CONTRACT DOCUMENTS

I-5 PUMP STATION AND FORCE MAIN UPGRADES

FOR

City of Woodburn

Volume 1 of 3

JULY 2021

City of Woodburn
Engineering Department
190 Garfield St
Woodburn, Oregon 97071

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I-5 PUMP STATION AND FORCE MAIN UPGRADES
FOR
CITY OF WOODBURN
PROJECT NO. 2018-012-11
BID NO. 2021-05

Division 44 through Division 46
NOT USED

VOLUME 3 OF 3

DRAWINGS
See Sheet G-1 for Drawing Index

END OF SECTION

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Divisions 01, 05, 07, 08, 09, 10, 11, 22, 23, 31, 32, 33, 41, 43 Sections 02 30 00, 02 41 00, 40 05 13, 40 05 23.72, 40 05 51, 40 05 51.24, 40 05 61, 40 05 62, 40 94 23

PROFESSIONAL OF RECORD CERTIFICATION(S):

	Signing as the Professional of Record for the divisions and sections listed below: Division 03, 04, 06 Section 02 35 00

PROFESSIONAL OF RECORD CERTIFICATION(S):

 2021.07.01 13:20:07-07'00'	Signing as the Professional of Record for the divisions and sections listed below: Division 26 Section 40 60 00

SECTION 2 INVITATION TO BID

By the
CITY OF WOODBURN
for
I-5 PUMP STATION AND FORCE MAIN UPGRADES

PROJECT No. 2018-012-11
BID No. 2021-05

Sealed bids for the construction of ***"I-5 Pump Station and Force Main Upgrades"*** will be received by the City of Woodburn, OR at City Hall Annex, 190 Garfield St. until **2:00 PM**, **July 29, 2021** and will thereafter be publicly opened and read.

Proposals shall be addressed to the Public Works Projects & Engineering Director, City of Woodburn, and 190 Garfield St., Woodburn, OR 97071. Bids shall be submitted in a plain sealed envelope bearing the Bidder's name, the name of the project and the date and time of the Bid opening, and shall be marked **"Bid No. 2021-05"** and bidders shall indicate on the Form of Proposal that ***"Bidder will comply with the provisions of Oregon Revised Statutes (ORS) Chapter 279C.840"***.

The major items of work are estimated as follows:

1. New 2,900 gallons-per-minute (GPM) raw sewage pump station at the existing I-5 Pump Station site, including a new 15-foot diameter concrete wet well.
2. New 533 square-foot concrete masonry unit Electrical Building at the I-5 Pump Station site.
3. Approximately 3,300 lineal feet of new 16-inch ductile iron sewer force main pipe in City streets, including connections to the existing 12-inch ductile iron force main pipe, and five new combination air-vacuum valve stations.
4. Water, sewer and drainage piping, stormwater basin, and demolition work at the existing I-5 Pump Station site.
5. Electrical improvements, including new diesel standby generator, at the existing I-5 Pump Station site.
6. Grading, landscaping, paving, fencing, and other miscellaneous works at the existing I-5 Pump Station site, as detailed in the plans and specifications.

Plans and specifications may be examined at the City Engineer's Office, City Hall Woodburn, OR on or after **Friday, July 2, 2021.** Copies of the Bid Documents may be obtained from the City Engineer's Office upon deposit of a non-refundable fee of one hundred fifty dollars ($150.00) for each set. Additionally, electronic plan sets are available for viewing and downloading on the Engineering Division's website at https://www.woodburn-or.gov/publicworks/page/bids-and-rfps and/or have been downloaded by the following plan centers.

DJC Plan Center – Portland, OR
Contractor's Plan Center – Clackamas, OR
Salem Contractor's Exchange – Salem, OR

Prospective bidders and interested parties may attend a Pre-Bid Conference. The Pre-Bid Conference will take place at the Project Site located at 598 Stacy Allison Way, Woodburn, OR 97071 at 10:00 a.m. on July 14, 2021.

Contractors must be qualified in accordance with the applicable parts of ORS 279 in order to enter into a contract with the City of Woodburn for public work in Oregon. To document qualifications, bidders shall submit a completely executed Contractor's Prequalification Application when submitting their bid proposal. Prequalification application forms may be obtained at the State of Oregon Department of Administrative Services, Purchasing Section, 1225 Ferry Street S.E., Salem, Oregon 97301-4285 or on-line at:

http://www.oregon.gov/DAS/EGS/PS/docs/contractors-pre-application.pdf

The City of Woodburn will investigate and determine the qualifications of the bidders as part of its evaluation of the bids.

No bid for a construction contract shall be received or considered unless the bidder is registered with the Construction Contractors Board. The Contractor and every Subcontractor must have a Public Works Bond filed with the CCB before starting work on the project.

All proposals shall be made on the proposal forms. All proposals shall be accompanied by a Bid Bond, equal to ten percent (10%) of the total bid. Bid Bond shall be forfeited to the City if the Contractor fails to execute the contract within time allotted under the specifications.

Pursuant to ORS 279C.370, bidders on public works projects with a contract value of $100,000 or more are required to disclose, 2-hours after bid opening, the bidders first-tier subcontractors. The bidder shall provide the information as required on City of Woodburn first-tier disclosure form, provided in the contract documents**.**

At the discretion of the Project Manager, Addenda (um) and Contract clarifications shall either be posted on the City, Engineering Division website or delivered to Plan Holders via facsimile. Potential Bidders should check the website on a daily basis until the Bid Opening date. The website can be found at https://www.woodburn-or.gov/publicworks/page/bids-and-rfps. Addenda must be signed and submitted with the Bid Proposal to be considered a responsive offer.

Although contract award is expected to be made by the City Council on **August 9, 2021** the City of Woodburn reserves the right to reject any and all bids not in compliance with prescribed bidding procedures and requirements, and may reject for good cause any and all bids upon a finding of the Agency if it is in the public interest to do so. The three (3) lowest bidders may not withdraw or modify his bid prior to the lapse of 35-days after the bid opening.

This project must be substantially completed within **four hundred and fifty (450) calendar days** after the date of "Notice to Proceed".

Heather Pierson
City Recorder
City of Woodburn, OR 97071

SECTION 3 INSTRUCTIONS TO BIDDERS
BID #2021-05

1. GENERAL:

A. SPECIFICATIONS – The Specifications that is applicable to the Work on this Project is the 2021 edition of the "Oregon Standard Specifications for Construction" as modified by Special Provisions, and the "Technical Specifications" specific to this Project.

