Locomotives, All	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Material Transfer Device	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Mechanics, All (leadmen - \$0.50 Per Hour Over Mechanic)	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Motor Patrol Graders	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Oil Distributors, Blower Distribution & Mulch Seeding Operator	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Outside Hoists (Elevators And Manlifts), Air Tuggers, Strato	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Overhead, Bridge Type: 100 Tons And Over	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Overhead, Bridge Type: 45 Tons Through 99 Tons	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Pavement Breaker	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Pile Driver (other Than Crane Mount)	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Plant Oiler - Asphalt, Crusher	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators</a>	Posthole Digger, Mechanical	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Power Plant	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Pumps - Water	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Quad 9, Hd 41, D10 And Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Remote Control Operator On Rubber Tired Earth Moving Equipment	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Rigger and Bellman	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Rigger/Signal Person, Bellman (Certified)	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Rollagon	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Roller, Other Than Plant Mix	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Roller, Plant Mix Or Multi-lift Materials	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Roto-mill, Roto-grinder	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Saws - Concrete	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Scraper, Self Propelled Under 45 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Scrapers - Concrete & Carry All	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Scrapers, Self-propelled: 45 Yards And Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Service Engineers - Equipment	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shotcrete/Gunite Equipment	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Shovel, Excavator, Backhoes: Over 90 Metric Tons	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Slipform Pavers	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Spreader, Topsider & Screedman	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Subgrader Trimmer	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Tower Bucket Elevators	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Tower Crane Up To 175' In Height Base To Boom	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Tower Crane: over 175' through 250' in height, base to boom	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Tower Cranes: over 250' in height from base to boom	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Transporters, All Track Or Truck Type	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators</a>	Trenching Machines	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Truck Crane Oiler/driver - 100 Tons And Over	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Truck Crane Oiler/Driver Under 100 Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Truck Mount Portable Conveyor	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Welder	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Wheel Tractors, Farmall Type	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators</a>	Yo Yo Pay Dozer	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Asphalt Plant Operators	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Assistant Engineer	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Barrier Machine (zipper)	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Batch Plant Operator, Concrete	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Bobcat	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Brokk - Remote Demolition Equipment	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Brooms	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Bump Cutter	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cableways	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Chipper	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Compressor	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Concrete Finish Machine - Laser Screed	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Conveyors	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes friction: 200 tons and over	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: 20 Tons Through 44 Tons With Attachments	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: 300 tons and over or 300' of boom including jib with attachments	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: 45 Tons Through 99 Tons, Under 150' Of Boom (including Jib With Attachments)	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: A-frame - 10 Tons And Under	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: Friction cranes through 199 tons	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Cranes: through 19 tons with attachments, A-frame over 10 tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Crusher	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Deck Engineer/Deck Winches (power)	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Derricks, On Building Work	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Dozers D-9 & Under	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Drill Oilers: Auger Type, Truck Or Crane Mount	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Drilling Machine	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Elevator And Man-lift: Permanent And Shaft Type	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Finishing Machine, Bidwell And Gamaco & Similar Equipment	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Forklift: 3000 Lbs And Over With Attachments	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Forklifts: Under 3000 Lbs. With Attachments	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Gradechecker/Stakeman	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Guardrail Punch	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Horizontal/Directional Drill Locator	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Horizontal/Directional Drill Operator	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Hydralifts/Boom Trucks Over 10 Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Hydralifts/Boom Trucks, 10 Tons And Under	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Loader, Overhead 8 Yards. & Over	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Loader, Overhead, 6 Yards. But Not Including 8 Yards	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Loaders, Overhead Under 6 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Loaders, Plant Feed	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Loaders: Elevating Type Belt	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Locomotives, All	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Material Transfer Device	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Mechanics, All (leadmen - \$0.50 Per Hour Over Mechanic)	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Motor Patrol Graders	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Oil Distributors, Blower Distribution & Mulch Seeding Operator	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Outside Hoists (Elevators And Manlifts), Air Tuggers, Strato	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Overhead, Bridge Type Crane: 20 Tons Through 44 Tons	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Overhead, Bridge Type: 100 Tons And Over	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Overhead, Bridge Type: 45 Tons Through 99 Tons	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Pavement Breaker	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Pile Driver (other Than Crane Mount)	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Plant Oiler - Asphalt, Crusher	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Posthole Digger, Mechanical	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Power Plant	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Pumps - Water	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Quad 9, Hd 41, D10 And Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Quick Tower - No Cab, Under 100 Feet In Height Based To Boom	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Remote Control Operator On Rubber Tired Earth Moving Equipment	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Rigger and Bellman	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Rigger/Signal Person, Bellman (Certified)	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Rollagon	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Roller, Other Than Plant Mix	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Roller, Plant Mix Or Multi-lift Materials	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Roto-mill, Roto-grinder	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Saws - Concrete	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Scraper, Self Propelled Under 45 Yards	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Scrapers - Concrete & Carry All	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Scrapers, Self-propelled: 45 Yards And Over	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Service Engineers - Equipment	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shotcrete/Gunite Equipment	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Shovel, Excavator, Backhoes: Over 90 Metric Tons	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Slipform Pavers	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Spreader, Topsider & Screedman	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Subgrader Trimmer	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Tower Bucket Elevators	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Tower Crane Up To 175' In Height Base To Boom	\$71.20	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Tower Crane: over 175' through 250' in height, base to boom	\$71.93	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Tower Cranes: over 250' in height from base to boom	\$72.63	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Transporters, All Track Or Truck Type	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>

Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Trenching Machines	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Truck Crane Oiler/driver - 100 Tons And Over	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Truck Crane Oiler/Driver Under 100 Tons	\$69.33	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Truck Mount Portable Conveyor	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Welder	\$70.49	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Wheel Tractors, Farmall Type	\$66.30	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Equipment Operators-Underground Sewer &amp; Water</a>	Yo Yo Pay Dozer	\$69.87	<a href="#">7A</a>	<a href="#">3K</a>	<a href="#">8X</a>	<a href="#">View</a>
Douglas	<a href="#">Power Line Clearance Tree Trimmers</a>	Journey Level In Charge	\$55.03	<a href="#">5A</a>	<a href="#">4A</a>		<a href="#">View</a>
Douglas	<a href="#">Power Line Clearance Tree Trimmers</a>	Spray Person	\$52.24	<a href="#">5A</a>	<a href="#">4A</a>		<a href="#">View</a>
Douglas	<a href="#">Power Line Clearance Tree Trimmers</a>	Tree Equipment Operator	\$55.03	<a href="#">5A</a>	<a href="#">4A</a>		<a href="#">View</a>
Douglas	<a href="#">Power Line Clearance Tree Trimmers</a>	Tree Trimmer	\$49.21	<a href="#">5A</a>	<a href="#">4A</a>		<a href="#">View</a>
Douglas	<a href="#">Power Line Clearance Tree Trimmers</a>	Tree Trimmer Groundperson	\$37.47	<a href="#">5A</a>	<a href="#">4A</a>		<a href="#">View</a>
Douglas	<a href="#">Refrigeration &amp; Air Conditioning Mechanics</a>	Journey Level	\$86.69	<a href="#">6Z</a>	<a href="#">1Q</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Brick Mason</a>	Journey Level	\$34.97		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Carpenters</a>	Journey Level	\$23.10		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Cement Masons</a>	Journey Level	\$20.67		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Drywall Applicators</a>	Journey Level	\$24.77		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Drywall Tapers</a>	Journey Level	\$13.69		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Electricians</a>	Journey Level	\$42.61	<a href="#">7F</a>	<a href="#">1D</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Glaziers</a>	Journey Level	\$16.50		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Insulation Applicators</a>	Journey Level	\$14.86		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Laborers</a>	Journey Level	\$20.46		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Marble Setters</a>	Journey Level	\$34.97		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Painters</a>	Journey Level	\$14.86		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Plumbers &amp; Pipefitters</a>	Journey Level	\$21.92		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Refrigeration &amp; Air Conditioning Mechanics</a>	Journey Level	\$17.25		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Sheet Metal Workers</a>	Journey Level (Field or Shop)	\$61.36	<a href="#">5I</a>	<a href="#">1B</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Soft Floor Layers</a>	Journey Level	\$20.40		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Sprinkler Fitters (Fire Protection)</a>	Journey Level	\$16.15		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Stone Masons</a>	Journey Level	\$34.97		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Terrazzo Workers</a>	Journey Level	\$14.86		<a href="#">1</a>		<a href="#">View</a>
Douglas	<a href="#">Residential Terrazzo/Tile Finishers</a>	Journey Level	\$22.48		<a href="#">1</a>		<a href="#">View</a>

Douglas	<a href="#">Residential Tile Setters</a>	Journey Level	\$14.86		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Roofers</a>	Journey Level	\$42.79	<u>5I</u>	<u>1R</u>		<a href="#">View</a>
Douglas	<a href="#">Roofers</a>	Using Irritable Bituminous Materials	\$44.79	<u>5I</u>	<u>1R</u>		<a href="#">View</a>
Douglas	<a href="#">Sheet Metal Workers</a>	Journey Level (Field or Shop)	\$61.36	<u>6Z</u>	<u>1B</u>		<a href="#">View</a>
Douglas	<a href="#">Sign Makers &amp; Installers (Electrical)</a>	Journey Level	\$85.05	<u>7F</u>	<u>1E</u>		<a href="#">View</a>
Douglas	<a href="#">Sign Makers &amp; Installers (Non-Electrical)</a>	Journey Level	\$16.14		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Soft Floor Layers</a>	Journey Level	\$51.91	<u>5A</u>	<u>3J</u>		<a href="#">View</a>
Douglas	<a href="#">Solar Controls For Windows</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Sprinkler Fitters (Fire Protection)</a>	Journey Level	\$60.86	<u>7J</u>	<u>1R</u>		<a href="#">View</a>
Douglas	<a href="#">Stage Rigging Mechanics (Non Structural)</a>	Journey Level	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Stone Masons</a>	Journey Level	\$53.34	<u>5A</u>	<u>1M</u>		<a href="#">View</a>
Douglas	<a href="#">Street And Parking Lot Sweeper Workers</a>	Journey Level	\$14.00		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Surveyors</a>	Assistant Construction Site Surveyor	\$69.33	<u>7A</u>	<u>3K</u>	<u>8X</u>	<a href="#">View</a>
Douglas	<a href="#">Surveyors</a>	Chainman	\$66.30	<u>7A</u>	<u>3K</u>	<u>8X</u>	<a href="#">View</a>
Douglas	<a href="#">Surveyors</a>	Construction Site Surveyor	\$70.49	<u>7A</u>	<u>3K</u>	<u>8X</u>	<a href="#">View</a>
Douglas	<a href="#">Telecommunication Technicians</a>	Telecom Technician Journey Level	\$47.28	<u>5B</u>	<u>1B</u>		<a href="#">View</a>
Douglas	<a href="#">Telephone Line Construction - Outside</a>	Cable Splicer	\$38.27	<u>5A</u>	<u>2B</u>		<a href="#">View</a>
Douglas	<a href="#">Telephone Line Construction - Outside</a>	Hole Digger/Ground Person	\$25.66	<u>5A</u>	<u>2B</u>		<a href="#">View</a>
Douglas	<a href="#">Telephone Line Construction - Outside</a>	Telephone Equipment Operator (Light)	\$31.96	<u>5A</u>	<u>2B</u>		<a href="#">View</a>
Douglas	<a href="#">Telephone Line Construction - Outside</a>	Telephone Lineperson	\$36.17	<u>5A</u>	<u>2B</u>		<a href="#">View</a>
Douglas	<a href="#">Terrazzo Workers</a>	Journey Level	\$43.81	<u>5A</u>	<u>1M</u>		<a href="#">View</a>
Douglas	<a href="#">Tile Setters</a>	Journey Level	\$43.81	<u>5A</u>	<u>1M</u>		<a href="#">View</a>
Douglas	<a href="#">Tile, Marble &amp; Terrazzo Finishers</a>	Journey Level	\$35.93	<u>5A</u>	<u>1M</u>		<a href="#">View</a>
Douglas	<a href="#">Traffic Control Stripers</a>	Journey Level	\$50.51	<u>7A</u>	<u>1K</u>		<a href="#">View</a>
Douglas	<a href="#">Truck Drivers</a>	Asphalt Mix Over 20 Yards	\$49.05	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers</a>	Asphalt Mix To 20 Yards	\$48.68	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers</a>	Dump Truck	\$48.68	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers</a>	Dump Truck & Trailer	\$49.05	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers</a>	Other Trucks	\$48.57	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers - Ready Mix</a>	Transit Mixers 20 yards and under	\$49.05	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Truck Drivers - Ready Mix</a>	Transit Mixers over 20 yards	\$49.38	<u>5D</u>	<u>1V</u>	<u>8M</u>	<a href="#">View</a>
Douglas	<a href="#">Well Drillers &amp; Irrigation Pump Installers</a>	Irrigation Pump Installer	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Well Drillers &amp; Irrigation Pump Installers</a>	Oiler	\$13.69		<u>1</u>		<a href="#">View</a>
Douglas	<a href="#">Well Drillers &amp; Irrigation Pump Installers</a>	Well Driller	\$18.00		<u>1</u>		<a href="#">View</a>

Benefit Code Key – Effective 9/1/2021 thru 3/2/2022

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**Overtime Codes**

**Overtime calculations** are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.
  - B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.
  - G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.
  - J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.
  - K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
  - M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
  - N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

**Overtime Codes Continued**

- 1. O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.
- P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
- Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.
- R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.
- U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.
- V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.
- W. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer)) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
- X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.
- Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.
- Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

**Overtime Codes Continued**

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

- B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.
- F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.
- M. This code appears to be missing. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.
- O. All hours worked on Sundays and holidays shall be paid at one and one-half times the hourly rate of wage.
- R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.
- U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

- F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.
- H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.
- J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

- A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

**Overtime Codes Continued**

4. C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

- D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

**EXCEPTION:**

On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

- E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

- G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

- I. The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

**Overtime Codes Continued**

4. J. The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
- K. All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
- L. The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.
- U. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- V. Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established or outside the normal shift (5 am to 6pm), and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.

In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

- W. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

**Overtime Codes Continued**

4. X. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

When an employee returns to work without at a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

- Y. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at time and one-half the straight time rate. All work performed after 6:00 pm Saturday to 6:00 am Monday and holidays shall be paid at double the straight time rate of pay.

Any shift starting between the hours of 6:00 pm and midnight shall receive an additional one dollar (\$1.00) per hour for all hours worked that shift.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

- Z. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 20% over the hourly rate of wage. Work performed on Sundays may be paid at double time. All hours worked on holidays shall be paid at double the hourly rate of wage.

11. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

- B After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

- C The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage. All non-overtime and non-holiday hours worked between 4:00 pm and 5:00 am, Monday through Friday, shall be paid at a premium rate of 15% over the hourly rate of wage.

## Benefit Code Key – Effective 9/1/2021 thru 3/2/2022

- D. All hours worked on Saturdays and holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

- E. The first two (2) hours after eight (8) regular hours Monday through Friday, the first ten (10) hours on Saturday, and the first ten (10) hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, and Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

### **Holiday Codes**

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).
- B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).
- C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
- D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).
- H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).
- I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).
- J. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (7).
- K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).
- L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).
- N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.
- Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

**Holiday Codes Continued**

- R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).
  - S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).
  - Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
- 6.
- G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).
  - H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).
  - T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).
  - Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.
- 7.
- A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
  - B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
  - C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
  - D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
  - E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

**Holiday Codes Continued**

7. F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.
- H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.
- Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

**Holiday Codes Continued**

7. W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.
- X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.
- Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.
- G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

**Holiday Codes Continued**

7. Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.
- X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.
- Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.
15. G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- H. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Eve Day, and Christmas Day (8). When the following holidays fall on a Saturday (New Year's Day, Independence Day, and Christmas Day) the preceding Friday will be considered as the holiday; should they fall on a Sunday, the following Monday shall be considered as the holiday.
- I. Holidays: New Year's Day, President's Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the last regular workday before Christmas (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

## Benefit Code Key – Effective 9/1/2021 thru 3/2/2022

### Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.
- L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$0.75, Level B: \$0.50, And Level C: \$0.25.
- M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: \$1.00, Levels C & D: \$0.50.
- N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$1.00, Level B: \$0.75, Level C: \$0.50, And Level D: \$0.25.
- S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.
- T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.
- U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: \$2.00, Class B Suit: \$1.50, And Class C Suit: \$1.00. Workers performing underground work receive an additional \$0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional \$0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do “pioneer” work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional \$0.50 per hour.
- V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.
- Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - \$2.00 per foot for each foot over 50 feet. Over 101' to 150' - \$3.00 per foot for each foot over 101 feet. Over 151' to 220' - \$4.00 per foot for each foot over 220 feet. Over 221' - \$5.00 per foot for each foot over 221 feet.
- Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25' to 300' - \$1.00 per foot from entrance. 300' to 600' - \$1.50 per foot beginning at 300'. Over 600' - \$2.00 per foot beginning at 600'.
- W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.

**Note Codes Continued**

8. X. Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: \$2.00, Class B Suit: \$1.50, Class C Suit: \$1.00, and Class D Suit: \$0.50. Special Shift Premium: Basic hourly rate plus \$2.00 per hour.

When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.

- Z. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.

Special Shift Premium: Basic hourly rate plus \$2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

9. A. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.

Special Shift Premium: Basic hourly rate plus \$2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid \$0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

(A) – 130' to 199' – \$0.50 per hour over their classification rate.

(B) – 200' to 299' – \$0.80 per hour over their classification rate.

(C) – 300' and over – \$1.00 per hour over their classification rate.

**Note Codes Continued**

9. B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.

- C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

- D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.
- E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$1.00, Level B: \$0.75, Level C: \$0.50, And Level D: \$0.25.
- F. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

## **FEDERAL WAGE RATES**

"General Decision Number: WA20210009 02/12/2021

Superseded General Decision Number: WA20200009

State: Washington

Construction Type: Building

County: Douglas County in Washington.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Modification Number	Publication Date
0	01/01/2021
1	01/22/2021
2	02/12/2021

ASBE0007-004 06/01/2020

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 59.37	17.90

BRWA0003-002 06/01/2017

	Rates	Fringes
BRICKLAYER.....	\$ 39.46	16.15

CARP0059-013 06/01/2020

	Rates	Fringes
CARPENTER (Including Cabinet Installation, Drywall Hanging, Form Work and Metal		

## Stud Installation)

EAST OF 120TH MERIDIAN.....\$ 31.91 17.36

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL  
CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERSHourly Zone Pay shall be paid on jobs located outside of the  
free zone computed from the city center of the following  
listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

## Zone Pay:

0 -25 radius miles	Free
26-35 radius miles	\$1.00/hour
36-45 radius miles	\$1.15/hour
46-55 radius miles	\$1.35/hour
Over 55 radius miles	\$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT  
AND PILEDRIVER ONLY)Hourly Zone Pay shall be computed from Seattle Union Hall,  
Tacoma City center, and Everett City center

## Zone Pay:

0 -25 radius miles	Free
26-45 radius miles	\$ .70/hour
Over 45 radius miles	\$1.50/hour

-----  
CARP0770-016 06/01/2020

Rates Fringes

CARPENTER (Including Cabinet  
Installation, Drywall  
Hanging, Form Work and Metal  
Stud Installation)

WEST OF 120TH MERIDIAN.....\$ 31.35 14.53

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL  
CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERSHourly Zone Pay shall be paid on jobs located outside of the  
free zone computed from the city center of the following  
listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

## Zone Pay:

0 -25 radius miles	Free
26-35 radius miles	\$1.00/hour

36-45 radius miles      \$1.15/hour  
 46-55 radius miles      \$1.35/hour  
 Over 55 radius miles    \$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT  
 AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall,  
 Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles      Free  
 26-45 radius miles      \$ .70/hour  
 Over 45 radius miles    \$1.50/hour

-----  
 ELEC0191-013 06/01/2020

	Rates	Fringes
ELECTRICIAN		
DOUGLAS, CHELAN, and OKANOGAN Counties.....	\$ 46.15	26.10
ISLAND, SAN JUAN, SKAGIT, SNOHOMISH and WHATCOM Counties.....	\$ 47.95	26.16

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ENGI0302-016 06/01/2019

West of the 120th Meridian

	Rates	Fringes
Power equipment operators:		
Group 1A.....	\$ 46.78	21.22
Group 1AA.....	\$ 47.46	21.22
Group 1AAA.....	\$ 48.14	21.22
Group 1.....	\$ 46.09	21.22
Group 2.....	\$ 45.50	21.22
Group 3.....	\$ 44.98	21.22
Group 4.....	\$ 42.10	21.22

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom  
 (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom  
 (including jib with attachments); Excavator/Trackhoe,  
 Backhoes: Over 90 metric tons

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom  
 (including jib with attachments); Loaders-overhead, 8 yards  
 and over; excavator/Trackhoe, backhoes: over 50 metric tons  
 to 90 metric tons

GROUP 1 - Cranes 45 tons thru 99 tons, under 150 ft of boom  
 (including jib with attachments); Excavator/Trackhoe,  
 backhoes: over 30 metric tons to 50 metric tons; Loader-  
 overhead 6 yards to, but not including 8 yards; Dozer D-10;  
 Screedman; Scrapers: 45 yards and over; Grader/Blade

GROUP 2 - Cranes, 20 tons thru 44 tons with attachments;  
 Drilling machine; Excavator/Trackhoe, backhoe: 15 to 30  
 metric tons; Horizontal/directional drill operator;

Loaders-overhead under 6 yards; Crane Oiler-100 Tons and Over; Compactor; Scraper: under 45 tons

GROUP 3 - Cranes-thru 19 tons with attachments; Dozers-D-9 and under; Motor patrol grader-nonfinishing; Roller-Plant Mix; Crane Oiler under 100 tons; Excavator/Trackhoe, backhoe: under 15 metric tons; Forklift: 3000 lbs and over with attachments; Service Oiler

GROUP 4 - Roller-other than plant mix; Forklift: under 3000 lbs with attachments

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ENGI0370-017 07/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 28.46	17.25
GROUP 2.....	\$ 28.78	17.25
GROUP 3.....	\$ 29.39	17.25
GROUP 4.....	\$ 29.55	17.25
GROUP 5.....	\$ 29.71	17.25
GROUP 6.....	\$ 29.99	17.25
GROUP 7.....	\$ 31.26	17.25
GROUP 8.....	\$ 31.36	17.25

ZONE DIFFERENTIAL (Add to Zone 1 rate): Zone 2 - \$2.00

Zone 1: Within 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

#### POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Compactor; Drill Oiler; Rollers, all types on subgrade, including seal and chip coatings

GROUP 2: Fork Lift

GROUP 3: Bulldozer (up to D-6 or equivalent)

GROUP 4: Drills (churn, core, calyx or diamond); Oiler; Loaders (overhead & front-end, under 4 yds. R/T); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (Under 45,000 gw); Trackhoe/Excavator (hoe Ram) (under 3/4 yd.); Cranes (25 tons & under), Drilling Equipment(8 inch bit & over) (Robbins, reverse circulation & similar)

GROUP 6: Asphalt Roller; Backhoe (45,000 gw and over to 110,000 gw); Trackhoe/Excavator (Hoe Ram) (3/4 yd. to 3 yd.); Compactor (self-propelled with blade); Cranes (over 25 tons, to and including 45 tons), Bulldozer, 834 R/T & similar; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.); Scrapers, all, rubber-tired; Screed Operator

GROUP 7: Backhoe (Over 110,000); Trackhoe/Excavator (Hoe Ram) (3 yds & over); Cranes (over 45 tons to but not including 85 tons); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Blade

GROUP 8: Cranes (85 tons and over, and all climbing, overhead, rail and tower); Loaders (overhead and front-end, 10 yards and over)

BOOM PAY: (All Cranes, Including Tower)

180 ft to 250 ft \$ .50 over scale

Over 250 ft \$ .80 over scale

NOTE:

In computing the length of the boom on Tower Cranes, they shall be measured from the base of the Tower to the point of the boom.

HAZMAT:

Anyone working on HAZMAT jobs, working with supplied air shall receive \$1.00 an hour above classification.

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IRON0014-013 07/01/2020

	Rates	Fringes
IRONWORKER (Ornamental, Reinforcing and Structural).....	\$ 34.59	30.10

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LABO0238-014 06/01/2020

	Rates	Fringes
LABORER: Mason Tender - Brick...	\$ 29.06	13.65

-----  
LABO0238-022 06/01/2020

	Rates	Fringes
LABORER		
GROUP 1.....	\$ 26.69	13.00
GROUP 2.....	\$ 28.79	13.00
GROUP 3.....	\$ 29.06	13.00
GROUP 4.....	\$ 31.32	13.00

Zone Differential (Add to Zone 1 rates): Zone 2 - \$2.00

BASE POINTS: Pasco

Zone 1: 0-45 radius miles from the main post office.

Zone 2: 45 radius miles and over from the main post office

LABORERS CLASSIFICATIONS

GROUP 1: Flagman

GROUP 2: Form-Stripping; General or Common Laborer

GROUP 3: Chipping Guns; Concrete Saw; Pipelayer; Mason Tender-Cement/Concrete

GROUP 4: Grade Checker; Gunite; Vibrating Plate

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LABO0348-005 06/01/2020

West of the 120th Meridian

	Rates	Fringes
LABORER		
GROUP 2.....	\$ 27.17	12.44
GROUP 3.....	\$ 29.74	12.44
GROUP 4.....	\$ 30.46	12.44
GROUP 5.....	\$ 30.99	12.44

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT,  
TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT.  
TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective  
city hall  
ZONE 2 - More than 25 but less than 45 radius miles from the  
respective city hall  
ZONE 3 - More than 45 radius miles from the respective city  
hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):

ZONE 2 - \$1.00

ZONE 3 - \$1.30

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

ZONE 1 - Projects within 25 radius miles of the respective  
city hall  
ZONE 2 - More than 25 radius miles from the respective city  
hall

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):

ZONE 2 - \$2.25

#### LABORERS CLASSIFICATIONS

GROUP 2: Flagman

GROUP 3: General Laborer; Chipping Gun (under 30 lbs.); Form  
Stripping

GROUP 4: Chipping Gun (over 30 lbs.); Concrete Saw Operator;  
Gunite; Pipe Layer; Vibrating Plate

GROUP 5: Mason Tender-Cement/Concrete; Grade Checker

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PAIN0005-025 04/15/2013

	Rates	Fringes
Painters:		
BRUSH AND ROLLER ONLY.....	\$ 21.23	10.23

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\* PLUM0032-008 01/01/2021

DOUGLAS COUNTY WHICH LIES WEST OF THE 120TH MERIDIAN

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 65.21	26.86

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PLUM0598-016 06/01/2020

	Rates	Fringes
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PLUMBER/PIPEFITTER.....	\$ 52.20	32.50
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ROOF0189-012 07/01/2020

	Rates	Fringes
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ROOFER (Includes Roof Tear Off, Waterproofing, and Installation of Metal Roofs).....	\$ 28.68	13.26
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SHEE0066-020 06/01/2017

	Rates	Fringes
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Sheet Metal Worker (Excluding HVAC Duct Installation).....	\$ 29.42	20.84
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TEAM0690-008 01/01/2019

	Rates	Fringes
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Truck drivers: (ANYONE  
WORKING ON HAZMAT JOBS SEE  
FOOTNOTE A BELOW)

ZONE 1: LEWISTON ZONE  
CENTER

GROUP 3.....	\$ 28.16	17.40
GROUP 4.....	\$ 28.49	17.40
GROUP 5.....	\$ 28.60	17.40
GROUP 6.....	\$ 28.76	17.40
GROUP 7.....	\$ 29.30	17.40
GROUP 8.....	\$ 29.62	17.40

ZONE 1: PASCO ZONE CENTER

GROUP 3.....	\$ 28.16	17.40
GROUP 4.....	\$ 28.49	17.40
GROUP 5.....	\$ 28.60	17.40
GROUP 6.....	\$ 28.76	17.40
GROUP 7.....	\$ 29.30	17.40
GROUP 8.....	\$ 29.62	17.40

ZONE 1: SPOKANE ZONE CENTER

GROUP 3.....	\$ 28.16	17.40
GROUP 4.....	\$ 28.49	17.40
GROUP 5.....	\$ 28.60	17.40
GROUP 6.....	\$ 28.76	17.40
GROUP 7.....	\$ 29.30	17.40
GROUP 8.....	\$ 29.62	17.40
ROUP 5.....	\$ 27.41	17.30

Zone Differential For ZONE 2: ( Zone 1 +\$2.00)

BASE POINTS: Spokane, Moses Lake, Pasco, Lewiston

Zone 1: 0-45 radius miles from the main post office

Zone 2: Outside a 45 mile radius from the main post office

#### TRUCK DRIVERS CLASSIFICATIONS

GROUP 3: Trucks, side, end, bottom and articulated end dump  
(3 yards to and including 6 yds.)

GROUP 4: Trucks, side, end, bottom and articulated end dump  
(over 6 yds. to & including 12 yds.)

GROUP 5: Trucks, side, end, bottom and articulated end dump  
(over 12 yds. to & including 20 yds.)

GROUP 6: Trucks, side, end, bottom and articulated end dump  
(over 20 yds. to & including 40 yds.)

GROUP 7: Truck, side, end, bottom and articulated end dump  
(over 40 yds. to & including 100 yds.)

GROUP 8: Trucks, side, end, bottom and articulated end dump  
(over 100 yds.)

FOOTNOTE A - Anyone working on a HAZMAT job, where HAZMAT  
cerfification is required, shall be compensated as a  
premium, in addition to the classification working in as  
follows:

LEVEL C-D: - \$.50 PER HOUR - This level may use an air  
purifying respirator or additional protective clothing.

LEVEL A-B: - \$1.00 PER HOUR - Uses supplied air in  
conjunction with a chemical splash suit or fully  
encapsulated suit with a self-contained breathing apparatus.

Employees shall be paid Hazmat pay in increments of four(4)  
and eight(8) hours.

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SUWA2009-022 05/22/2009

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 16.33	1.32
FLOOR LAYER: Carpet.....	\$ 23.72	1.98
LABORER: Handheld Drill.....	\$ 17.17	5.36
LABORER: Irrigation.....	\$ 11.58	0.00
LABORER: Landscape.....	\$ 11.08	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 22.05	7.35
OPERATOR: Concrete Pumper.....	\$ 22.30	5.27
OPERATOR: Mechanic.....	\$ 24.33	4.33
PAINTER: Spray.....	\$ 24.80	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 17.85	3.75
SPRINKLER FITTER (Fire Sprinklers).....	\$ 18.02	1.57
TILE SETTER.....	\$ 18.39	4.26
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 20.59	5.56

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WELDERS - Receive rate prescribed for craft performing  
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

#### Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and

non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

#### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

## **PART 7**

## **APPENDIX**

## **APPENDIX A**

### **SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA**

## APPENDIX A

### SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS WASTEWATER TREATMENT FACILITY OPERATIONS BUILDING RESTORATION

**These forms shall be completed in their entirety and submitted by the apparent two lowest Bidders to the City of Bridgeport by 12:00 p.m. (noon) of the second business day following the bid submittal deadline.**

Failure to submit and meet the requirements as stated in [Section 1-02 of the Special Provisions/Section 2.01.8 of the General Conditions] shall be grounds for rejection of the bid. The City of Bridgeport will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

Contractor:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Contact Person: \_\_\_\_\_

#### 2. Delinquent State Taxes

Instructions to Bidders: Check the appropriate box

- ☐ The Bidder does not owe delinquent taxes to the Washington State Department of Revenue.
- ☐ Alternatively, the Bidder does owe delinquent taxes to the Washington State Department of Revenue.

If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

**3. Claims Against Retainage and Bonds:**

Instructions to Bidders: Check the appropriate box

- ☐ The Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date.
- ☐ Alternatively, the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date.

If the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date, submit a list of public works projects completed during this period that have had claims against retainage and bonds and include name of Project, contact information for the Owner, a list of claims filed against retainage and/or payment bond for any of the projects listed; and a written explanation of circumstances surrounding each claim and the ultimate resolution of the claim.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

**4. Public Bidding Crime:**

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder and/or its Owners have not been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

If the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract, provide a written explanation identifying the date of the conviction and a description of the circumstances surrounding the conviction.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

**5. Termination for Cause/Termination for Default**

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had any public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder has had public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.

If the Bidder has had any public works contracts terminated for cause or terminated for default in the 5 years prior to the bid submittal date, provide a written explanation for all contracts terminated for cause or terminated for default by identifying the project contract that was terminated, the government agency which terminated the Contract, the date of the termination, and a description of the circumstances surrounding the termination.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

**6. Lawsuits**

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.
- ☐ Alternatively, the undersigned confirms that the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

If the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, submit a list of lawsuits along with a written explanation of the circumstances surrounding each lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet the terms of contracts.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

**7. Contract Time (Liquidated Damages)**

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had liquidated damages assessed on any project it has completed in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder has had liquidated damages assessed on projects in the 5 years prior to the bid submittal date.

If the Bidder has had liquidated damages assessed against projects in the 5 years prior to the bid submittal date, submit a list of projects along with Owner contact information, and number of days assessed liquidated damages. The Contracting Agency shall determine whether the Contractor has a pattern of failing to complete projects within Contract Time.

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

\_\_\_\_\_  
(Title)

## 8. Capacity and Experience

The Bidder shall have sufficient current capacity and the Project Superintendent assigned to the Project shall have experience to meet the requirements of this Project. The Bidder and Project Superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

### A. Capacity

- i. Gross dollar amount of work currently under contract:

---

- ii. Gross dollar amount of contracts currently not completed:

---

- iii. List five major pieces of equipment which are anticipated to be used on this project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

---

---

---

---

---

- iv. Number of superintendents on Bidder's staff:

---

B. Experience

i. General character of work performed by firm:

---

---

---

---

ii. Identify who will be the superintendent on this project and years of experience. Also, list the number of years this person has been with your firm.