B. This is a formal procure. Faxed bids will not be accepted.

C. Bidding requirements and obligations shall comply and conform to Part 00100 of the General Conditions of the Standard Specifications or as modified by the Special Provisions or herein.

2. SECURING CONTRACT DOCUMENTS:

A. Copies of the Contract Documents are on file with the Public Works Department - Engineering Division, located at:

City Hall Annex
190 Garfield Street
Woodburn, OR 97071.

B. Questions regarding bidding, materials or technical requirements should be directed to the Project Manager at:

Dago Garcia, City Engineer
190 Garfield St.
Woodburn, OR 97071
Phone: 503.982.5248
Email: dago.garcia@ci.woodburn.or.us

Or

Eric Liljequist, PE, Public Works Director
190 Garfield St.
Woodburn, OR 97071
Phone: 503.982.5241
Email: Eric.Liljequist@ci.woodburn.or.us

C. Bidder is responsible for completing and returning all page(s), attachment(s) which require a response.

D. Plan Holder's List – An electronic copy of the "Plan Holders List" is provided on the Agency website and will be periodically updated. Contractors, suppliers and others wishing to be added to this list should contact the Project Manager as identified in 2.B.

E. Project Notifications – Addenda, clarifications, etc. shall be posted on the Agency website and are the responsibility of the Contractor to download before submission

of bids. Contractor shall sign and submit with offer all Addenda associated (posted on website) with the project.

3. PROJECT FINANCING:

A. This project is financed and paid for by the City of Woodburn.

B. The Engineer's cost estimated range for the construction of this project is between: $5,000,000 and $6,000,000.

C. This project is subject to the prevailing wages rates under the Oregon Prevailing Wages Law (BOLI).

D. The applicable BOLI prevailing wage rates are included with the Special Provisions.

Applicable link is as follows:

https://www.oregon.gov/boli/employers/Pages/prevailing-wage-rates.aspx

and listed as "Prevailing Wage Rates for Public Works Contracts in Oregon effective January 1, 2021"

4. CONSTRUCTION AGREEMENT

A. The construction contract between Owner and Contractor shall be provided by The City of Woodburn. A sample Agreement is included in these documents.

5. PREBID CONFERENCE:

A. Prospective bidders interested parties may attend a Pre-Bid Conference. The Pre-Bid Conference will take place at the Project Site located at 598 Stacy Allison Way, Woodburn, OR 97071 at 10:00 a.m. on Wednesday July 14, 2021.

6. AWARD OF THE CONTRACT:

A. Award of the Contract, by the Contract Review Board (City Council), will be by recommendation of the Public Works Department, based on the lowest cost offer of the responsive and responsible Bidder in accordance with Section 00130 of the Oregon Standard Construction Specifications and all modifications by Special Provisions.

B. Notice to Proceed will be provided by the City to the Contractor within 90 days of Contract Award.

7. TIME OF COMPLETION:

A. The project shall be substantially completed within four-hundred and fifty (450) calendar days after the dated 'Notice to Proceed". Substantial completion is defined as successful installation, connection, and pressure testing of the 3,230-linear-feet replacement 16-inch sewer force main, beginning of operational testing of two installed 140 Hp submersible pumps, installation and completion of operational

testing of new generator and automatic transfer switch, and completion of paving at the I-5 Pump Station site. Final completion shall be four-hundred and eighty (480) days after the date of the "Notice to Proceed".

SECTION 4
CERTIFICATION PAGE

Each Bidder (offeror) must read and comply with the following Sections. Failure to do so may result in bid/proposal (offer) rejection.

RESIDENCY INFORMATION

ORS 279A.120 (2) states "For the purposes of awarding a public contract, a contracting agency shall: (a) Give preference to goods or services that have been manufactured or produced in this state if price, fitness, availability and quality are otherwise equal; and (b) Add a percent increase to the bid of a nonresident bidder equal to the percent, if any, of the preference given to the bidder in the state in which the bidder resides."

"Resident bidder" means a bidder that has paid unemployment taxes or income taxes in this state during the 12 calendar months immediately preceding submission of the bid, has a business address in this state and has stated in the bid whether the bidder is a "resident bidder" [ORS 279A.120(1)(b)].

"Non-resident bidder" means a bidder who is not a "resident bidder" as defined above [ORS 279A.120 (1)(b)].

Check one: Bidder is a (☐) RESIDENT bidder (☐) NON-RESIDENT bidder.

CERTIFICATION OF COMPLIANCE WITH DISCRIMINATION LAWS

By my signature in Form of Proposal, I hereby attest or affirm under penalty of perjury that I am authorized to act on behalf of Contractor in this matter, and to the best of my knowledge the Contractor has not discriminated against minority, women or emerging small business enterprises certified under ORS 200.055, in obtaining any required subcontract or against a business enterprise that is owned or controlled by or that employs a disable veteran as defined in ORS 408.225.

CERTIFICATION OF COMPLIANCE WITH OREGON TAX LAWS

By my signature in Form of Proposal, I hereby attest or affirm under penalty of perjury that I am authorized to act on behalf of Contractor in this matter that I have authority and knowledge regarding the payment of taxes, and that Contractor is, to the best of my knowledge, not in violation of any Oregon Tax Laws.

For purposes of this certificate, 'Oregon Tax Laws' means those programs listed in ORS 305.380(4) which is incorporated herein by this reference. Examples include the state inheritance tax, personal income tax, withholding tax, corporation income and excise taxes, amusement device tax, timber taxes, cigarette tax, other tobacco tax, 9-1-1 emergency communications tax, the homeowners and renters property tax relief program and local taxes administered by the Department of Revenue.

VERIFICATION OF RESPONSIBILITY

The City reserves the right, pursuant to ORS 279C.375 and OAR 137-049-0390, to investigate and evaluate, at any time prior to award and execution of the contract, the lowest bidder's (apparent successful offeror's) ability to perform the contract. Submission of a signed offer shall constitute approval for the City to obtain any information the City deems necessary to conduct the evaluation. The City shall notify the apparent successful offeror, in writing, of any other documentation required. Being a responsible bidder may include having the appropriate financial, material, equipment, facility and personnel resources and expertise, or ability to obtain the resources and expertise to perform the contract. Contractor shall have a satisfactory record of contract performance. The Contractor shall also have a satisfactory record of integrity. An unsatisfactory record of integrity may include previous violations of state environmental laws or false certifications made to any Public Agency. The Contractor is to be qualified legally to contract with the City of Woodburn. Failure to promptly provide any requested information may result in bid/proposal rejection.

The City may postpone the award of the contract after announcement of the apparent successful offeror in order to complete its investigation and evaluation. Failure of the apparent successful offer or to demonstrate responsibility, as required under ORS 279C.375 and OAR 137-049-0390, may render the offeror non-responsible and shall constitute grounds for offer rejection.

DRUG TESTING POLICY CERTIFICATION

DRUG-TESTING POLICY CERTIFICATION:
By my signature in Form of Proposal, I hereby attest or affirm under penalty of perjury that I am authorized to act on behalf of Contractor in the matter, and to the best of my knowledge the Contractor has a drug-testing program in place which applies to all employees. Contractor shall maintain a drug-testing program at all times during the performance of the Contract awarded. Failure to maintain such a program shall constitute a material breach of contract. [ORS 279C.505J]

SECTION 5
FORM OF PROPOSAL
For
I-5 PUMP STATION AND FORCE MAIN UPGRADES

PROJECT No. 2018-012-11
Bid No. 2021-05

Honorable Mayor and City Council
City Hall
Woodburn, Oregon 97071

The undersigned, hereinafter called the Bidder, declares that the only persons or parties interested in this Proposal are those named herein, that the Proposal is in all respects fair and without fraud, which it is made without any connection or collusion with any person making another Proposal on this Contract.

The Bidder further declares that he has carefully examined the Contract Documents for the construction of the proposed improvements; that he has personally inspected the site; that he has satisfied himself as to the quantities of materials, items of equipment, and conditions or work involved, including the fact that the description of work and materials as included herein, is brief and is intended only to indicate the general nature of such items and to identify the said quantities with the detailed requirements of the Contract Documents; and that this Proposal is made according to the provisions and the terms of the Contract Documents, which Documents are herein attached and are hereby made a part of this Proposal.

The Bidder further agrees to complete construction of all work in all respects in accordance with the Special Provisions incorporated herein.

In the event the Bidder is awarded the Contract and shall fail to complete the work within the time limit set under Specifications of this document or extended time limit agreed upon, as more particularly set forth in the Contract Documents, liquidated damages shall be paid to the City of Woodburn, Oregon, using the rate formula outlined in the Special Provisions, and not less than $1,000.00 per day, until the work shall have been finished, as provided by the Contract Documents.

The Bidder further proposes to accept as full payment for the work proposed herein the amount computed under the provisions of the Contract Documents and based on the following unit price amounts, it being expressly understood that the unit prices are independent of the exact quantities involved, that they represent a true measure of the labor and material required to perform the work, including all allowance for overhead and profit for each type and unit of work called for in these Contract Documents.

The amounts shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.

It is declared that the Bidder will comply with all provisions of ORS 279C.840. The workmen on the project will be paid Oregon Prevailing Wage Rates (also called "PWR").

It is agreed that if the Bidder is awarded the Contract for the work herein proposed and shall fail or refuse to execute the Contract and furnish the specified Performance Bond within ten (10) calendar days after receipt of notification of acceptance of his Proposal, then, in that event, the bid security in the sum of:

(In Words):_____

(In Numbers): $_____

deposited herewith according to the conditions of the Advertisement for Bids and Information to Bidders, shall be retained by the City of Woodburn, Oregon, as liquidated damages; and it is agreed that the said sum is a fair measure of the amount of damage the City of Woodburn will sustain in case the Bidder shall fail or refuse to enter into the contract for the said work and to furnish the Performance Bond as specified in the Contract Documents. Bid security in the form of a certified check shall be subject to the same requirements as a bid bond.

If the Bidder is awarded a construction contract on this proposal, the surety who will provide the Performance Bond will be:

_____ Whose address is:

_____, _____, _____
Street City State Zip

Agent's Name:_____ _____
Phone

The address for all communications concerned with this Proposal and where the Contract shall be sent is:

Contractor: _____ doing business at:

_____ , _____, _____
Street City State Zip

Bid Form

City of Woodburn, OR
I-5 Pump Station and Force Main Upgrades

Item No.	Items of Work and Materials	Units	Unit Price	Approx. Quantity	Extended Price
1	Mobilization, Bonds, Insurance, and Demobilization	Lump Sum	$	1	$
2	Temporary Traffic Control, Complete	Lump Sum	$	1	$
3	Erosion and Sediment Control	Lump Sum	$	1	$
4	Existing Pump Station Demolition	Lump Sum	$	1	$
5	Pump Station, Complete	Lump Sum	$	1	$
6	Landscaping, Complete	Lump Sum	$	1	$
7	Dewatering	Lump Sum	$	1	$
8	4” CARV Assembly and Enclosure – New Force Main	Each	$	5	$
9	4” CARV Assembly and Enclosure on Existing FM	Lump Sum	$	1	$
10	16-Inch Ductile Iron Pipe with Class B Backfill	Linear Feet	$	3230	$
11	16-Inch Diameter Force Main Fittings	Pounds	$	2800	$
12	16-Inch Diameter Buried Plug Valves	Each	$	3	$
13	Existing 8” FM Abandonment	Lump Sum	$	1	$
14	Existing 12” FM Abandonment	Lump Sum	$	1	$
15	Discharge Manhole Coating	Lump Sum	$	1	$
16	HMAC Pavement Restoration: 6-Inch Depth	Square Yard	$	1500	$
17a	Sawcutting	Linear Feet	$	6800	$
17b	Sawcutting, Extra Depth	Linear Feet	$	50	
18	Trench Foundation Stabilization for Unsuitable Foundation Conditions	Cubic Yard	$	480	$
19	Rock Excavation	Cubic Yard	$	50	$
20	Connection to Existing 12-Inch FM at STA 1+00 on the Corner of W Hayes & Harvard	Lump Sum	$	1	$
21	Connection to Existing 12-Inch FM at STA 33+60 on W Lincoln St	Lump Sum	$	1	$
TOTAL BASE BID - (Items 1 through 21) =					***$***

The names of the principal officers of the corporation submitting this Proposal, or of the partnership, or of all persons interested in this Proposal as principals are as follows:

_____

_____

_____

(If Sole Proprietor or Partnership)

In witness hereto the undersigned has set his (its) hand this_____ day of _____, 20___.