---

---

iii. Similar Size and Scope Projects Completed in the Past 5 Years

#1 Owner's Name and Contact Information: \_\_\_\_\_

---

Owner is a Government Agency? \_\_\_\_ Yes \_\_\_\_ No

Superintendent's Name: \_\_\_\_\_

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

Awarded Contract Amount: \_\_\_\_\_

Final Contract Amount: \_\_\_\_\_

Completion Date: \_\_\_\_\_

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

---

---

---

#2 Owner's Name and Contact Information: \_\_\_\_\_

Owner is a Government Agency? \_\_\_\_ Yes \_\_\_\_ No

Superintendent's Name: \_\_\_\_\_

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

Awarded Contract Amount: \_\_\_\_\_

Final Contract Amount: \_\_\_\_\_

Completion Date: \_\_\_\_\_

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

#3 Owner's Name and Contact Information: \_\_\_\_\_

Owner is a Government Agency? \_\_\_\_ Yes \_\_\_\_ No

Superintendent's Name: \_\_\_\_\_

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

Awarded Contract Amount: \_\_\_\_\_

Final Contract Amount: \_\_\_\_\_

Completion Date: \_\_\_\_\_

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

**APPENDIX B**

**GEOTECHNICAL REPORT**

March 2, 2012  
Revised April 12, 2012  
Job No. 11-135

Ms. Nancy Morter, P.E.  
**Gray & Osborne, Inc.**  
107 South 3<sup>rd</sup> Street  
Yakima, Washington 98901

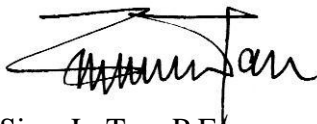
**Subject: Geotechnical Engineering Report  
Wastewater Treatment Facility Expansion  
10 First Street, Bridgeport, Washington  
G&O Reference No. 11033**

Dear Ms. Morter,

PanGEO has completed a geotechnical study for the proposed wastewater treatment facility expansion project in Bridgeport, Washington. The results of our study are presented in the attached report. In summary, the improvement areas are underlain by 9 to 10 feet of very loose to medium dense fill overlaying medium dense to very dense granular alluvial deposits. It is our opinion that the site soils are adequate for supporting the new grit/aeration basin, grit/electrical building, secondary clarifier, scum pump station, and influent pump station provided the recommendations in the attached geotechnical report are incorporated into design and construction of the project. Construction dewatering and temporary shoring will likely be needed to accomplish the secondary clarifier and influent pump station excavations.

We appreciate the opportunity to assist you with this project. Please call if you have any questions.

Sincerely,



Siew L. Tan, P.E.  
Principal Geotechnical Engineer

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**GEOTECHNICAL ENGINEERING REPORT  
WASTEWATER TREATMENT FACILITY EXPANSION  
10 FIRST STREET, BRIDGEPORT, WASHINGTON**

---

**1.0 GENERAL**

PanGEO completed a geotechnical engineering study to assist the project team with the design and construction of improvements to the existing wastewater treatment facility (WWTF) in Bridgeport, Washington. Our work was performed in accordance with our proposal dated August 19, 2011. The purpose of our geotechnical study was to evaluate subsurface conditions at the site and to provide geotechnical engineering recommendations pertinent to the proposed improvements. Our services included a site reconnaissance, drilling two test borings, excavating three test pits, and developing the conclusions and recommendations contained in this report.

**2.0 SITE AND PROJECT DESCRIPTION**

The existing wastewater treatment facility is located at 10 First Street in Bridgeport, Washington approximately as shown on Figure 1, Vicinity Map. The properties adjacent to the site are vacant and the site is situated approximately 200 feet south of the left bank of the Columbia River. Furthermore, the site is located approximately 2¾ miles downriver of the Chief Joseph Dam. Topography across the southern two-thirds of the site is essentially flat. The existing facility structures are located within this flat area. An approximately 6 to 8 foot high north-facing slope that descends to a relatively level gravel access road at gradients on the order of 15 to 20 percent is located just north of the existing facility structures (see Plate 1 on the following page). Vegetation at the site primarily consists of short grass.

We understand that the expansion project will include six major elements: a secondary clarifier, an influent pump station, a grit/aeration basin, a grit/electrical building, a clarifier splitter box, and a scum pump station. The location of the proposed structures is shown on Figure 2, Site and Exploration Plan. Our understanding of the proposed structures is as follows:

**Secondary Clarifier** – The proposed secondary clarifier is a 35-foot diameter concrete tank with a cone shaped base. The bottom of the tank will be approximately 21 feet below the ground surface. We understand the outside wall of the new secondary clarifier

will be located approximately 34 feet west of the outside wall of the existing secondary clarifier. The bottom of the excavation is anticipated to be about 1 to 2 feet lower to accommodate a leveling course and working surface for an overall excavation depth of 22 to 23 feet below grade. Based on the existing ground surface of approximately Elevation 799 feet, the temporary excavation may extend as deep as approximately Elevation 776 feet. Furthermore, it is our understanding that the outside edge of the nearby existing secondary clarifier is approximately 15½ feet below the ground surface. The floor of the existing secondary clarifier slopes toward a sludge pit located at the center of the structure. The bottom of the sludge pit is approximately 19¼ feet below grade.



**Plate 1.** North-facing slope in northern portion of site. Backhoe in photo is excavating TP-2. Facing east.



**Plate 2.** Drill rig in vicinity of proposed secondary clarifier. Existing secondary clarifier is in the foreground. Facing west.

**Influent Pump Station** – We understand the influent pump station will consist of a 6-foot diameter structure that will extend approximately 20 feet below grade. As designed, the bottom of the influent pump station will be at approximately Elevation 776 feet. As shown in Figure 2, the location of the new influent pump station is crowded with existing facility equipment including a sludge holding tank, headworks screen, influent flow meter, oxidation ditch, and associated underground utilities. Given the crowded area, relatively shallow groundwater, and the depth of the excavation, the influent pump station will likely be installed as a sinking caisson or by drilled shaft methods. Alternatively, excavation shoring will be needed to protect the existing structures.

**Grit/Aeration Basin** – The grit/aeration basin is an approximately 70-foot long by 30-foot wide concrete structure with a slab-on-grade floor that we understand will extend up to 10 feet below grade. A sump that extends approximately 7 feet below the floor slab (approximately 17 feet below existing ground surface) will be located in the grit chamber of the structure, which is located in the western portion of the structure.

**Grit/Electrical Building** – The grit/electrical building is located between the proposed grit/aeration basin and the existing oxidation ditch. We understand the grit/electrical building will be an approximately 40-foot long by 20-foot wide building with a basement level. Excavations to reach the basement level are expected to be on the order of 10 feet below grade.

**Clarifier Splitter Box** – The clarifier splitter box will be located on the north side of the existing oxidation ditch and will share a common wall with the oxidation ditch. The top of wall for the clarifier splitter box will be the same as the top of wall of the oxidation ditch and we understand the top of slab for the clarifier splitter box will extend approximately 8¼ feet below the top of wall.

**Scum Pump Station** – The scum pump station is an approximately 15-foot deep manhole structure that will be located on the east side of the new secondary clarifier. We anticipate the scum pump station will be installed within the excavation for the new secondary clarifier.

### **3.0 SUBSURFACE EXPLORATION**

#### **3.1 FIELD EXPLORATIONS**

Two test borings (BH-1 and BH-2) were drilled on August 30, 2011, at the approximate locations indicated on Figure 2. The borings were advanced to 36½ feet below existing grade. The borings were drilled using a Mobile B-80 truck-mounted drill rig owned and operated by Environmental West of Spokane Valley, Washington. The borings were drilled using a Tubex XL air rotary system with 6” outside diameter casing. The Tubex XL system utilizes a downhole hammer with an eccentric bit that allows the casing to follow the borehole. Soil samples were obtained from the borings at 2½- and 5-foot intervals. Standard penetration tests were performed in the borings using a 2-inch outside

diameter split-spoon sampler. In addition, a 3½-inch outside diameter sampler was also used in gravelly deposits in an attempt to recover a more representative soil sample. The sampler was generally driven into the soil a distance of 18 inches using a standard 140-pound safety hammer falling a distance of 30 inches (auto-trip mechanism). The number of blows required for each 6-inch increment of sampler penetration was recorded, and the blowcounts required for the last 12 inches of penetration is termed the SPT N-value. SPT N-value provides an empirical measure of the relative density of cohesionless soil, or the relative consistency of fine-grained soils.

In addition, three test pits (TP-1 to TP-3) were excavated at time of drilling. The approximate locations of the test pits are indicated on Figure 2. The test pits were excavated using a Case 580 rubber-tired backhoe operated by City of Bridgeport Public Works personnel. The test pits were excavated to depths ranging from 10 to 12 feet below the existing surface. The relative density and consistency of the underlying soil was estimated based on probing the walls of the excavation and the difficulty of completing the excavations.

The soils observed in the borings and test pits were classified in the field, and a summary of the subsurface conditions at each test pit location is presented in Appendix A of this report. The soil samples were described using the system outlined in Figure A-1.

A geologist from our firm was present throughout the field exploration program to observe the drilling and test pits, assist in sampling, and to prepare descriptive logs of the explorations. The soils were described using the system outlined on Figure A-1, and the summary boring logs and test pit logs are included in Appendix A.

### **3.2 LABORATORY TESTS**

Grain size distribution laboratory tests were performed on representative samples obtained from the explorations. The grain size distribution analyses were performed in general accordance with ASTM D-422. The test results are included in Appendix B.

## **4.0 SUBSURFACE CONDITIONS**

### **4.1 SITE GEOLOGY**

The site is located within the Columbia River flood plain approximately 2¾ miles downriver of the Chief Joseph Dam and approximately 6 miles upriver of the Columbia's confluence with the Okanogan River. The Columbia Valley has been modified by the advance and retreat of the Cordilleran Ice Sheet during the Quaternary Period. The ice sheet consisted of separate ice sheets that formed over the Rocky Mountains and Coastal Ranges of British Columbia, which coalesced and flowed south into the area of Washington State. The most recent advance of the Okanogan Lobe, which directly affected the project area, has been dated to roughly between 17,240 and 11,250 radio carbon years before present (Booth, et al, 2004). The Okanogan lobe reached past the present confluence of the Okanogan and Columbia Rivers, advancing as far up the Columbia as Grand Coulee and as far south onto the Waterville Plateau as the Winthrop area (Minard, 1985). In the project area, the ice was up to 1,000 meters thick. The ice left a variety of glacial debris, including glacial till, morainal deposits, outwash sand and gravel, and fine-grained lacustrine silt, fine sand and clay. Since the glaciers receded to the north, the Columbia and Okanogan Rivers have cut downward through the glacial sediments and into the metamorphic and granitic bedrock.

Review of the *Geologic Map of the Omak 1:100,000 Quadrangle* (Gulick and Korosec, 1990) indicates that the surficial geologic unit mapped in the vicinity of the site is glacial outwash (Map Unit Qgo). Gulick and Korosec describe the mapped glacial outwash as poorly stratified, clay, silt, sand, and gravel deposited by glacial meltwater streams as much as 115 feet thick.

### **4.2 SOIL CONDITIONS**

In summary, based on the subsurface conditions encountered in the test pits and in the borings, the proposed improvement areas are underlain by up to approximately 9 to 10 feet of fill material overlying granular alluvial deposits. The following is a description of the soils encountered at the site. Please refer to the summary boring and test pit logs in Appendix A for additional details.

**Fill** – All the borings and test pits encountered existing fill that extended 9 to 10 feet below the ground. The existing fill typically consisted of very loose to medium dense dark brown silty fine to medium sand to sandy silt with varying gravel content. At test pits TP-1 and TP-2, cobbles and boulders were encountered in the fill soils (see photos on test pit logs). A moderate amount of caving was noted in the existing fill at the test pit locations. We understand some of the existing fill encountered at the test pit locations came from the excavation spoils for the existing secondary clarifier.

**Alluvium** – Underlying the existing fill we encountered sand and gravel deposits that we interpret to be alluvium deposited by the Columbia River. The alluvial deposits likely originated from glacial outwash sediments that have been reworked and deposited by the Columbia River. Alluvial soils extended to at least the maximum exploration depth of 10 to 12 feet below grade at the test pit locations and 36½ feet below grade at BH-1 and BH-2.

The alluvial deposits encountered in the test pits consisted of loose to medium dense silty to relatively clean fine sand with occasional gravel. At BH-1 and BH-2, the alluvial deposits consisted of sequences of very loose to medium dense silty to relatively clean fine to medium sand and medium dense to very dense gravel with a varying silt and sand content. Based on the drill rig action and comments from the drill rig operator, large cobbles and boulders are present in this deposit. In addition, based on a conversation with the WWTF Operator (Mr. Bruce Plimpton), we understand boulders were encountered in the excavation for the existing secondary clarifier.

### 4.3 GROUNDWATER

Groundwater was encountered at approximately 14 feet below existing grade in boring BH-1 and at approximately 16 feet in boring BH-2 at the time of drilling (near Elevation 784 feet in both borings). Groundwater levels are expected to be influenced by seasonal fluctuations and by the Columbia River level which is in-turn regulated by the Chief Joseph Dam located approximately 2¾ miles upriver of the site. Changes of the River level on the order of several feet in a day are not uncommon. Hydrologic data for the Chief Joseph Dam can be found at <http://www.nwd-wc.usace.army.mil/report/chj.htm>.

Based on discussions with the WWTF Operator, he recalls that when the existing secondary clarifier was constructed in the early 1990's, groundwater was encountered in the excavation at about 12 feet below grade. He also noted that in the spring of 2011, the water level of the Columbia River reached the north fence line of the WWTF, near Elevation 790 feet.

## 5.0 GEOTECHNICAL RECOMMENDATIONS

### 5.1 SEISMIC DESIGN PARAMETERS

The seismic design of the new structures can be accomplished using the 2009 or later editions of the International Building Code (IBC), which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years). The table below presents the seismic design parameters in accordance with the 2009 IBC, which are consistent with the 2002 USGS seismic hazard maps.

Site Class	Spectral Acceleration at 0.2 sec. (g) $S_s$	Spectral Acceleration at 1.0 sec. (g) $S_1$	Site Coefficients		Design Spectral Response Parameters		Design PGA ( $S_{DS}/2.5$ )
			$F_a$	$F_v$	$S_{DS}$	$S_{D1}$	
D	0.516	0.157	1.387	2.172	0.477	0.227	0.191

### 5.2 SOIL LIQUEFACTION

Soil liquefaction is a condition where saturated cohesionless soils undergo a substantial loss of strength due to the build-up of excess pore water pressures resulting from cyclic stress applications induced by earthquakes. Soils most susceptible to liquefaction are loose, uniformly graded sands and loose silts with little cohesion. Due to medium dense to very dense condition and coarse grain size of the granular alluvial soils encountered below the groundwater table, the susceptibility of the site to earthquake-induced soil liquefaction is considered to be low. Therefore, it is our opinion that special design considerations associated with soil liquefaction are not necessary for this project.

### **5.3 SECONDARY CLARIFIER, INFLUENT PUMP STATION, AND SCUM PUMP STATION**

#### ***5.3.1 Buoyancy Force***

The proposed secondary clarifier, influent pump station, and scum pump station will extend below the groundwater table and will be subjected to hydrostatic uplift forces when the groundwater level outside the structure will be higher than the water level inside the structure. As such, the proposed secondary clarifier, influent pump station, and scum pump station should be designed to resist such forces.

Although the groundwater level was at about 14 to 16 feet at the time of our drilling, the groundwater level is anticipated to be higher during periods of heavy precipitation and when the River level is high. For design purposes, we recommend that the design groundwater level be consistent with the 100-year flood level in the area. Design parameters for calculating uplift resistance are provided on Figure 3. As an alternative, pressure relief valves (PRVs) may be incorporated into the construction of the secondary clarifier, influent pump station, and scum pump station to prevent buildup of excessive pore water pressure.

#### ***5.3.2 Lateral Pressure***

The proposed secondary clarifier, influent pump station, and scum pump station should be designed to withstand lateral earth pressures exerted by the soils that will be placed behind the walls and any unbalanced hydrostatic pressure if there is a difference in water level inside and outside the structure. We recommend that the following earth pressures be incorporated into the design of the below-grade structures:

Above water level:	50 pcf
Below Water Level:	85 pcf

For design purposes, the groundwater level may be assumed at the 100-year flood event.

The earth pressures outlined above will be partially offset by the hydraulic pressure exerted by the water inside the structure. The hydraulic pressure inside the secondary clarifier and influent pump station should be calculated based on a unit weight for water of 62.4 pcf.

### ***5.3.3 Secondary Clarifier, Influent Pump Station, and Scum Pump Station Subgrade Preparation***

Based on the subsurface conditions encountered in boring BH-1 and BH-2, alluvium consisting of wet, medium dense to very dense, clean gravel with sand, cobbles and boulders is expected to be encountered at the base of the excavations. The gravel is subround to round and may get loosened by construction activities. To reduce the potential of the rounded gravel from loosening and to provide a firm working and bearing surface, we recommend at least 1 foot of overexcavation and replacement. The overexcavation should be backfilled with coarse clean crushed rock such as Permeable Ballast (Standard Specifications 9.03.9(2)) and the material should be compacted to a firm and unyielding condition. A representative of Gray & Osborne or PanGEO should verify the adequacy of the subgrade prior to placing forms or reinforcing steel. Provided the secondary clarifier subgrade is prepared in accordance with the recommendations in this report, the subgrade should be capable of providing a bearing capacity of at least 4,000 psf.

We anticipate the scum pump station structure will be placed in conjunction with backfilling the excavation for the new secondary clarifier. As such, the scum pump station will be supported on newly placed wall backfill. To provide a firm bearing surface for the scum pump station, we recommend supporting the structure on at least 1-foot of coarse clean crushed rock such as Permeable Ballast or other approved suitable materials compacted to a firm and unyielding condition.

### ***5.3.4 Wall Backfill for Secondary Clarifier, Influent Pump Station, and Scum Pump Station***

It is our opinion that the onsite soils may be used as backfill around the secondary clarifier, influent pump station, and scum pump station provided the material can be adequately compacted. The contractor should be aware that the existing fill (silty sand) encountered at our subsurface explorations is moisture sensitive and will likely become difficult or impossible to adequately compact if it becomes too wet. Therefore, we recommend that the existing fill not be used as backfill below the groundwater table.

The on-site gravelly alluvium may be reused as backfill below the groundwater table. If import material is needed for backfill, we recommend that wall backfill consist of

granular soils such as Gravel Borrow (Standard Specifications Section 9.03.14(1)). The secondary clarifier wall backfill should be compacted to at least 95% of its maximum dry density (Modified Proctor ASTM D1557). The wall backfill placed within 5 feet of the structures should be compacted using small hand-held equipment to prevent over-stressing the structures.