_____ _____

Signature of Bidder Title (If Corporation)

In witness whereof the undersigned corporation has caused this instrument to be executed and its seal affixed by its duly authorized officer this_____ day of _____, 20___.

Name of Corp: _____

Oregon Corp. No: _____

By: _____

Title: _____

CCB No: _____

Attest: _____

Secretary

_____*"Bidder will comply with the provisions of Oregon Revised Statutes (ORS) 279C.840".*

Initial

Attest: _____

Bidder

SECTION 6
BID BOND
FOR
I-5 PUMP STATION AND FORCE MAIN UPGRADES
FOR
CITY OF WOODBURN, OREGON

KNOW ALL PEOPLE BY THESE PRESENTS:

That we,_____, hereinafter called
(Name of Contractor)
the PRINCIPAL, as Principal, and _____ ,
(Name of Surety)
a corporation and existing under and by virtue of the laws of the State of _____
and authorized to transact a surety business in the State of Oregon, hereinafter called the SURETY, as Surety, are held and firmly bound unto the City of Woodburn, a Municipal Corporation of the State of Oregon, hereinafter called the OBLIGEE, in the

penal sum of _____ Dollars

($_____) for the payment of which sum well and truly to be made, the said PRINCIPAL and the said SURETY bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS the PRINCIPAL has submitted a Bid Proposal for the I-5 Pump Station and Force Main Upgrades, City of Woodburn, Oregon.

NOW, THEREFORE, if the Bid Proposal submitted by the PRINCIPAL is accepted, and the Contract awarded to the PRINCIPAL, and if the PRINCIPAL shall execute the proposed Agreement and shall furnish such Performance and Payment Bonds as required by the Contract Documents within the time fixed by the Documents, then this obligation shall be void; if the PRINCIPAL shall fail to execute the proposed Agreement and furnish the bonds, the SURETY hereby agrees to pay to the OBLIGEE the penal sum as liquidated damages, within ten (10) days of such failure.

Signed and sealed this _____ day of _____ , 2021.

CONTRACTOR AS PRINCIPAL:	SURETY:
(Corp. Seal)	(Corp. Seal)
Company: _____	Company: _____
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
	(Attach Power of Attorney)

CITY OF WOODBURN, OR

SECTION 7 FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM

PROJECT NAME:	**I-5 Pump Station and Force Main Upgrades**		
PROJECT No:	**2018-012-11**	BID No:	**2021-05**
BID CLOSING DATE:	**July 29, 2021**	TIME:	**2:00 PM**
DISCLOSURE DEADLINE DATE:	**July 29, 2021**	TIME:	**4:00 PM**

This form must be submitted at the location specified in the Invitation to Bid on the advertised bid closing date with in two working hours after the advertised bid closing.

List below the name of each subcontractor that will be furnishing labor or materials and that is required to be disclosed, the category of work that the subcontractor will be performing and the dollar value of the subcontract. Enter "None" if there are no subcontractors that need to be disclosed. (IF NEEDED, ATTACH ADDITIONAL SHEETS.)

	NAME	DOLLAR VALUE	CATEGORY OF WORK
1		$	
2		$	
3		$	
4		$	
5		$	

The above listed first-tier subcontractor(s) are providing labor and/or materials with a Dollar Value equal to or greater:

a. 5% of the total contract price or $15,000 (including all alternates), whichever is greater; or
b. $350,000.00 regardless of the percentage of the total Contract Price.

FAILURE TO SUBMIT THIS FORM FILLED OUT BY THE DISCLOSURE DEADLINE WILL RESULT IN A NON-RESPONSIVE BID. A NON-RESPONSIVE BID WILL NOT BE CONSIDERED FOR AWARD.

Form Submitted by (Bidder Name): _____

Contact Name: _____ **Phone No:** _____

Deliver Form to Agency: CITY OF WOODBURN

Person Designated to Receive Form: CITY ENGINEER

Agency's Address: 190 Garfield Street, Woodburn, OR 97071

UNLESS OTHERWISE STATED IN THE ORIGINAL SOLICITATION, THIS DOCUMENT SHALL NOT BE FAXED.

SECTION 8
BID SUBMITTAL CHECKLIST

The following is a checklist of the items that shall be submitted with the Bidder's Bid Proposal

- ❑ Form of Proposal
- ❑ Bid Bond
- ❑ First Tier Subcontractor Disclosure Form (Submit within two hours after bid opening time)
- ❑ Certification Page
- ❑ Contractor's Prequalification Application

SECTION 9
CONSTRUCTION AGREEMENT

THIS AGREEMENT, made this_____ day of _____, **2021**, by and between _____., hereinafter called "CONTRACTOR" and the CITY OF WOODBURN, an Oregon Municipal Corporation, hereinafter called "City" or "Owner".

The Contractor, for the consideration hereinafter named, does hereby agree to furnish all materials, equipment, labor and necessary implements for the construction of the **I-5 Pump Station and Force Main Upgrades** and doing such other work as is necessary to make an appropriate and complete improvement.

All of said work shall be done according to the terms, conditions, and requirements of the Contract Documents including the: Advertisement of Bids, Contractor's signed Proposal, information to bidders, special specifications, general conditions, standard specifications, general specifications, and plans and Addendum Nos. **( )** for said improvement, which Contract Documents by this reference are made a part of this agreement.

Said improvement shall be completed by the date specified in said Contract Documents and if not so completed, unless said time for completion is extended, as provided in the Contract Documents, or if extended, if the same is not completed within time extended, the City will suffer liquidated damages as specified in the Contract Documents, which liquidated damages shall be retained out of any monies due or to become due under this agreement.

Payments shall be made as provided in the Contract Documents. The contract amount, as approved by the Council on **July 29, 2021**, and agreed by the Contractor, is **$_____**.

The City will pay the required fee to the Bureau of Labor and Industries equal to one-tenth of one percent (0.1 percent) of the price of this contract, minimum fee in the amount of $250.00 and maximum fee of $7,500.00.

The Contractor will pay the prevailing wage rates in accordance with ORS279C.830.

NOW, THEREFORE, in consideration of the faithful performance of the covenants and agreements hereinbefore made by the Contractor, the City hereby covenants and agrees to pay the Contractor as in said Contract Documents provided.

IN WITNESS WHEREOF, the respective parties hereto have each caused these presents to be executed in duplicate the day and year first above written.

CITY OF WOODBURN, OREGON

ATTESTED: _____ _____.
Heather Pierson, *CITY RECORDER* Eric Swenson, *MAYOR*

CONTRACTOR: _____.
Organization

By:_____. Title:_____.

Bond No. _____
Solicitation _____
Project BID#: **2021-05**

SECTION 10
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that, _____, as the Principal, and _____, a corporation organized and existing under the laws of the State of Oregon, and duly authorized to transact a surety business in the State of Oregon, as Surety, are held and firmly bound unto the City of Woodburn, a municipal corporation of the State of Oregon, in the penal sum of $_____ Dollars $_____, lawful money of the United States of America, for the payment whereof well and truly to be made, we and each of us, jointly and severally, bind ourselves, our and each of our heirs, executors, administrators successors and assign, firmly by these presents.

WHEREAS, the Principal has entered into a contract with the City of Woodburn, the plans, specifications, terms and conditions of which are contained in the above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Performance Bond by reference, whether or not attached to the contract (all hereafter called the "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety,

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH:

That if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things undertaken by Contractor to be performed under the Contract, upon the terms set forth therein, and within the time prescribed therein, or as extended as provided in the Contract, with or without notice to the Sureties, and shall indemnify and save harmless the City of Woodburn, the, its officers, employees and agents, against any direct or indirect damages or claim of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Principal or its subcontractors, and shall in all respects perform said contract according to law, then this obligation is to be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond nor shall the City of Woodburn, be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapter 279C, the provisions of which hereby are incorporated into this bond and made a part hereof.

Contractor

_____

BY:

TITLE: _____

Surety

By: _____
Attorney-In-Fact

Bond No. _____
Solicitation:_____
Project Bid#: **2021-05**

SECTION 11
PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that, _____, as the Principal, and _____, a corporation organized and existing under the laws of the State of Oregon, and duly authorized to transact a surety business in the State of Oregon, as Surety, are held and firmly bound unto the City of Woodburn, a municipal corporation of the State of Oregon, in the penal sum of $_____ Dollars $_____, lawful money of the United States of America, for the payment whereof well and truly to be made, we and each of us, jointly and severally, bind ourselves, our and each of our heirs, executors, administrators successors and assign, firmly by these presents.

WHEREAS, the Principal has entered into a contract with the City of Woodburn, the plans, specifications, terms and conditions of which are contained in the above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Payment Bond by reference, whether or not attached to the contract (all hereafter called the "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety,

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH:

That if the Principal shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things by it undertaken to be performed under said Contract and any duly authorized modifications that are made, upon the terms set forth therein, and within the time prescribed therein, or as extended therein as provided in the Contract, with or without notice to the sureties, including the conditions listed in ORS 279.310 to 279.320, and shall indemnify and save harmless the City of Woodburn, its officers, employees and agents, against any claim for direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Contractor or its Subcontractors, and shall promptly pay all persons supplying labor, materials or both to the Principal or its Subcontractors for prosecution of the work provided in the Contract; and shall promptly pay all contributions due the State Industrial Accident Fund and the State Unemployment Compensation Fund from the Principal or its Subcontractor in connection with the performance of the Contract; and shall pay over to the Oregon Department of Revenue all

sums required to be deducted and retained from the wages of employees of the Principal and its Subcontractors pursuant to ORS 316.167, and shall permit no lien nor claim to be filed or prosecuted against the City of Woodburn on account of any labor or materials furnished; and shall do all things required of the Principal by the laws of this State, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond nor shall the City of Woodburn, be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapter 279C, the provisions of which hereby are incorporated into this bond and made a part hereof.

Contractor

_____

BY:

TITLE: _____

Surety

By: _____
Attorney-In-Fact

Bond No. _____

Solicitation _____

Project Bid No. 2021-05

Project Name: **I-5 Pump Station and Force Main Upgrades**

SECTION 12
MAINTENANCE/WARRANTY BOND

KNOW ALL MEN BY THESE PRESENTS that, _____, as the Principal, and _____, a corporation organized and existing under the laws of the State of Oregon, and duly authorized to transact a surety business in the State of Oregon, as Surety, are held and firmly bound unto the City of Woodburn, a municipal corporation of the State of Oregon, in the penal sum of $_____ Dollars $_____, lawful money of the United States of America, for the payment whereof well and truly to be made, we and each of us, jointly and severally, bind ourselves, our and each of our heirs, executors, administrators successors and assign, firmly by these presents.

WHEREAS, the Principal has entered into a contract with the City of Woodburn, the plans, specifications, terms and conditions of which are contained in the above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Maintenance/Warranty Bond by reference, whether or not attached to the contract (all hereafter called the "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety,

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH:

That the Principal agrees to warrant to the City of Woodburn that the construction is, and will remain for a period of one (1) year from the date of acceptance, free from defects in materials and workmanship.

That if the Principal herein shall faithfully and truly observe the terms, provisions, conditions, stipulations, directions, and requirements of the Contract and shall in all respects, whether the same be enumerated herein or not, faithfully comply with the same and shall assume the defense of indemnify and save harmless the City of Woodburn, its officers, agents, and employees from all claims, liabilities, loss, damage or injury which may have been suffered or claimed to have been suffered to persons or property directly or indirectly resulting from or arising out of the operations or conduct of the Principal or any subcontractor in the performance of the work under the

Contract and shall indemnify and make whole the City for any injury or damage to any street, highway, avenue, private driveway, paved pathway, or road or any part thereof, resulting from the operations or conduct of the Principal or any subcontractor in connection with performance or conduct of the work under the Contract, and shall in all respects faithfully keep and observe all of said terms, provision, conditions, stipulations, directions, and requirements, then this obligation is void, otherwise, it shall remain in full force and effect.

WITNESS our hand and seals this __ day of_____, 2021.

Name:

_____
BY:

TITLE: _____

Surety

By: _____
Attorney-In-Fact

SECTION 13 ***NOTICE TO PROCEED*** **PUBLIC WORKS DEPT.** **ENGINEERING DIV.**	WOODBURN OREGON Incorporated 1889

PROJECT NAME:	I-5 Pump Station and Force Main Upgrades		
BID #:	2021-05	PROJECT No #:	2018-012-11
AMOUNT:	$	BEGIN DATE:	
CONTRACTOR:		CCB #:	
ADDRESS:			

You are hereby notified to commence work on the referenced contract, and shall substantially complete all of the work of said contract within four hundred and eighty calendar days of the Notice to Proceed.