### ***5.3.5 Temporary Excavation Slopes, Temporary Shoring, and Dewatering***

Because of the relatively shallow groundwater table and the close proximity of the proposed secondary clarifier and influent pump station to existing structures, we anticipate the need for dewatering measures at both structure locations and an excavation shoring system to accomplish the influent pump station excavation. We recommend that the selection of shoring and dewatering systems and their design be made the contractor's responsibility. The shoring should be designed in accordance with the current requirements of WISHA to provide adequate protection for the workers, adjacent structures, utilities, and other facilities. Our recommendations for temporary excavations, temporary shoring, and dewatering for the secondary clarifier and influent pump station follow:

**Secondary Clarifier** – The excavation for the secondary clarifier will extend about 22 to 23 feet below grade and more than 10 feet below the groundwater table. It is our opinion that the excavation may be accomplished using open cuts provided the groundwater table can be lowered to about 2 feet below the bottom of the excavation. We envision it will be necessary to install dewatering wells outside and inside of the excavation to lower the groundwater level in order to accomplish the excavation using temporary excavation slopes and to prevent base instability. To reduce the volume of construction dewatering, the secondary clarifier should be constructed during the time when the river level is low.

The design of temporary control of groundwater is the responsibility of the contractor. However, it should be noted that, because of the coarse grained nature of the submerged soils, the volume of pumping is expected to be quite high. At the contractor's option, a temporary sheetpile cutoff wall may be installed to reduce the amount of water entering through the bottom of the excavation. The sheet piles must be installed sufficiently deep to prevent heaving. Because of the presence of cobbles and boulders, pre-drilling may be needed to facilitate the sheetpile installation.

After groundwater in the vicinity of the secondary clarifier has been adequately lowered, we recommend that the temporary excavation slope from existing grade to 10 feet below grade be sloped at a maximum inclination of 1H:1V (Horizontal:Vertical) and temporary excavations from 10 feet below grade to the bottom of excavation be sloped at a maximum inclination of 1½H:1V as shown in Figure 4. However, due to limited space in the vicinity of the oxidation ditch, the temporary excavation slope will need to be locally oversteepened to approximately 1¼H:1V in order to accomplish the excavation (see Figure 5).

We anticipate the approximately 15-foot deep scum pump station located on the east side of the new secondary clarifier will be installed in conjunction with backfilling the secondary clarifier excavation (see Figure 4).

**Influent Pump Station** – The excavation for the influent pump station will extend about 20 feet below grade and will extend below the groundwater table. The vicinity of the proposed influent pump station is crowded with existing structures and underground utilities. As a result, an unsupported sloped excavation is likely not feasible. Although we recommend the design of the temporary shoring system be the contractor's responsibility, it is our opinion that a fully-cased drilled shaft or sinking-caisson would be feasible. In addition, an enclosed steel sheetpile cofferdam or a soldier pile wall with steel plate lagging are also feasible temporary shoring options. Selection of installation methods should consider the potential impacts to existing nearby structures and utilities and the presence of large cobbles and boulders.

Because the existing fill encountered at boring BH-2 was generally very loose, construction-induced vibration could lead to ground subsidence and could cause damage the existing structures and underground utilities. As a result, the use of a conventional vibratory hammer should not be allowed. Instead, either an impact hammer or a variable moment variable frequency vibratory hammer should be used to install the soldier piles or the sheetpiles. The soldier piles may also be installed in pre-drilled holes then backfilled with sand and gravel, but the use of temporary casings likely will be needed to prevent caving during drilling.

Because the anticipated excavation will be about 20 feet, internal bracing will be needed to provide a more economical design than a cantilevered wall, and to limit excessive lateral movements near the top of the walls.

To limit the needs for construction dewatering, the influent pump station should be constructed during the drier summer months. It is also our opinion that the needs for dewatering can be reduced with the use of a drilled shaft, caisson, or steel sheetpile cofferdam, instead of a soldier pile wall, because they provide better groundwater cutoff. In general, the groundwater level should be lowered to about 2 feet below the bottom of the excavation.

**Potential Obstruction** - The potential to encounter large cobbles or boulders in the existing fill and in the alluvial soils should be considered when selecting a shoring system, installation equipment, and installation methods. Obstructions at shallow depths should be removed with an excavator, if feasible. However, if obstructions are encountered at deeper depths, it is likely that other removal methods will be required. This may include, but not limited to the use of core barrels, expansive agents, and spudding.

**Construction Sequencing** – To provide space for the secondary clarifier excavation to be accomplished utilizing open cuts it is our opinion that the secondary clarifier should be constructed prior to foundation work for the grit/aeration basin and the grit/electrical building.

## **5.4 GRIT/AERATION BASIN AND GRIT/ELECTRICAL BUILDING**

### ***5.4.1 Temporary Excavations***

We understand excavations for the proposed grit/aeration basin and grit/electrical building will extend approximately 10 feet below grade. A sump that will be approximately 7 feet lower than the grit/aeration basin floor (i.e. approx. 17 feet below grade) is located in the west end of the basin. We anticipate that the excavations for these structures will largely encounter loose to medium dense existing fill that is prone to caving as observed in the test pits. For planning purposes, the temporary excavations for the grit/aeration basin and grit/electrical building may be sloped as steep as 1H:1V but

should be re-evaluated in the field during construction based on actual observed soil conditions.

#### ***5.4.2 Dewatering***

Groundwater may be encountered in the sump portion of the grit/aeration basin excavation. Given the relatively small area of the excavation that may extend below the groundwater table, we anticipate that sumps and pumps will be adequate for controlling the groundwater at the grit/aeration basin sump excavation, if the water level in the river is relatively low at the time of construction. The spacing of the sumps should be determined by the contractor, and may be determined during construction based on field observations at the time of construction. If the groundwater level is quite high, it may be necessary to install a well to control the groundwater.

#### ***5.4.3 Footing Design Parameters***

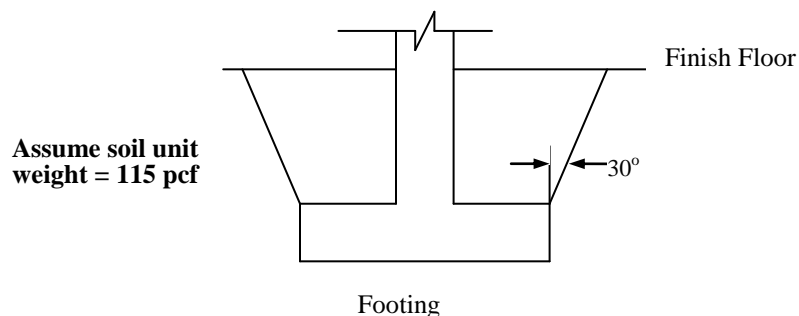
Support for the proposed grit/aeration basin and grit/electrical building may be provided by conventional spread footings or a structural slab with thickened edges. The foundation elements should bear directly on reworked existing fill compacted to the requirements of structural fill or on medium dense alluvial soils. We anticipate the reworking depth of the exiting fill (if warranted) would be on the order of 2 feet thick or less. Provided the foundation subgrade is prepared as recommended in this report, a maximum allowable bearing pressure of 2,000 psf may be used for foundation design. The recommended allowable bearing pressure may be increased by 1/3 for transient conditions such as wind and seismic loading. For frost heave considerations, all exterior foundation perimeters should be founded a minimum distance of 36 inches below the adjacent finished grade, and all interior footings should be at least 12 inches below the top of floor slab.

Based on the results of our subsurface exploration and the anticipated depth of cuts to reach foundation subgrade elevations, we anticipate loose to medium dense fill or medium dense granular alluvial soils will be encountered at the base of footing excavations. If loose existing fill or loose alluvial soil is encountered at foundation subgrade elevations, the soil should be reworked and compacted to the requirements of structural fill. We anticipate the reworking depth of the exiting fill (if warranted) would

be on the order of 2 feet thick or less. The adequacy of the foundation bearing soils should be verified by a representative of Gray & Osborne or PanGEO.

**Lateral Resistance** - Lateral forces resulting from wind or seismic events may be resisted by a combination of sliding resistance at the footing base and passive earth pressure against the buried portions of the structure. A coefficient of friction of 0.5 may be assumed between the base of the footings and the bearing surface. Passive soil resistance against the sides of buried footings can be estimated using an equivalent fluid unit weight of 350 pounds per cubic foot (pcf) assuming that the backfill against the footings consists of structural fill compacted to a minimum of 95 percent of the materials maximum dry density, determined in general accordance with the Modified Proctor (ASTM D1557). The recommended passive resistance includes a factor of safety of about 1.5.

**Uplift Resistance** - Uplift resistance of the footings may be estimated using the weight of the soil wedge extending 30 degrees out from each side of the footings, as shown below.



**Footing Excavation** - All footing excavations should be trimmed neat and the bottom of the excavation should be carefully prepared. The footing excavations should be observed by a representative of Gray & Osborne or PanGEO prior to placing forms and reinforcing steel, to verify that the recommendations of this report have been followed and that an adequate bearing surface has been prepared.

**Anticipated Footing Performance** - Total and differential settlements of footings designed and constructed in accordance with our recommendations are anticipated to be within tolerable limits. Under static loading, we estimate that the spread footings may experience total settlements of up to ½ inch. Differential settlements between two

adjacent load-bearing components supported on competent soils are expected to be less than about ¼ inch in 50 lineal feet.

#### ***5.4.4 Concrete Floor Slab***

Interior concrete floors should be provided with an adequate capillary break. The capillary break should consist of a minimum of 6 inches of free-draining, crushed rock or well-graded sand and gravel which is compacted to a firm and unyielding condition. We recommend that the capillary break material have a maximum particle size of ¾ inch, with no more than 80 percent passing the U.S. Standard No. 4 sieve and less than 5 percent passing the U.S. Standard No. 100 sieve. In areas where moisture will be detrimental to floor coverings or equipment, a 10-mil polyethylene vapor barrier should be placed directly over the capillary break.

#### ***5.4.5 Retaining Wall Design Parameters***

Retaining walls, should be properly designed to resist the pressure exerted by the soils behind the walls. Proper drainage provisions should also be provided behind the walls to intercept and remove groundwater from behind the wall. Our geotechnical recommendations for the design and construction of retaining walls are presented below.

**Lateral Earth Pressures** - The below grade portions of the walls that are designed to yield should be designed for a static lateral earth pressure based upon an equivalent fluid weight of 35 pounds per cubic foot (pcf). If the top of retaining walls will be restrained from lateral movement, the walls should be designed for a static earth pressure based upon an equivalent fluid weight of 50 pcf. If walls will be located below the design groundwater elevation (i.e. 100-year flood level), an equivalent fluid weight of 85 pcf should be used for design. A uniform pressure of 7H psf should be added to reflect the increase loading for seismic conditions, where H corresponds to the buried depth of the wall. The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions. If surcharge loads or building foundations will be located within a horizontal distance equal to the height of the wall, lateral earth pressures will need to be increased based upon the type and magnitude of surcharge.

**Wall Drainage** – Provisions for wall drainage should consist of a rigid 4-inch diameter perforated drainpipe behind and at the base of the wall footings. The drainpipe should be embedded in 12 to 18 inches of pea gravel. A minimum 12-inch wide layer of free draining granular soils (i.e. pea gravel or washed rock) is recommended adjacent to the wall for the full height of the wall. Alternatively, a composite drainage material, such as Miradrain 6000 may be used in lieu of free draining granular soils. The composite drainage material should be installed per the manufacturer's recommendations. The drainpipe at the base of the wall should be graded to direct water to a suitable outlet.

**Lateral Resistance** -Lateral forces from wind or seismic loading and unbalanced lateral earth pressures may be resisted by passive earth pressures acting against the embedded portions of the foundation. Passive resistance values may be determined using an equivalent fluid weight of 350 pounds per cubic foot (pcf). This value includes a factor of safety of 1.5, assuming that the structural fill adjacent to the sides of the foundation has been properly compacted.

**Wall Backfill** - The on-site soils may be considered for wall backfill provided the previously recommended wall drainage measures are implemented and provided the material can be compacted to the requirements of structural fill. If imported wall backfill is needed below the groundwater table, we recommend using Gravel Borrow, Permeable Ballast, or approved equivalent.

Wall backfill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D 1557 (Modified Proctor). Small hand operated compaction equipment should be used within 5 feet of walls to prevent overstressing the walls.

**Damp Proofing and Waterproofing** - The exterior of all basement walls should be protected with a damp proofing compound. If portions of the grit/electrical building will be located below the design groundwater elevation (i.e. 100-year flood level), and if the intent is to prevent water from intruding into the basement during flooding, it may be necessary to support the building on a mat or a structural slab

instead of conventional footings. In addition, it will be necessary on incorporate water-stops where cold joints may be present in the concrete.

## **5.5 NEW UTILITIES**

### ***5.5.1 Clarifier Splitter Box Subgrade Preparation***

The base of the clarifier splitter box will extend approximately 8 feet below grade. Loose to medium dense existing fill material is anticipated to be present at the subgrade elevation of this structure. To provide adequate support for the clarifier splitter box, we recommend overexcavating at least 1-foot of the existing fill material and replacing it with properly compacted Permeable Ballast, Gravel Borrow, or approved equivalents. The base of the overexcavation should be compacted to a dense and relatively unyielding condition prior to placing the new fill.

### ***5.5.2 Trench Excavation***

Loose to medium dense existing fill and medium dense to very dense granular alluvial soils are expected to be encountered in utility trench excavations. In addition, we anticipate that some of the new utility pipes will be located below the groundwater table. Trench sidewalls in the existing fill and granular alluvial soils may become unstable, especially when wet conditions are present. Where trench excavation will extend into submerged alluvial soils, construction dewatering will be needed to lower the groundwater level prior to trenching in order to reduce the risks of sidewall caving, and to achieve a stable subgrade.

Trench excavations may be accomplished using conventional excavation equipment. All excavations in excess of 4 feet in depth should be sloped in accordance with Washington Administrative Code (WAC) 296-155, or be shored. It is the contractor's responsibility to design and maintain the required temporary excavation stability and dewatering to achieve a safe working condition.

### ***5.5.3 Pipe Support and Bedding***

Based on our field explorations, we anticipate loose to medium dense silty sand existing fill and relatively clean alluvial sand and gravel will be encountered in utility trench

excavations. Utility installation should be conducted in accordance with the 2012 WSDOT Standard Specifications or other applicable specifications for placement and compaction of pipe bedding and backfill. Soft or loose soils, if present, should be compacted in-place to a firm and unyielding condition or removed from the bottom of the trench and replaced with pipe bedding material.

General recommendations relative to pipe bedding are presented below.

- Pipe bedding material, placement, compaction, and shaping should be in accordance with the project specifications and the pipe manufacturer's recommendations. At a minimum, the pipe bedding should meet the gradational requirements for Gravel Backfill for Pipe Zone Bedding, Section 9-03.12(3) of the 2012 WSDOT *Standard Specifications*;
- Pipe bedding should be placed on relatively undisturbed native soils, or compacted fill. If the native subgrades are disturbed, the disturbed material should be removed and replaced with compacted bedding material;
- Pipe bedding should provide a firm, uniform cradle for the pipe. We recommend that a minimum 4-inch thickness of bedding material beneath the pipe be provided. Greater thicknesses may be necessary to prevent loosening and softening of the natural soils during pipe placement;
- Prior to the installation of the pipe, the pipe bedding should be shaped to fit the lower part of the pipe exterior with reasonable closeness to provide continuous support along the pipe;
- Pipe bedding material and/or backfill around the pipe should be placed in layers and tamped to obtain complete contact with the pipe. In areas where a trench box is used, the bedding material should be placed before the trench box is advanced.

#### **5.5.4 Utility Backfill**

Trench backfill and backfill adjacent to the clarifier splitter box should consist of properly compacted import granular fill as outlined in Section 6.4 of this report. Backfill

in structural areas should be placed in 8- to 12-inch, loose lifts and compacted using mechanical equipment to at least 95 percent maximum dry density, per ASTM D1557.

During placement of the initial lifts, the trench backfill should not be bulldozed into the trench or dropped directly on the pipe. Furthermore, heavy vibratory equipment should not be permitted to operate directly over the pipe until a minimum of 2 feet of backfill has been placed over the pipe.

## **6.0 EARTHWORK CONSIDERATIONS**

### **6.1 SITE PREPARATION**

Site preparation for the proposed project includes striping and clearing of surface vegetation and excavating to the design subgrade. All stripped materials should be disposed off-site or be “wasted” on-site in non-structural landscaping areas. Stripping depths may be on the order of about 3 to 4 inches. Following the site clearing and excavation, the exposed subgrade beneath the new structures should be compacted to a dense and unyielding condition. Soil in loose or soft areas, should be over-excavated and replaced with compacted structural fill.

### **6.2 TEMPORARY EXCAVATIONS**

All temporary excavations should be performed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring. For planning purposes, the temporary excavations situated above the groundwater table may be sloped as steep as 1H:1V and excavations situated below the groundwater table may be sloped as steep as 1½H:1V. However, temporary excavations should be re-evaluated in the field during construction based on actual observed soil conditions. During wet weather, the cut slopes may need to be flattened to reduce potential erosion.

Additional temporary excavation recommendations specific to the proposed secondary clarifier, influent pump station, and scum pump station are located in Section 5.3.5 of this report and temporary excavation recommendations for the grit/aeration basin and grit/electrical building are located in Section 5.4.1.