The substantial completion date is therefore: **four hundred and fifty calendar days from issuance of Notice to Proceed.**

The completion date is therefore: **_____, 2022.**

The contract provides for the assessment of liquidated damages for each consecutive calendar day after the above-established contract completion date that the work remains incomplete in the amount established by the Special Provisions, which is equivalent to $_____ per day.

PM for THE CITY OF WOODBURN: Dago Garcia

DATE: _____

Contractor: *Complete items below this line and return Document to Owner within seven (7) days*: _____

CONTRACTOR'S ACCEPTANCE OF THIS NOTICE

Receipt of the foregoing Notice to Proceed is hereby acknowledged:

SIGNED: _____

TITLE: _____

DATE: _____

SECTION 14
SPECIAL PROVISIONS

WORK TO BE DONE

The Work to be done under this Contract consists of the following on the City of Woodburn, OR in Marion County:

1. New 2,900 gallons-per-minute (GPM) raw sewage pump station at the existing I-5 Pump Station site, including a new 15-foot diameter concrete wet well.
2. New 533 square-foot concrete masonry unit Electrical Building at the I-5 Pump Station site.
3. Approximately 3,300 lineal feet of new 16-inch ductile iron sewer force main pipe in City streets, including connections to the existing 12-inch ductile iron force main pipe, and five new combination air-vacuum valve stations.
4. Water, sewer and drainage piping, stormwater basin, and demolition work at the existing I-5 Pump Station site.
5. Electrical improvements, including new diesel standby generator, at the existing I-5 Pump Station site.
6. Grading, landscaping, paving, fencing, and other miscellaneous works at the existing I-5 Pump Station site, as detailed in the plans and specifications.
7. Perform additional and incidental Work as called for by the Specifications and Plans

CONTRACT TIME AND PROJECT SCHEDULE

A. The work to be completed under this contract and described by these specifications shall adhere to the following project schedule:

Project Phase / Event	**Date**
Bids Due	July 29, 2021
Notice of Intent to Award	July 29, 2021
Issuance of Notice to Proceed	Within 90 calendar days of Contract Award
Substantial Completion	450 days after Notice to Proceed
Final Completion	480 days after Notice to Proceed

NOTICE TO PROCEED

A. The City intends to provide written Notice to Proceed within 90 calendar days after the City has issued a Notice of Intent to Award, provided the Selected Bidder submits all required bonds and insurance information within 60 days after the City has issued a Notice of Intent to Award.

B. The City retains the right to delay the Notice to Proceed. The City shall provide the Contractor with notification that the Notice to Proceed will be delayed and an estimate of when Notice to Proceed will be issued as soon as a delay is anticipated. The Contractor shall not commence work under the contract until such written notice has been given.

EXPERIENCE AND QUALIFICATIONS

1. The Contractor shall demonstrate the following minimum qualification criteria:

    a. Has performed construction work on at least three (3) wastewater pump station projects in the last five (5) years, with each contract value totaling $2,000,000 or more – and of those, two of the projects listed shall involve the installation of below-grade precast circular wet wells of a depth of 15 feet or deeper.

    b. Bidder is a licensed Commercial General Contractor Level 1 (CGC1) in the State of Oregon.

    c. The person submitting this offer has the authority to submit the offer and to represent Bidder in all phases of this procurement process;

    d. Bidder is a "resident bidder", as described in ORS 279A.120 in the State of Oregon, or is a "non-resident bidder" of another State and has not discriminated against any minority, women, or emerging small business enterprises in obtaining any required subcontracts in accordance with ORS 279A.110. Non-resident bidder also agrees to report their participation in this contract, if awarded, to the Oregon Department of Revenue as required by ORS 279A.120 (3).

    e. Any false statement may disqualify this offer from further consideration or be the cause of contract termination;

    f. Bidder has the appropriate financial, material, equipment, facility, personnel resources, and expertise or the ability to obtain the resources and expertise necessary to meet all contractual responsibilities;

    g. Bidder has an employee drug testing program in place as required by ORS 279C.505 (2);

2. Contractors must be qualified in accordance with the applicable parts of ORS 279 in order to enter into a contract with the City of Woodburn for public works in Oregon. To document qualifications, bidders shall submit a completely executed Contractor's Prequalification Application when submitting their bid proposal. Prequalification application forms may be obtained at the State of Oregon Department of Administrative Services, Purchasing Section, 1225 Ferry Street S.E., Salem, Oregon 97301-4285 or on-line at:

    http://www.oregon.gov/DAS/EGS/PS/docs/contractors-pre-application.pdf

    The City of Woodburn will investigate and determine the qualifications of the bidders as part of its evaluation of the bids.

PRE-BID CONFERENCE

Prospective bidders interested parties may attend a Pre-Bid Conference if they register 72 hours in advance by contacting Dago Garcia by e-mail at dago.garcia@ci.woodburn.or.us. The Pre-Bid Conference will take place at the Project Site located at 598 Stacy Allison Way, Woodburn, OR 97071 at 10:00 a.m. on Wednesday July 14, 2021.

PRE-CONSTRUCTION CONFERENCE

1. A mandatory pre-construction conference shall be scheduled no less than two weeks prior to the start of work. At this conference, the Contractor shall provide the following pre-construction submittals in addition to those outlined elsewhere in these Contract Documents:

    a. Construction Schedule: A detailed construction schedule, which shall be followed by the Contractor throughout the duration of the contract and updated as needed.

    b. Weekend/Emergency Contacts: The names, addresses, and telephone numbers of two or more persons employed by the Contractor who can be reached during evening and weekend hours to handle emergency matters.

STANDBY/DELAY TIME, INCIDENTAL, AUTHORIZED HOURLY WORK

A. Time lost to the project schedule can be expected during the course of project execution due to unavoidable and unforeseen events. Time lost to the project due to such circumstances may be originated by the City or the Contractor. Time lost from stoppage of work at the request of the City shall be defined as "standby time." Time lost due to the inability of the Contractor to proceed shall be defined as "delay time." These terms are further defined as follows:

    1. **Standby Time**: Standby time is the duration of idle time greater than one (1) hour accrued at the request of the City. The Contractor's workers and equipment shall remain onsite while standby time is in effect. In the event of standby time, the City shall pay the Contractor for equipment and crew per hour, not to exceed eight (8) hours per working day.