### **6.3 MATERIAL REUSE**

It is our opinion that the on-site silty sand existing fill and granular alluvial soils may be considered for use as structural fill or trench backfill provided the soil can be compacted to the project requirements for structural fill. However, the existing fill soils have a relatively high fines content and are considered moisture sensitive. Given the relatively high fines content, the existing fill soils are not considered appropriate for use as structural fill or trench backfill during wet weather or below the groundwater table.

### **6.4 STRUCTURAL FILL AND COMPACTION**

Imported structural fill, if needed, should consist of granular soils such as Gravel Borrow (Standard Specifications Section 9.03.14(1)). The fine-grained portion of structural fill soils should consist of non-plastic material. Gravel Borrow may be used as structural fill above and, with proper dewatering, below the design groundwater table.

Structural fill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D 1557.

### **6.5 WET WEATHER CONSTRUCTION**

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. The following procedures are best management practices recommended for use in wet weather construction:

- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing  $\frac{3}{4}$ -inch sieve. The fines should be non-plastic.

- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Geotextile silt fences and/or bales of straw should be strategically located to control surface water and to limit erosion.
- Excavation slopes and soils stockpiled on-site should be covered with plastic sheets during periods of wet weather.

## **7.0 LIMITATIONS**

We have prepared this report for Gray & Osborne, Inc., the City of Bridgeport, and the project design team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our work specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances.

This report has been prepared for planning and design purposes for specific application to the proposed project in accordance with the generally accepted standards of local practice at the time this report was written. No warranty, express or implied, is made.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

We appreciate the opportunity to be of service.

Sincerely,



Steven T. Swenson, L.G.  
Project Geologist



Siew L. Tan, P.E.  
Principal Geotechnical Engineer

## 8.0 LIST OF REFERENCES

- Booth, D.B, Troost, K.G., Clague, J.J. and Waitt, R.B., 2004, The Cordilleran Ice Sheet, in The Quaternary Period in the United States, Gillespie, A.R., Porter, S.C. and Atwater, B.F. editors, Elsevier, Ltd, Amsterdam, The Netherlands.
- Gulick, C. W.; Korosec, M. A., compilers, 1990, Geologic map of the Omak 1:100,000 Quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 90-12, 52 p., 1 plate.  
[[http://www.dnr.wa.gov/Publications/ger\\_ofr90-12\\_geol\\_map\\_omak\\_100k.zip](http://www.dnr.wa.gov/Publications/ger_ofr90-12_geol_map_omak_100k.zip)]
- International Building Code (IBC), 2009, International Code Council.
- Minard, J.P., 1985, Geologic map of the Quaternary deposits of the Potholes Quadrangle, Okanogan County, Washington, U.S.G.S Miscellaneous Field Studies Map MF-1680.
- WSDOT, (2012). *Standard Specifications for Road, Bridges, and Municipal Construction*.



Not To Scale



**Wastewater Treatment Facility  
Expansion  
10 First Street  
Bridgeport, WA**

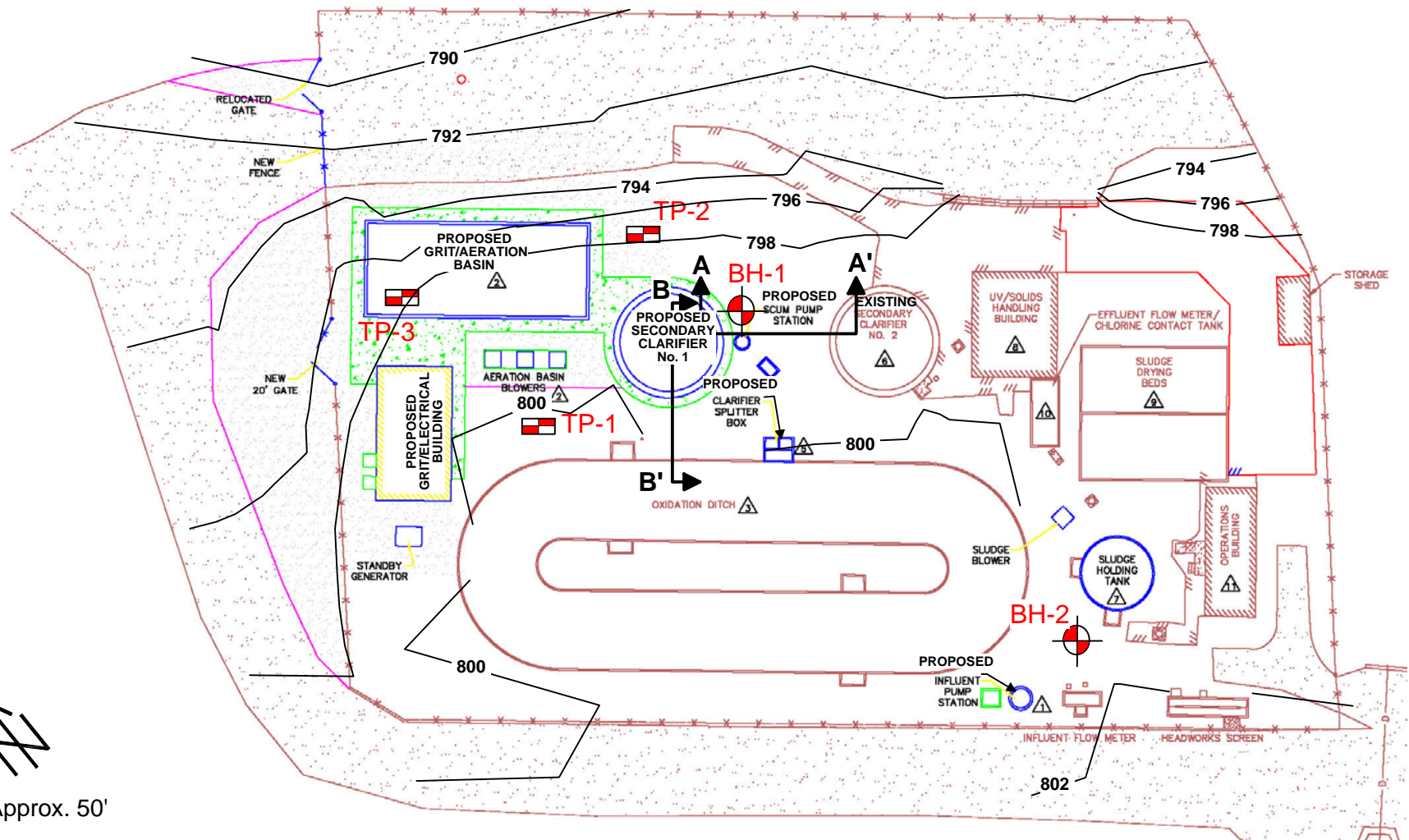
## VICINITY MAP

Project No.

**11-135**




Figure No.

**1**



1" = Approx. 50'

Legend:

-  Approx. Borehole Location
-  Approx. Test Pit Location
-  Generalized Subsurface Profile

Note: Preliminary site plan dated April 2012 provied by Gray & Osborne.



**Wastewater Treatment Facility  
Expansion  
10 First Street  
Bridgeport, Washington**

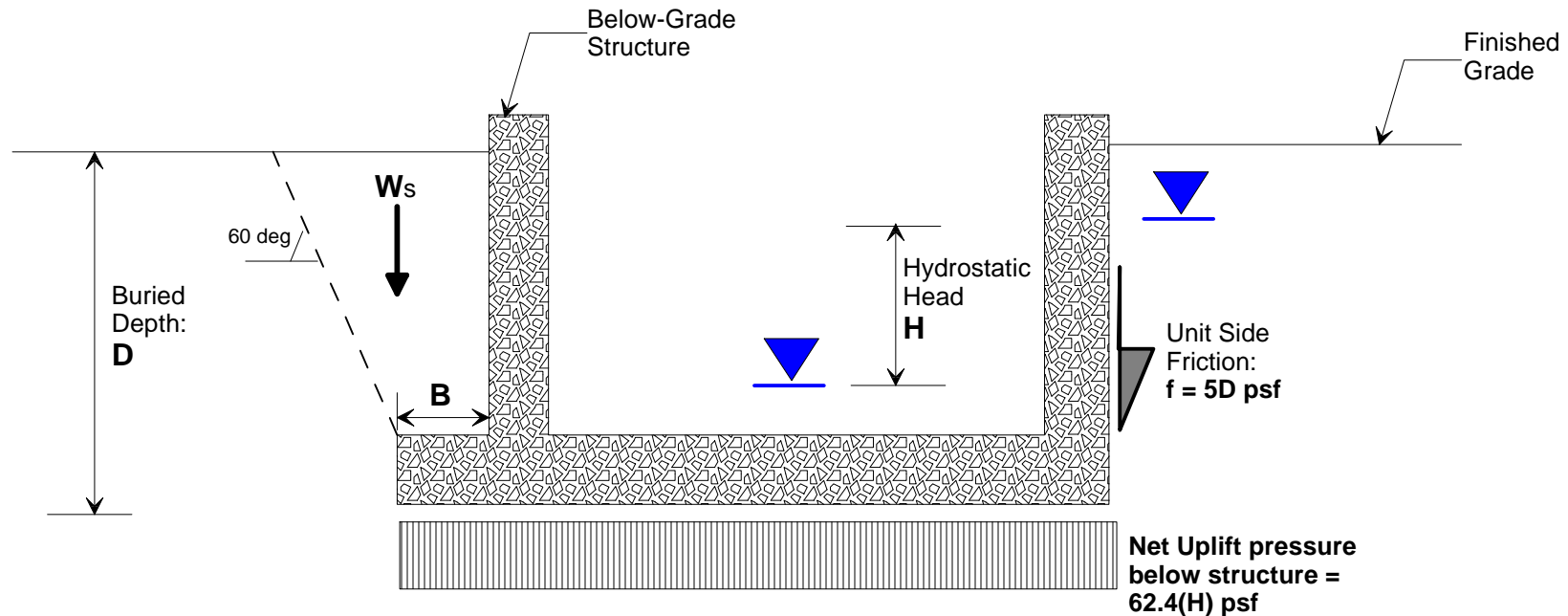
## SITE AND EXPLORATION PLAN

Project No.

11-135

Figure No.

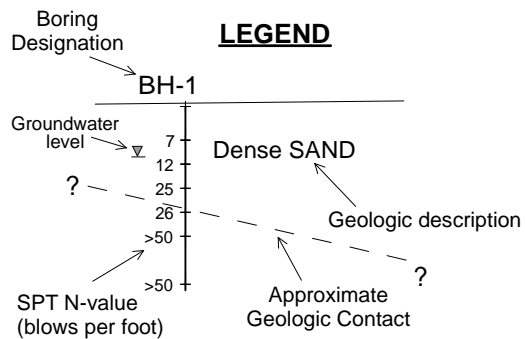
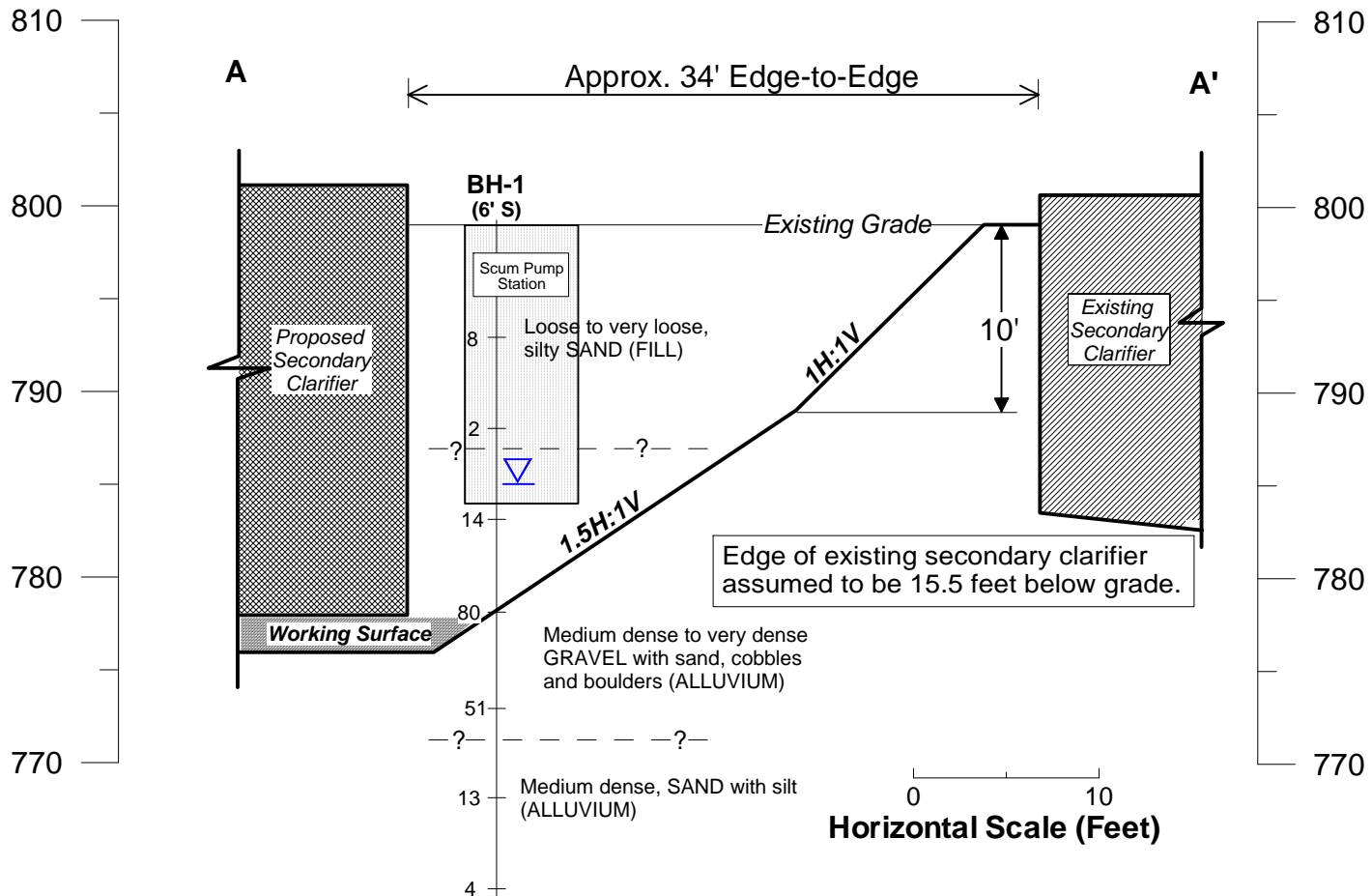
2



## Notes:

**(1)** Where foundation extends beyond the footprint of the structure (left hand side of the diagram), the uplift resistance should be computed as the sum of the weight of the structure, plus the weight of the soil wedge ( $W_s$ ).  $W_s$  should be computed using an effective soil unit weight of 50 pcf for the submerged portion and 115 pcf above the groundwater level based on the 100-year flood event.

**(2)** Without the extended foundation lid (right hand side of the diagram), the uplift resistance should be computed as the sum of the weight of the structure, plus the side friction at the soil-structure interface.



**Wastewater Treatment Facility  
Expansion  
10 First Street  
Bridgeport, Washington**

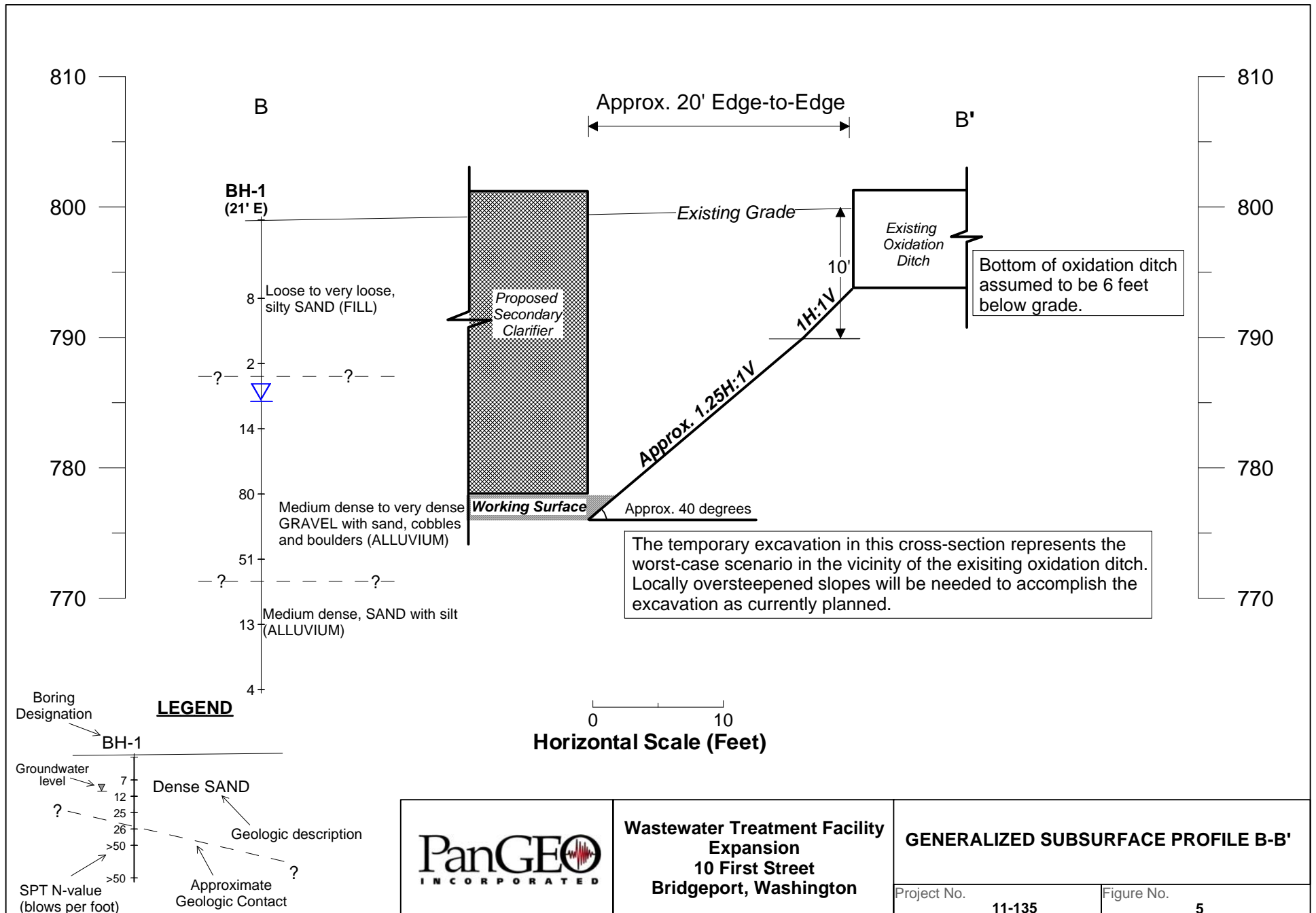
**GENERALIZED SUBSURFACE PROFILE A-A'**

Project No.

**11-135**

Figure No.

**4**


















## **APPENDIX A**

### **SUMMARY BORING AND TEST PIT LOGS**

## RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

## UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	 GW: Well-graded GRAVEL	
	GRAVEL (>12% fines)	 GP: Poorly-graded GRAVEL	
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	 GM: Silty GRAVEL	
		 GC: Clayey GRAVEL	
		 SW: Well-graded SAND	
		 SP: Poorly-graded SAND	
Silt and Clay 50% or more passing #200 sieve	SAND (>12% fines)	 SM: Silty SAND	
		 SC: Clayey SAND	
	Liquid Limit < 50	 ML: SILT	
		 CL: Lean CLAY	
		 OL: Organic SILT or CLAY	
	Liquid Limit > 50	 MH: Elastic SILT	
		 CH: Fat CLAY	
		 OH: Organic SILT or CLAY	
Highly Organic Soils		 PT: PEAT	

- Notes:**
- Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.
  - The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

## DESCRIPTIONS OF SOIL STRUCTURES

<b>Layered:</b> Units of material distinguished by color and/or composition from material units above and below	<b>Fissured:</b> Breaks along defined planes
<b>Laminated:</b> Layers of soil typically 0.05 to 1mm thick, max. 1 cm	<b>Slickensided:</b> Fracture planes that are polished or glossy
<b>Lens:</b> Layer of soil that pinches out laterally	<b>Blocky:</b> Angular soil lumps that resist breakdown
<b>Interlayered:</b> Alternating layers of differing soil material	<b>Disrupted:</b> Soil that is broken and mixed
<b>Pocket:</b> Erratic, discontinuous deposit of limited extent	<b>Scattered:</b> Less than one per foot
<b>Homogeneous:</b> Soil with uniform color and composition throughout	<b>Numerous:</b> More than one per foot
	<b>BCN:</b> Angle between bedding plane and a plane normal to core axis

## COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

## TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

## SYMBOLS

Sample/In Situ test types and intervals



2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)



3.25-inch OD Split Spoon (300-lb hammer, 30" drop)



Non-standard penetration test (see boring log for details)



Thin wall (Shelby) tube



Grab



Rock core



Vane Shear

## MONITORING WELL



Groundwater Level at time of drilling (ATD)



Static Groundwater Level



Cement / Concrete Seal



Bentonite grout / seal



Silica sand backfill



Slotted tip



Slough



Bottom of Boring

## MOISTURE CONTENT



Dry



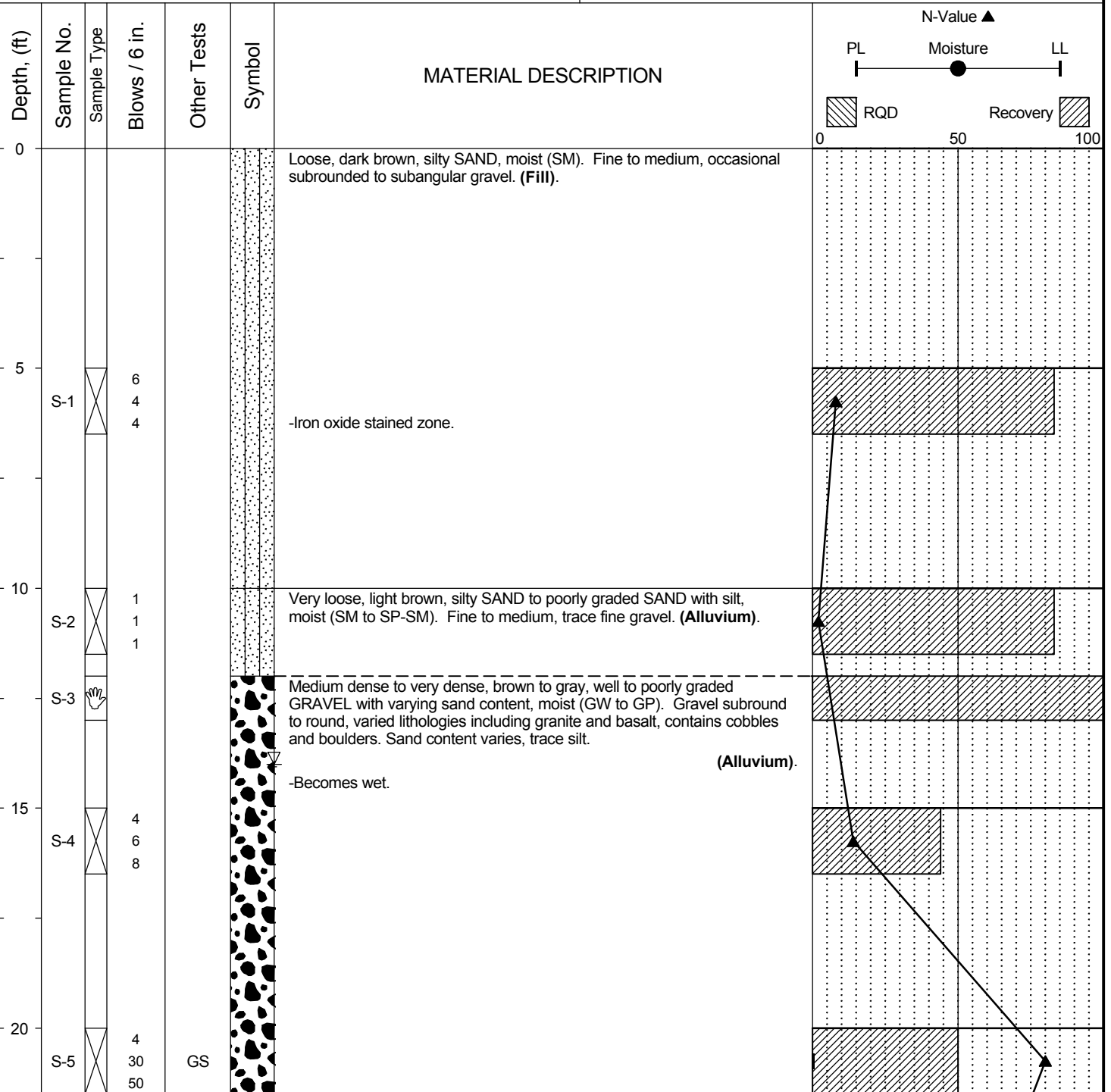
Moist



Wet

Project: Wastewater Treatment Facility  
 Job Number: 11-135  
 Location: Bridgeport, WA  
 Coordinates: Northing: , Easting:

Surface Elevation: 799.0ft  
 Top of Casing Elev.:  
 Drilling Method: Air Rotary (Tubex)  
 Sampling Method: SPT



Completion Depth: 36.5ft  
 Date Borehole Started: 8/30/11  
 Date Borehole Completed: 8/30/11  
 Logged By: STS  
 Drilling Company: Environmental West

Remarks: Mobile B-80 truck-mounted drill rig equipped with auto-hammer for Standard Penetration Tests (SPT).

**PanGEO**  
 INCORPORATED  
 Phone: 206.262.0370

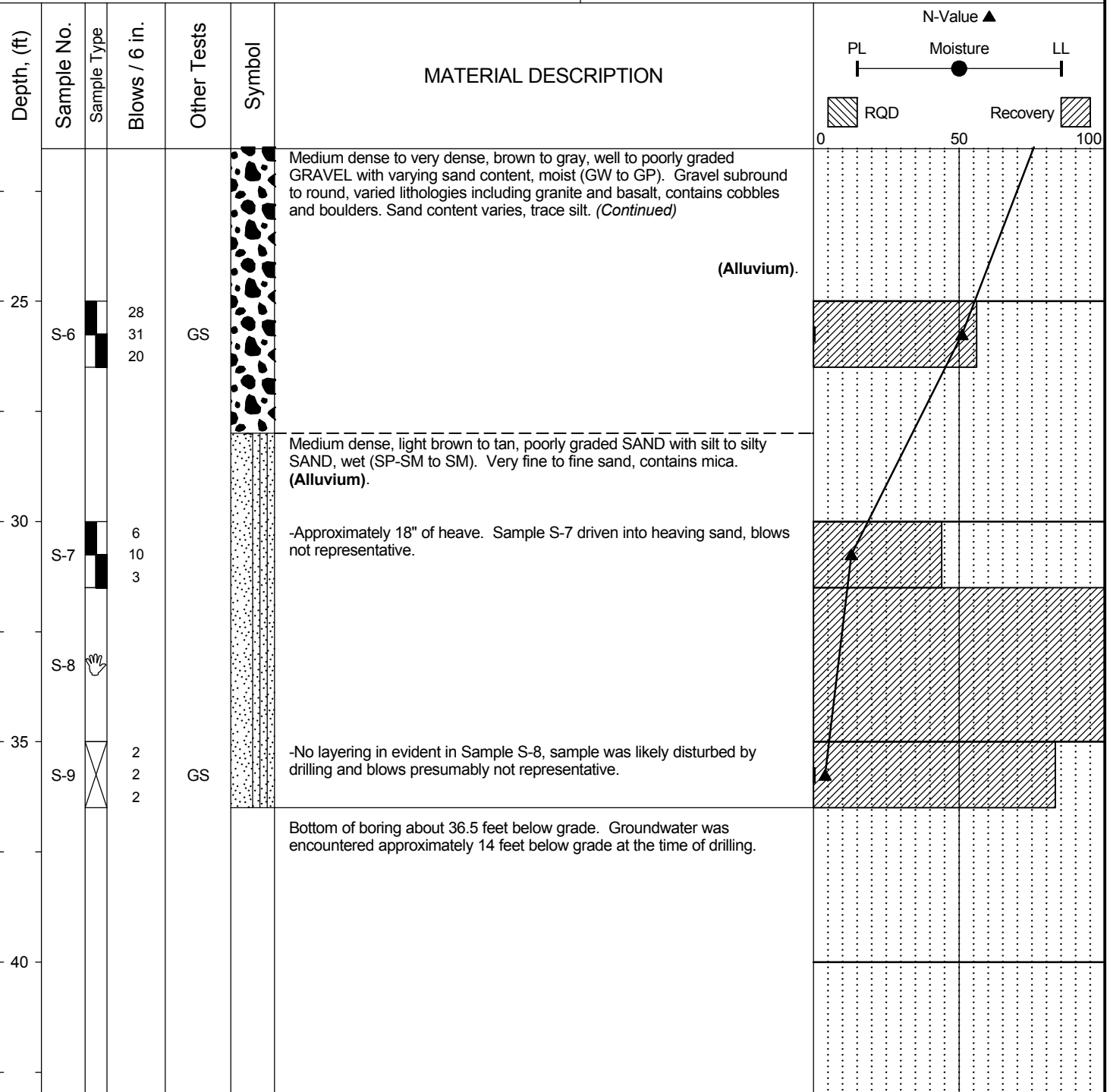
## LOG OF TEST BORING BH-1

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project: Wastewater Treatment Facility  
 Job Number: 11-135  
 Location: Bridgeport, WA  
 Coordinates: Northing: , Easting:

Surface Elevation: 799.0ft  
 Top of Casing Elev.:  
 Drilling Method: Air Rotary (Tubex)  
 Sampling Method: SPT



Completion Depth: 36.5ft  
 Date Borehole Started: 8/30/11  
 Date Borehole Completed: 8/30/11  
 Logged By: STS  
 Drilling Company: Environmental West

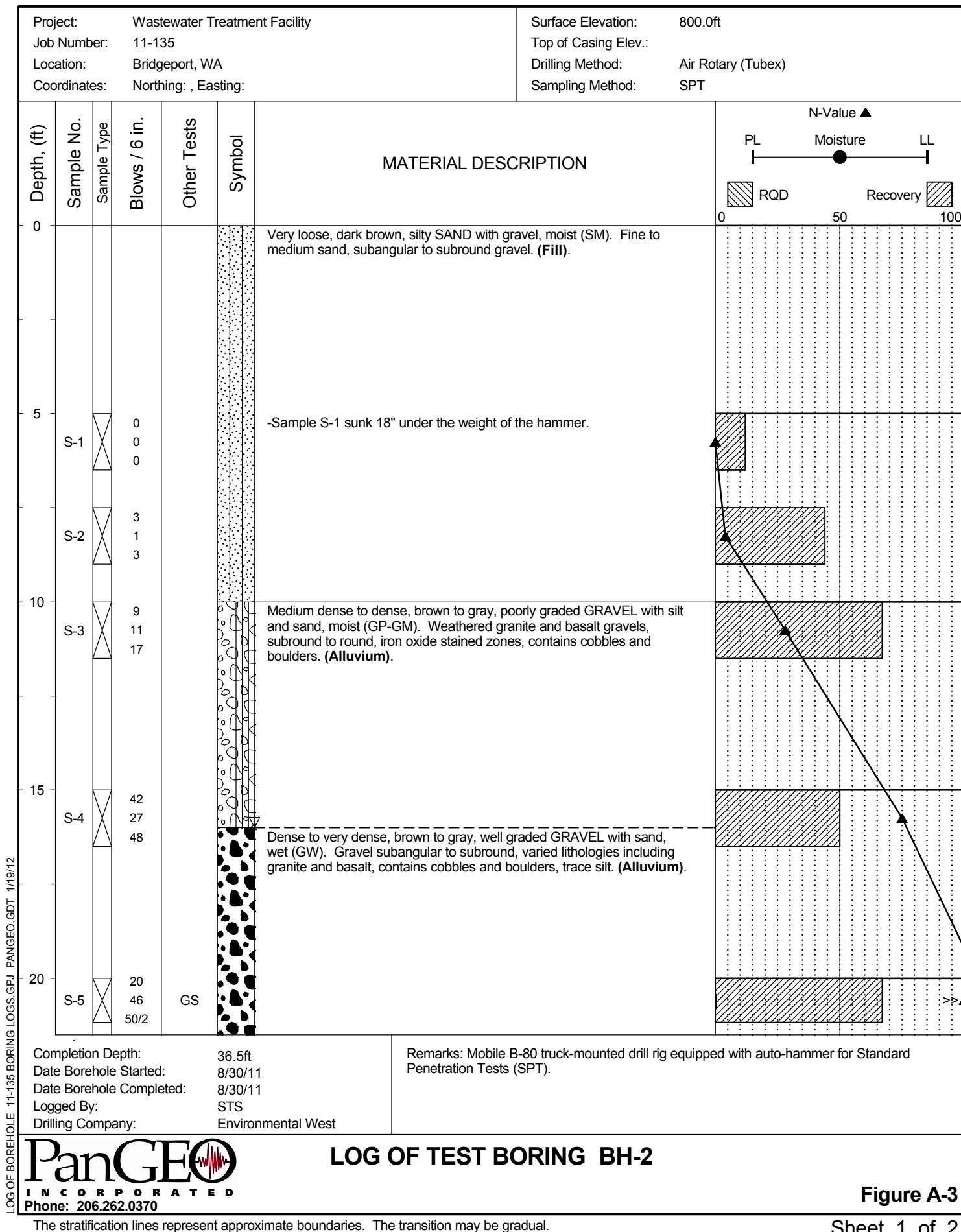
Remarks: Mobile B-80 truck-mounted drill rig equipped with auto-hammer for Standard Penetration Tests (SPT).