    2. **Delay Time**: Delay time is defined as avoidable delays greater than one (1) hour caused by neglect in planning, improper scheduling or sequencing of work by the Contractor. These items shall include, but are not limited to, the Contractor's tardiness and inability to provide the trained staff and adequate equipment in a reasonable manner. Delay time shall not include time lost to the project as a result of conditions beyond the Contractor's control. These unavoidable delays shall include, but are not limited to, inclement weather and unexpected or unusual conditions. The Contractor may give a 12-hour notice to City that there will be a delay without being assessed delay time in the event of equipment breakdown and parts not easily attainable and must be ordered. Shorter notice may suffice at the City's discretion. Except in the case of emergency or unless otherwise approved by the City, a working day shall be defined for this purpose as any consecutive 12-hour period between 7:00

a.m. and 7:00 p.m. of a working day with a maximum 1-hour lunch break and a 5-day work week Monday through Friday, excluding holidays. Any additional hours (weekends) will be negotiated between the City and the Contractor.

3. **Authorized Hourly Work:** Authorized hourly work shall include furnishing all equipment, labor, tools, and miscellaneous materials necessary to conduct activities not covered under other bid items, and as approved by the City in writing. The City and the Contractor shall maintain records for this work. The City's record will be binding. No hourly payment will be made to the Contractor for work being performed to condition or ream the borehole, or to repair, clean, or replace equipment that is not in working condition.

NOISE LIMITS

A. The Contractor shall use all reasonable and available means to reduce noise to minimum levels during working hours. The Contractor shall review the site and understand the relationship of the site to surrounding facilities.

WORK LIMITS AND HOURS

A. The Contractor shall limit work to the following daily schedule; Monday through Friday, 7:00 AM to 7:00 PM.

B. The Contractor shall obtain approval from the City prior to conducting work on weekends.

WORK COVERED / NOT COVERED BY THE CONTRACT

A. The general work to be completed under this contract consists of modifications to an existing sewer pump station, construction of a new electrical building, pump station site improvements, installation of new 16-inch sewer force main in City streets, and other miscellaneous works.

B. The City reserves the right to limit (reduce) any aspect of the project for any reason.

PREVAILING WAGE:

Comply with prevailing wage requirements listed in BOLI's published 2021 prevailing wage rates for all Covered Occupations regulated by BOLI that are necessary to perform the Work. The specific 2021 rates for Marion County are available on the BOLI website.

APPLICABLE SPECIFICATIONS

The Specifications that are applicable to the Work on this Project is the 2021 edition of the "Oregon Standard Specifications for Construction" and the "Technical Specifications" which are part of the Contract Bid Documents.

All number references in these Special Provisions shall be understood to refer to the Sections and subsections of the Standard Specifications bearing like numbers and to Sections and subsections contained in these Special Provisions in their entirety.

PART 00100 – GENERAL CONDITIONS

SECTION 00110 - ORGANIZATION, CONVENTIONS, ABBREVIATIONS AND DEFINITIONS

Comply with Section 00110 of the Standard Specifications modified as follows:

00110.05(e) Reference to Websites - Add the following bullet list to the end of this subsection:

- City of Woodburn Public Works Department:
  https://www.woodburn-or.gov/?q=public_works
- City of Woodburn Public Works Department Bids and RFPs:
  http://www.ci.woodburn.or.us/?q=blog-categories/bids-and-rfps
- American Traffic Safety Services Association (ATSSA)
  www.atssa.com
- ODOT Construction Section
  www.oregon.gov/odot/construction/pages/index.aspx
- ODOT Construction Section - Qualified Products List (QPL)
  www.oregon.gov/ODOT/Construction/Pages/Qualified-Products.aspx
- ODOT Estimating
  www.oregon.gov/ODOT/Business/Pages/Steel.aspx
- Oregon Legislative Counsel
  www.oregonlegislature.gov/lc
- ODOT Procurement Office - Conflict of Interest Guidelines and Disclosure Forms
  www.oregon.gov/ODOT/Business/Procurement/Pages/PSK.aspx
- ODOT Procurement Office - Construction Contracts Unit Notice of Intent
  www.oregon.gov/ODOT/Business/Procurement/Pages/NOI.aspx
- ODOT Procurement Office - Construction Contracts Unit prequalification forms
  www.oregon.gov/odot/business/procurement/pages/bid_award.aspx
- Oregon Secretary of State: State Archives
  sos.oregon.gov/archives/Pages/default.aspx
- ODOT Traffic Control Plans Unit
  www.oregon.gov/ODOT/Engineering/Pages/Work-Zone.aspx
- ODOT Traffic Standards
  www.oregon.gov/ODOT/Engineering/Pages/Signals.aspx

Replace the “Agency” definition with the following definition:

Agency – The City of Woodburn Public Works Department – Engineering Division.

Add the following definition:

Agency Website – This is the website of the Public Works Department, Engineering Division as owned, controlled and administrated by the City of Woodburn, OR. The URL being referenced when this term is used shall be the following:

http://www.ci.woodburn.or.us/?q=blog-categories/bids-and-rfps

Replace the "Bid Booklet" definition with the following definition:

Bid Booklet - The version that can be accessed and printed from the Agency website.

SECTION 00120 - BIDDING REQUIREMENTS AND PROCEDURES

Comply with Section 00120 of the Standard Specifications modified as follows:

00120.00 Prequalification of Bidders - Replace this subsection, except for the subsection number and title, with the following:

The Agency will prequalify Bidders according to ODOT’s Oregon Administrative Rules and prequalification procedures. A Bidder must file for prequalification and **NO** fee. Prequalification must be renewed annually. Bidders shall make application for prequalification and for required renewals on standard forms available from the ODOT Procurement Office - Construction Contracts Unit website. Bidders shall return the completed application to the Dago Garcia at 190 Garfield St. Woodburn, OR 97071 or e-mail to dago.garcia@ci.woodburn.or.us. No facsimile of Prequalification will be accepted.