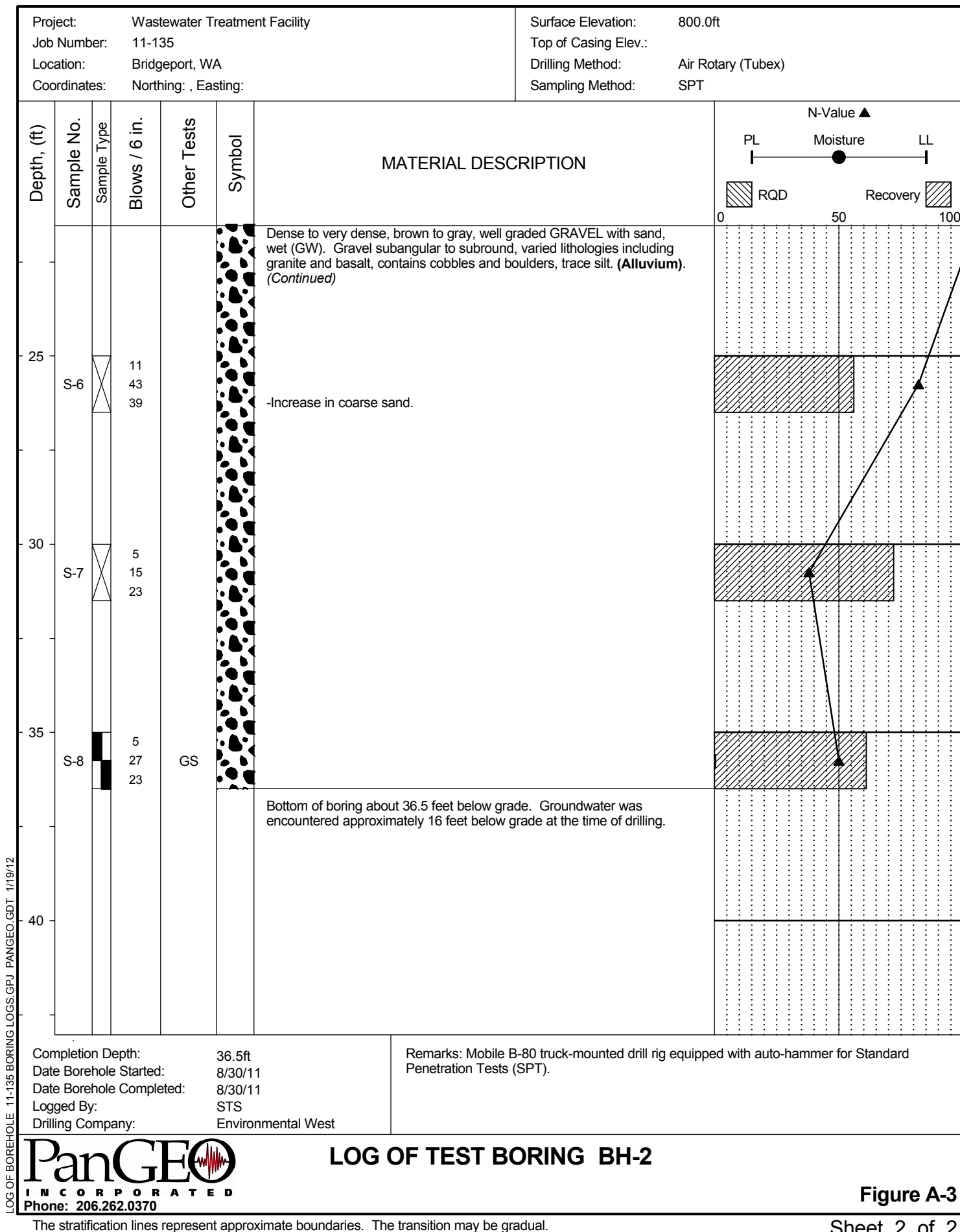
**PanGEO**  
 INCORPORATED  
 Phone: 206.262.0370

## LOG OF TEST BORING BH-1



Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.









## TEST PIT LOGS

<b>Test Pit TP-1</b> Approximate ground surface elevation: 800 feet Surface conditions: Topsoil and sod, 2" to 3" thick	
<u>Depth (ft)</u>	<u>Material Description</u>
0 –9	Loose to medium dense, dark brown to brown, silty fine SAND to sandy SILT, moist (SM to ML). Contains gravel, and occasional cobbles and small boulders. <b>(Fill)</b> -Some caving of test pit walls observed
9 – 12	Loose to medium dense, light brown, silty fine SAND, moist (SM). Trace gravel. <b>(Alluvium)</b> -Increase in gravel and around 11 feet below grade.
<div style="display: flex; justify-content: space-around;">   </div> <p>TP-1 was terminated 12 feet below the ground surface. No groundwater was encountered at the time of excavation.</p>	

**Figure A-4**

<p align="center"><b>Test Pit TP-2</b></p> <p>Approximate ground surface elevation: 797 feet</p> <p>Surface Conditions: Topsoil and sod, 2" to 4" thick</p>	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 10	<p>Loose to medium dense, dark brown to brown, silty fine SAND to sandy SILT, moist (SM to ML). <b>(Fill)</b></p> <p>-Numerous boulders to 5 feet below grade, moderate caving.</p> <p>-Metal debris at 5 feet below grade.</p>
10 – 11	<p>Loose to medium dense, light brown, silty fine SAND to poorly graded SAND with silt, moist (SM to SP-SM). <b>(Alluvium)</b></p>
<div style="display: flex; justify-content: space-around;">   </div> <p>TP-2 was terminated 11 feet below the ground surface. Groundwater was not encountered at the time of excavation.</p>	

**Figure A-5**

<p align="center"><b>Test Pit TP-3</b></p> <p>Approximate ground surface elevation: 798 feet</p> <p>Surface Conditions: Topsoil and sod, up to 2" to 4" thick</p>	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 9	Loose to medium dense, brown, silty fine SAND to sandy SILT, moist (SM to ML). <b>(Fill)</b> -Occasional gravel and cobbles.
9 – 10	Loose to medium dense, light brown, silty fine SAND, moist (SM). <b>(Alluvium)</b>
<div style="display: flex; justify-content: space-around;">   </div> <p>TP-3 was terminated at approximately 10 feet below ground surface. Groundwater was not encountered at the time of excavation.</p>	

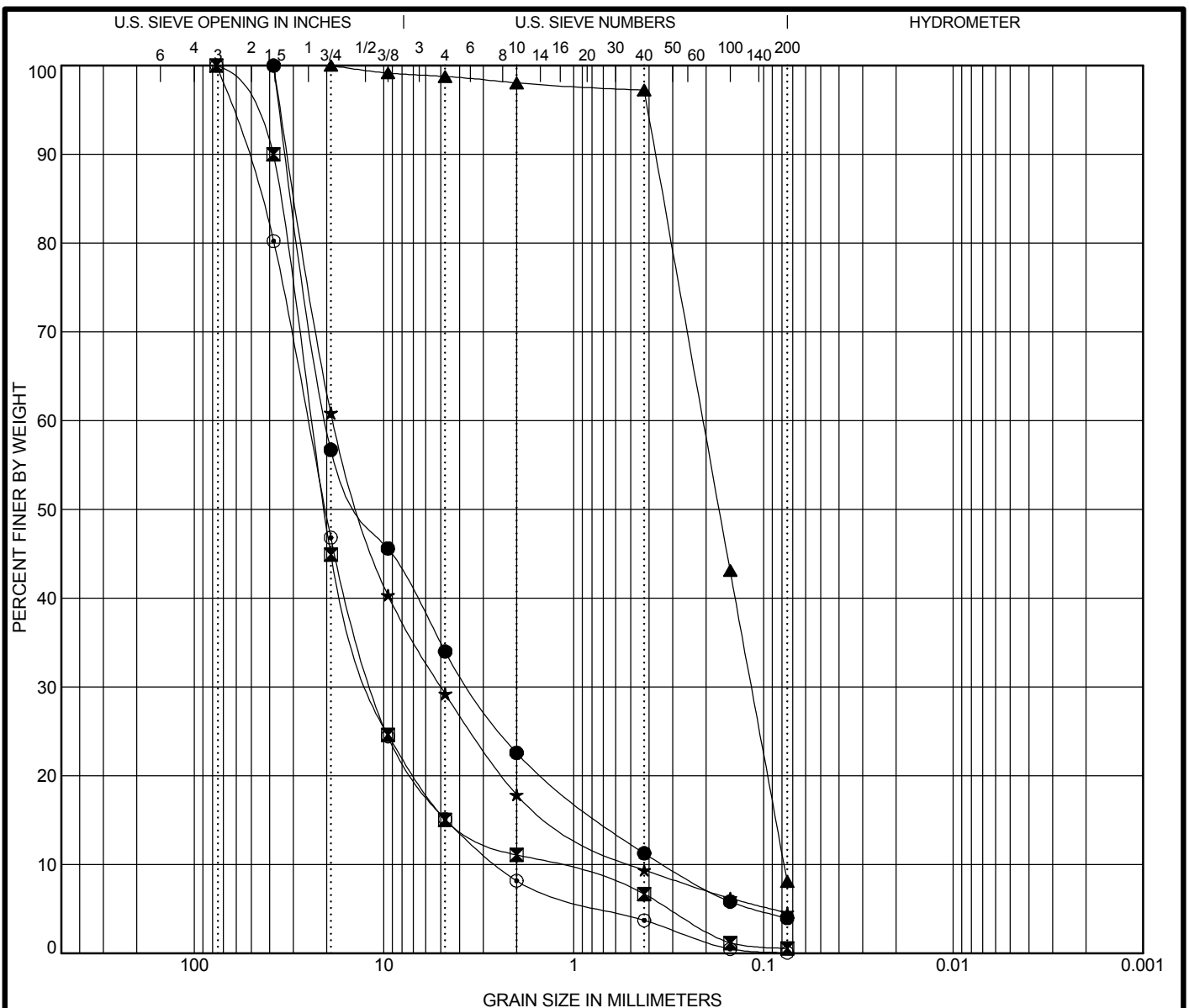
**Test Pits Logged By:** STS

**Test Pits Excavated:** August 30, 2011 using a Case 580 rubber-tired backhoe owned and operated by the City of Bridgeport.

**Figure A-6**

## **APPENDIX B**

### **LABORATORY TEST RESULTS**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	BH-1	@ 20.0 ft.	WELL-GRADED GRAVEL with SAND(GW)						1.84	60.16
☒	BH-1	@ 25.0 ft.	POORLY GRADED GRAVEL(GP)						4.00	17.63
▲	BH-1	@ 35.0 ft.	POORLY GRADED SAND with SILT(SP-SM)						0.83	2.67
★	BH-2	@ 20.0 ft.	WELL-GRADED GRAVEL with SAND(GW)						2.82	38.81
◎	BH-2	@ 35.0 ft.	WELL-GRADED GRAVEL with SAND(GW)						2.04	9.97
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH-1	20.0	38.1	20.08	3.51	0.334	66.0	30.0	4.0	
☒	BH-1	25.0	76.2	24.031	11.449	1.363	84.7	14.5	0.6	
▲	BH-1	35.0	19.05	0.208	0.116	0.078	1.2	90.7	8.1	
★	BH-2	20.0	38.1	18.505	4.988	0.477	70.8	24.7	4.6	
◎	BH-2	35.0	76.2	25.043	11.32	2.512	84.4	15.0	0.1	

**PanGEO**  
INCORPORATED  
Phone: 206.262.0370

## GRAIN SIZE DISTRIBUTION

Project: Wastewater Treatment Facility  
Job Number: 11-135  
Location: Bridgeport, WA

**Figure  
B-1**

## **APPENDIX C**

### **HAZARDS CLASSIFIED AREAS LETTER**



March 5, 2021

Mr. John H. Glenn  
Fire Chief/Fire Marshal  
Douglas County Fire District #2  
377 Eastmont Avenue  
East Wenatchee, Washington 98802

SUBJECT: DOCUMENTATION OF HAZARDOUS (CLASSIFIED) AREAS,  
WASTEWATER TREATMENT FACILITY  
CITY OF BRIDGEPORT, DOUGLAS COUNTY, WASHINGTON  
G&O #20859

Dear Mr. Glenn:

In accordance with the requirements of NEC 500.3(b), the following provides documentation of hazardous (classified) areas at the Wastewater Treatment Facility in Bridgeport, Washington. In preparing this document, consideration has been given to the information contained in NFPA 820 *Standard for Fire Protection in Wastewater Treatment and Collection Facilities*, as well as the actual treatment process, physical layout, ventilation, and similar factors at the Wastewater Treatment Facility.

This letter is to be made available to, and used by, those authorized to design, install, inspect, maintain, or operate electrical equipment at the Wastewater Treatment Facility.

It is important to note that this letter relates only to hazardous (classified) areas as defined in NEC Article 500. The scope of that article is limited to requirements for “electrical and electronic equipment and wiring” in locations where “fire or explosion hazards may exist due to flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts, or ignitable fibers/flyings.” There may be other areas at the Wastewater Treatment Facility that are considered hazardous as a result of hazards other than those in the scope of NEC Article 500. These may include but are not limited to hazards to life, limb, and/or property due to electromagnetic radiation, biological, chemical, radiological, or other agents or dangers.

The City is in the process of designing the replacement of the Operations Building at the Wastewater Treatment Facility, which was destroyed during the Pearl Hill Fire in September of 2020. The Operations Building includes a laboratory, bathroom, chlorine storage room, electrical room, sludge pump room, and spare parts storage room. Exterior



Mr. John H. Glenn  
March 5, 2021  
Page 2

to the building is a new chlorine gas scrubber. This letter presents our determination of possible hazards and the corresponding electrical classifications, as well as the closest NFPA 820 (2020 Edition) descriptions for the new Operation Building.

## **SLUDGE PUMP ROOM**

### **Closest NFPA 820 Description**

<b>Table</b>	<b>Row</b>	<b>Line</b>	<b>Location and Function</b>	<b>Fire and Explosion Hazard</b>	<b>Ventilation</b>	<b>Extent of Classified Area</b>	<b>NEC – Area Electrical Classification</b>
6.2.2(a)	9	b	Dry side of a sludge pumping station	Buildup of methane gas or flammable vapors	C (continuously ventilated at six air changes per hour)	Entire dry well when physically separated from a wet well or separate structures	Class I, Group D, Unclassified

### **Our Determination**

Possible Hazards: Buildup of methane gas or flammable vapors.

Classification: A Class I, Unclassified area exists within a continuously ventilated area at six changes per hour.

Conclusion: All electrical systems within this envelope should be designed and installed in accordance with the above NEC classification requirements.

## **LABORATORY, BATHROOM, CHLORINE STORAGE ROOM, ELECTRICAL ROOM, SPARE PARTS STORAGE ROOM, AND CHLORINE GAS SCRUBBER**

### **Closest NFPA 820 Description**

The NFPA does not include classifications for these areas.

### **Our Determination**

Possible Hazards: There are no hazards in these areas.



Mr. John H. Glenn  
March 5, 2021  
Page 3

Classification: These areas are considered Unclassified.

Conclusion: There are no special electrical requirements in these areas.

We understand that Washington State Department of Labor and Industries Electrical Inspectors will rely on your agreement with the hazardous area classifications described above. We will be contacting you in the near future to discuss these hazardous areas at the Wastewater Treatment Facility and to reach a mutual agreement on their classifications. If we do not receive a response to this letter within 60 calendar days, we will assume that your jurisdiction agrees with our assessment and will proceed with the system design according to the conclusions stated above.

Please contact me at (509) 453-4833 or via email at [nwetch@g-o.com](mailto:nwetch@g-o.com) if you have any questions or need any additional information.

Sincerely,

GRAY & OSBORNE, INC.

A handwritten signature in blue ink, reading "Nancy Wetch", is written over the printed name. The signature is fluid and cursive.

Nancy Wetch, P.E.

NW/ma

cc: Mr. Stuart Dezellem, Public Works Director, City of Bridgeport

**APPENDIX D**

**INADVERTENT DISCOVERY PLAN**



## INADVERTENT DISCOVERY PLAN PLAN AND PROCEDURES FOR THE DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6000 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay Service at 711. People with a speech disability may call TTY at 877-833-6341.

Site Name(s): City of Bridgeport  
Wastewater Treatment Facility

Location: Bridgeport, Washington

County: Douglas

Project Organization: City of Bridgeport

*If this Inadvertent Discovery Plan (IDP) is for multiple (batched) projects, ensure the location information covers all project areas.*

### 1. INTRODUCTION

The IDP outlines procedures to perform in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. An IDP is required, as part of Agency Terms and Conditions for all grants and loans, for any project that creates disturbance above or below the ground. An IDP is not a substitute for a formal cultural resource review (Executive 05-05 or Section 106).

Once completed, **the IDP shall always be kept at the project site** during all project activities. All staff, contractors, and volunteers shall be familiar with its contents and know where to find it.

### 2. CULTURAL RESOURCE DISCOVERIES

A cultural resource discovery could be prehistoric or historic. Examples include (see images for further examples):

- An accumulation of shell, burned rocks, or other food related materials.
- Bones, intact or in small pieces.
- An area of charcoal or very dark stained soil with artifacts.
- Stone tools or waste flakes (for example, an arrowhead or stone chips).
- Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings.
- Agricultural or logging materials that appear older than 50 years. These could include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, and many other items.
- Clusters of tin cans or bottles, or other debris that appear older than 50 years.
- Old munitions casings. **Always assume these are live and never touch or move.**
- Buried railroad tracks, decking, foundations, or other industrial materials.
- Remnants of homesteading. These could include bricks, nails, household items,

toys, food containers, and other items associated with homes or farming sites. The above list does not cover every possible cultural resource. When in doubt, assume the material is a cultural resource.

### 3. ON-SITE RESPONSIBILITIES

If any employee, contractor, or subcontractor believes that they have uncovered cultural resources or human remains at any point in the project, take the following steps to **Stop-Protect-Notify**. If you suspect that the discovery includes human remains, also follow Sections 5 and 6.

#### STEP A: Stop Work.

All work must stop immediately in the vicinity of the discovery.

#### STEP B: Protect the Discovery.

Leave the discovery and the surrounding area untouched and create a clear, identifiable, and wide boundary (30 feet or larger) with temporary fencing, flagging, stakes, or other clear markings. Provide protection and ensure integrity of the discovery until cleared by the Department of Archaeological and Historical Preservation (DAHP) or a licensed, professional archaeologist.

Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site. Do not allow work to resume within the boundary until the requirements of this IDP are met.

#### STEP C: Notify Project Archaeologist (if applicable).

If the project has an archaeologist, notify that person. If there is a monitoring plan in place, the archaeologist will follow the outlined procedure.

#### STEP D: Notify Project and Washington Department of Ecology (Ecology) contacts.

##### Project Lead Contacts

###### Primary Contact

Name: Stuart Dezelle (City)

Phone: (509) 686-3613

Email: [pwsuper@nwi.net](mailto:pwsuper@nwi.net)

###### Alternate Contact

Name: Nancy Wetch (Gray & Osborne)

Phone: (509) 453-4833

Email: [nwetch@g-o.com](mailto:nwetch@g-o.com)

##### Ecology Contacts (completed by Ecology Project Manager)

###### Ecology Project Manager

Name: Cynthia Wall

Program: CCWF/SRF

Phone: (509) 575-2490

Email: [CYWA461@ecy.wa.gov](mailto:CYWA461@ecy.wa.gov)

###### Alternate or Cultural Resource Contact

Name: Liz Ellis

Program: Water Quality Program

Phone: (360) 628-4410

Email: [liz.ellis@ecy.wa.gov](mailto:liz.ellis@ecy.wa.gov)

### **STEP E: Ecology will notify DAHP.**

Once notified, the Ecology Cultural Resource Contact or the Ecology Project Manager will contact DAHP to report and confirm the discovery. To avoid delay, the Project Lead/Organization will contact DAHP if they are not able to reach Ecology.

DAHP will provide the steps to assist with identification. DAHP, Ecology, and Tribal representatives may coordinate a site visit following any necessary safety protocols. DAHP may also inform the Project Lead/Organization and Ecology of additional steps to further protect the site.

**Do not continue work until DAHP has issued an approval for work to proceed in the area of, or near, the discovery.**

#### DAHP Contacts:

Name: Rob Whitlam, PhD  
Title: State Archaeologist  
Cell: 360-890-2615  
Email: [Rob.Whitlam@dahp.wa.gov](mailto:Rob.Whitlam@dahp.wa.gov)  
Main Office: 360-586-3065

#### **Human Remains/Bones:**

Name: Guy Tasa, PhD  
Title: State Anthropologist  
Cell: 360-790-1633 (24/7)  
Email: [Guy.Tasa@dahp.wa.gov](mailto:Guy.Tasa@dahp.wa.gov)

### **4. TRIBAL CONTACTS**

In the event cultural resources are discovered, the following tribes will be contacted. See Section 10 for Additional Resources.

Tribe: Confederated Tribes of the  
Coville Reservation  
Name: Guy Moura  
Title: Program Manager  
Phone: (509) 634-2695  
Email: [guy.moura@covilletribes.com](mailto:guy.moura@covilletribes.com)

Tribe: Spokane Tribe of Indians  
Name: Randy Abrahamson  
Title: THPO  
Phone: (509) 258-4222  
Email: [randya@spokanetribe.com](mailto:randya@spokanetribe.com)

Tribe: Confederated Tribes of the  
Coville Reservation  
Name: Elizabeth Armstrong  
Title: Archeologist II  
Phone: (509) 634-2887  
Email: [elizabeth.armstrong.HSY@colvilletribes.com](mailto:elizabeth.armstrong.HSY@colvilletribes.com)

Tribe:  
Name:  
Title:  
Phone:  
Email:

Please provide contact information for additional tribes within your project area, if needed, in Section 11.

**5. FURTHER CONTACTS (if applicable)**

If the discovery is confirmed by DAHP as a cultural or archaeological resource, or as human remains, and there is a partnering federal or state agency, Ecology or the Project Lead/Organization will ensure the partnering agency is immediately notified.

Federal Agency:

Agency:

Name:

Title:

Phone:

Email:

State Agency:

Agency: Department of Ecology

Name: Cynthia Wall

Title: CCWF/SRF Project Manager

Phone: (509) 575-2490

Email: [CYWA461@ecy.wa.gov](mailto:Cywa461@ecy.wa.gov)

## 6. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL REMAINS

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Follow the steps under **Stop-Protect-Notify**. For specific instructions on how to handle a human remains discovery, see: [RCW 68.50.645: Skeletal human remains—Duty to notify—Ground disturbing activities—Coroner determination—Definitions](#).

**Suggestion:** If you are unsure whether the discovery is human bone or not, contact Guy Tasa with DAHP, for identification and next steps. Do not pick up the discovery.

Guy Tasa, PhD State Physical Anthropologist

[Guy.Tasa@dahp.wa.gov](mailto:Guy.Tasa@dahp.wa.gov)

(360) 790-1633 (Cell/Office)

For discoveries that are confirmed or suspected human remains, follow these steps:

1. Notify law enforcement and the Medical Examiner/Coroner using the contacts below. **Do not call 911** unless it is the only number available to you.

Enter contact information below (required):

- Local Medical Examiner or Coroner name and phone: 509-745-8535
  - Local Law Enforcement main name and phone: 509-884-0941
  - Local Non-Emergency phone number (911 if without a non-emergency number): 800-452-1732
2. The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human or if the discovery site constitutes a crime scene and will notify DAHP.
  3. **DO NOT speak with the media, allow photography or disturbance of the remains, or release any information about the discovery on social media.**
  4. If the remains are determined to be non-forensic, cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed by others or disturbed.

Further activities:

- Per [RCW 27.44.055](#), [RCW 68.50](#), and [RCW 68.60](#), DAHP will have jurisdiction

over non-forensic human remains. Ecology staff will participate in consultation. The Project Lead/Organization may also participate in consultation.

- Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in [RCW 27.44.055](#), [RCW 68.50](#), and [RCW 68.60](#).
- When consultation and documentation activities are complete, work in the discovery area may resume as described in Section 8.

If the project occurs on federal lands (such as a national forest or park or a military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) apply and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, the Project Lead/Organization will comply with applicable state and federal laws, and the above protocol.

## **7. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS**

Archaeological resources discovered during construction are protected by state law [RCW 27.56](#) and assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

The Project Lead/Organization must ensure that proper documentation and field assessments are made of all discovered cultural resources in cooperation with all parties: the federal agencies (if any), DAHP, Ecology, affected tribes, and the archaeologist.

An archaeologist will record all prehistoric and historic cultural material discovered during project construction on a standard DAHP archaeological site or isolate inventory form. They will photograph site overviews, features, and artifacts and prepare stratigraphic profiles and soil/sediment descriptions for minimal subsurface exposures. They will document discovery locations on scaled site plans and site location maps.

Cultural features, horizons, and artifacts detected in buried sediments may require the archaeologist to conduct further evaluation using hand-dug test units. They will excavate units in a controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. They may also use a test unit or trench excavation to determine if an intact occupation surface is present. They will only use test units when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. They will conduct excavations using standard archaeological techniques to precisely document the location of cultural deposits, artifacts, and features.

The archaeologist will record spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock for each unit on a standard form. They will complete test excavation unit level forms, which will include plan maps for each excavation level and artifact counts and material types, number, and vertical provenience (depth below surface and stratum association where applicable) for all recovered artifacts. They will draw a stratigraphic profile for at least one wall of each test excavation unit.

The archaeologist will screen sediments excavated for purposes of cultural resources

investigation through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

The archaeologist will analyze, catalogue, and temporarily curate all prehistoric and historic artifacts collected from the surface and from probes and excavation units. The ultimate disposition of cultural materials will be determined in consultation with the federal agencies (if any), DAHP, Ecology, and the affected tribe(s).

Within 90 days of concluding fieldwork, the archaeologist will provide a technical report describing any and all monitoring and resultant archaeological excavations to the Project Lead/Organization, who will forward the report to Ecology, the federal agencies (if any), DAHP, and the affected tribe(s) for review and comment.

If assessment activities expose human remains (burials, isolated teeth, or bones), the archaeologist and Project Lead/Organization will follow the process described in **Section 6**.

## **8. PROCEEDING WITH WORK**

The Project Lead/Organization shall work with the archaeologist, DAHP, and affected tribe(s) to determine the appropriate discovery boundary and where work can continue.

Work may continue at the discovery location only after the process outlined in this plan is followed and the Project Lead/Organization, DAHP, any affected tribe(s), Ecology, and the federal agencies (if any) determine that compliance with state and federal laws is complete.

## **9. ORGANIZATION RESPONSIBILITY**

The Project Lead/Organization is responsible for ensuring:

- This IDP has complete and accurate information.
- This IDP is immediately available to all field staff at the site and available by request to any party.
- This IDP is implemented to address any discovery at the site.
- That all field staff, contractors, and volunteers are instructed on how to implement this IDP.

## **10. ADDITIONAL RESOURCES**

### **Informative Video**

Ecology recommends that all project staff, contractors, and volunteers view this informative video explaining the value of IDP protocol and what to do in the event of a discovery. The target audience is anyone working on the project who could unexpectedly find cultural resources or human remains while excavating or digging. The video is also posted on DAHP's inadvertent discovery language website.

[Ecology's IDP Video](https://www.youtube.com/watch?v=ioX-4cXfbDY) (<https://www.youtube.com/watch?v=ioX-4cXfbDY>)

## **Informational Resources**

[DAHP](https://dahp.wa.gov) (<https://dahp.wa.gov>)

[Washington State Archeology \(DAHP 2003\)](https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf)

([https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch\\_0.pdf](https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf))

[Association of Washington Archaeologists](https://www.archaeologyinwashington.com) (<https://www.archaeologyinwashington.com>)

## **Potentially Interested Tribes**

[Tribal Contacts: Interactive Map of Tribes by Area](https://dahp.wa.gov/archaeology/tribal-consultation-information)

(<https://dahp.wa.gov/archaeology/tribal-consultation-information>)

[Tribal Contacts - WSDOT Tribal Contact Website](https://wsdot.wa.gov/tribal/TribalContacts.htm)

(<https://wsdot.wa.gov/tribal/TribalContacts.htm>)

## **11. ADDITIONAL INFORMATION**

Please add any additional contact information or other information needed within this IDP.

**Implement the IDP if you see...**

**Chipped stone artifacts.**

Examples are:

- Glass-like material.
- Angular material.
- “Unusual” material or shape for the area.
- Regularity of flaking.
- Variability of size.



*Stone artifacts from Oregon.*



*Stone artifacts from Washington.*



*Biface-knife, scraper, or pre-form found in NE Washington. Thought to be a well knapped object of great antiquity. Courtesy of Methow Salmon Rec. Foundation.*

## Implement the IDP if you see...

### Ground stone artifacts.

Examples are:

- Unusual or unnatural shapes or unusual stone.
- Striations or scratching.
- Etching, perforations, or pecking.
- Regularity in modifications.
- Variability of size, function, or complexity.



Above: Fishing Weight - credit [CRITFC Treaty Fishing Rights website](#).



Artifacts from unknown locations (left and right images).



## Implement the IDP if you see...

### Bone or shell artifacts, tools, or beads.

Examples are:

- Smooth or carved materials.
- Unusual shape.
- Pointed as if used as a tool.
- Wedge shaped like a “shoehorn”.
- Variability of size.
- Beads from shell (dentalium) or tusk.



Upper Left: *Bone Awls from Oregon.*

Upper Center: *Bone Wedge from California.*

Upper Right: *Plateau dentalium choker and bracelet, from Nez Perce National Historical Park, 19th century, made using Antalis pretiosa shells*  
*Credit: Nez Perce - Nez Perce National Historical Park, NEPE 8762, Public Domain.*

Above: *Tooth Pendants. Right: Bone Pendants. Both from Oregon and Washington.*



## Implement the IDP if you see...

### Culturally modified trees, fiber, or wood artifacts.

Examples are:

- Trees with bark stripped or peeled, carvings, axe cuts, de-limbing, wood removal, and other human modifications.
- Fiber or wood artifacts in a wet environment.
- Variability of size, function, and complexity.



Left and Below: *Culturally modified tree and an old carving on an aspen (Courtesy of DAHP). These are examples of above ground cultural resources.*

Right, Top to Bottom: *Artifacts from Mud Bay, Olympia: Toy war club, two strand cedar rope, wet basketry.*



## Implement the IDP if you see...

### Strange, different, or interesting looking dirt, rocks, or shells.

Human activities leave traces in the ground that may or may not have artifacts associated with them. Examples are:

- “Unusual” accumulations of rock (especially fire-cracked rock).
- “Unusual” shaped accumulations of rock (such as a shape similar to a fire ring).
- Charcoal or charcoal-stained soils, burnt-looking soils, or soil that has a “layer cake” appearance.
- Accumulations of shell, bones, or artifacts. Shells may be crushed.
- Look for the “unusual” or out of place (for example, rock piles in areas with otherwise few rocks).



*Shell Midden pocket in modern fill discovered in sewer trench.*



*Underground oven. Courtesy of DAHP.*

*Shell midden with fire cracked rock.*



*Hearth excavated near Hamilton, WA.*

**Implement the IDP if you see...**

**Historic period artifacts (historic archaeology considered older than 50 years).**

Examples are:

- Agricultural or logging equipment. May include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, etc.
- Domestic items including square or wire nails, amethyst colored glass, or painted stoneware.



*Left: Top to Bottom: Willow pattern serving bowl and slip joint pocket knife discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.*



*Right: Collections of historic artifacts discovered during excavations in eastern Washington cities.*



**Implement the IDP if you see...**

**Historic period artifacts (historic archaeology considered older than 50 years).**

Examples are:

- Railway tokens, coins, and buttons.
- Spectacles, toys, clothing, and personal items.
- Items helping to understand a culture or identity.
- Food containers and dishware.



Main Image: Dishes, bottles, work boot found at the North Shore Japanese bath house (ofuro) site, Courtesy Bob Muckle, Archaeologist, Capilano University, B.C. This is an example of an above ground resource.



Right, from Top to Bottom:  
Coins, token, spectacles and  
Montgomery Ward pitchfork  
toy discovered during  
Seattle Smith Cove  
shantytown (45-KI-1200)  
excavation.



## Implement the IDP if you see...

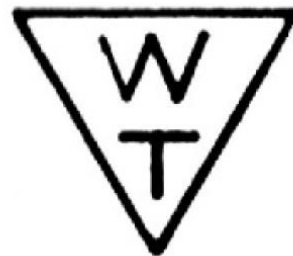
- Old munition casings – if you see ammunition of any type – ***always assume they are live and never touch or move!***
- Tin cans or glass bottles with an older manufacturer's technique – maker's mark, distinct colors such as turquoise, or an older method of opening the container.



Far Left: .303 British cartridge found by a WCC planting crew on Skagit River. ***Don't ever touch something like this!***

Left: Maker's mark on bottom of old bottle.

Right: Old beer can found in Oregon. ACME was owned by Olympia Brewery. Courtesy of Heather Simmons.



Logo employed by Whithall Tatum & Co. between 1924 to 1938 (Lockhart et al. 2016).



Can opening dates, courtesy of W.M. Schroeder.

**Implement the IDP if you see...**

**Historic foundations or buried structures.**

Examples are:

- Foundations.
- Railroad and trolley tracks.
- Remnants of structures.



Counter Clockwise, Left to Right: *Historic structure 45KI924, in WSDOT right of way for SR99 tunnel. Remnants of Smith Cove shantytown (45-KI-1200) discovered during Ecology CSO excavation, City of Spokane historic trolley tracks (above ground historic resources) uncovered during stormwater project, intact foundation of historic home that survived the Great Ellensburg Fire of July 4, 1889, uncovered beneath parking lot in Ellensburg.*

**Implement the IDP if you see...**

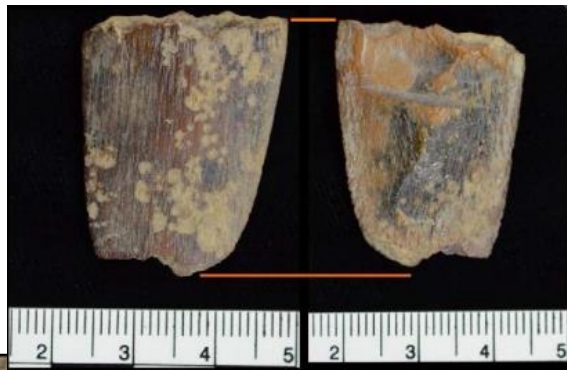
**Potential human remains.**

Examples are:

- Grave headstones that appear to be older than 50 years.
- Bones or bone tools--intact or in small pieces. It can be difficult to differentiate animal from human so they must be identified by an expert.
- These are all examples of animal bones and are not human.

Center: *Bone wedge tool, courtesy of Smith Cove Shantytown excavation (45KI1200).*

*Other images (Top Right, Bottom Left, and Bottom) Center: Courtesy of DAHP.*



Directly Above: *This is a real discovery at an Ecology sewer project site.*

*What would you do if you found these items at a site? Who would be the first person you would call?*

*Hint: Read the plan!*

## **APPENDIX E**

### **SRF FORMS**

## Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE<sup>1</sup> subcontractor<sup>2</sup> the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity <b>Department of Ecology</b>	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment, or Supplies	Amount Received by Prime Contractor

<sup>1</sup> A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

<sup>2</sup> Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.



**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Participation Form**

Please use the space below to report any concerns regarding the above EPA-funded project:

<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>



**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Performance Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Utilization Form**

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE<sup>1</sup> subcontractors<sup>2</sup> and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)		Point of Contact
Address			
Telephone No.		Email Address	
Issuing/Funding Entity <b>Department of Ecology</b>			

I have identified potential DBE certified subcontractors <input type="checkbox"/> YES <input type="checkbox"/> NO			
If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Estimated Dollar Amount	Currently DBE Certified?

Add more lines if needed

<sup>1</sup> A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

<sup>2</sup> Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.



**Disadvantaged Business Enterprise (DBE) Program  
DBE Subcontractor Utilization Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>