Contracts will only be awarded to Bidders who, at the time of Bid Opening, are prequalified in the Class or Classes of Work specified in the Special Provisions, except that a Bidder whose prequalification has been revoked or revised as provided in ORS 279C.430(4) may also be eligible for Award under that statute if the Project was advertised prior to the revocation or revision. The Agency will consider a Bid from a Bidder whose complete application for prequalification has been received by the Public Works Department – Engineering Division Office at least 3 Calendar Days before the opening of Bids. Bidders shall submit Bids in the same company name used on the prequalification application; provided however, if Bidder’s legal name has changed since the submittal of its application for prequalification, it shall submit its Bid under its current legal name with the former name referenced by "formerly known as".

The Agency will regularly evaluate the performance of Contractors on its projects for purposes of responding to reference checks, future prequalification and determinations of responsibility.

00120.01 General Bidding Requirements - In the paragraph that begins "Bidders may submit …", replace the paragraph with the following sentence:

Bidders may submit Bids by paper only. No electronic (e-mail or facsimile) Bids will be accepted.

00120.05 Request for Plans, Special Provisions, and Bid Booklets - Replace this subsection, with the following subsection:

00120.05 Request for Plans, Special Provisions, and Bid Booklets:

(a) Informational Plans and Special Provisions - Informational Project Plans and Special Provisions are available, free of charge, on the Agency's website.

(b) Bidding Plans, Special Provisions, and Bid Booklets - Bidders must submit paper Bids.

(1) Paper Bids - Bidders submitting bids shall access and print Plans, Special Provisions, and Bid Booklets from the Agency's website. Bidders obtaining Plans, Special Provisions, and Bid Booklets must register on Agency's list of "Holders of Bidding Plans". Bids will be considered responsive only if Bidders are registered as "Holders of Bidding Plans".

Delete the paragraph that begins with the following;

"(2) Electronic Bids - Bidders …"

The Plans, which are applicable to the Work to be performed under the Contract, are included in these Special Provisions.

00120.10 Bid Booklet - In the paragraph that begins "The Bid Section includes all pages after…", add the following bullet to the bullet list:

- Certificate of nondiscrimination regarding ORS 279A.110 and certificate regarding policy and practice against sexual harassment, sexual assault and discrimination against employees who are members of a protected class as required by Chapter 212, Oregon Laws 2017 (House Bill 3060)

00120.30 Changes to Plans, Specifications, or Quantities before Opening of Bids - Replace all "ODOT eBids website" wording in this section with "Agency's website".

Delete "(see 00110.05(e))" wording in this section.

00120.40(a-1) Paper Bids - Replace this subsection, except for the subsection number and title, with the following:

Bidders shall not alter, in any manner, the (paper) documents within the Bid Section that are accessed and printed from the Agency's website. Bidders shall complete the certifications and statements included in the Bid Section of the Bid Booklet according to the instructions. Signature of the Bidder's authorized representative thereon constitutes the Bidder's confirmation

of an agreement to all certifications and statements contained in the Bid Booklet. Entries on paper documents in the Bid Section shall be in ink or typed.

The Bidder shall properly complete and bind all the paper documents in the Bid Section, as specified in 00120.10, together with all other required documents that are part of the Bid Booklet, between the front and back covers of the Bid Booklet, except that the Bid Bond is not required if another permissible type of Bid guaranty is provided. (see 00120.40(e))

00120.40(a-2) Electronic Bids – Delete this subsection in its entirety.

00120.40(c-2) Electronic Bid Schedule Entries – Delete this subsection in its entirety.

00120.40(e-2) Bid Guaranty with Electronic Bids - Delete this subsection in its entirety.

00120.40(f) Disclosure of First-Tier Subcontractors - Replace this subsection, except for the subsection number and title, with the following:

Without regard to the amount of a Bidder's Bid, the Bidder shall, within 2 working hours of the time Bids are due to be submitted, submit to the Agency, on a form provided by the Agency, a disclosure identifying any first-tier Subcontractors that will furnish labor or labor and Materials, and whose contract value is equal to or greater than:

- $250,000, regardless of the percentage of the total Project Bid.

For each Subcontractor listed, Bidders shall state:

- The name of the Subcontractor;
- The dollar amount of the subcontract; and
- The category of Work that the Subcontractor would be performing.

If no subcontracts subject to the above disclosure requirements are anticipated, a Bidder shall so indicate by entering "NONE" or by filling in the appropriate check box. For each Subcontractor listed, Bidders shall provide all requested information. An incomplete form will be cause for rejection of the Bid.

The Subcontractor Disclosure Form may be submitted for a paper Bid (See 00120.05(b-1) either:

By filling out the Subcontractor Disclosure Form printed from the Bid Booklet on the Agency's Engineering Division's website.

Subcontractor Disclosure Forms will be considered late if not received by the Agency within 2 working hours of the time designated for receiving Bids.

The Agency is not responsible for partial, failed, illegible or partially legible facsimile (FAX) transmissions or submittals, and such forms may be rejected as incomplete.

In the event that multiple Subcontractor Disclosure Forms are submitted, the last version received prior to the deadline will be considered to be the intended version.

Bids not in compliance with the requirements of this Subsection will be considered non-responsive.

00120.45 Submittal of Bids – Replace subsections (a) with the following:

00120.45 Submittal of Bids – Bids may be submitted by mail, parcel delivery service, or hand delivery to the office and address and at the time given in the Bid Booklet. Submit Bids in a sealed envelope and marked on the outside of the envelope as required by the Invitation to Bid. Closing time for acceptance of Bids is 2:00:00 p.m. local time on the day of Bid Opening. Bids submitted after the time set for receiving Bids will not be opened or considered. The Agency assumes no responsibility for the receipt and return of late Bids.

00120.45(b) Electronic Bids - Delete this subsection in its entirety.

00120.60(a) Paper Bids - In the paragraph that begins "Information entered into…", replace the words " ODOT Procurement Office" with the words "Agency".

In the paragraph that begins "A Bidder may withdraw…", replace the words "ODOT Procurement Office " with the words "Agency".

00120.60(b) Electronic Bids – Delete this subsection in its entirety.

00120.70 Rejection of Nonresponsive Bids - Add the following bullet*(*s*)* to the end of the bullet list:

- The Bidder has liquidated any delinquent debt owed to the State or any department or agency of the State.

SECTION 00130 - AWARD AND EXECUTION OF CONTRACT

Comply with Section 00130 of the Standard Specifications modified as follows:

00130.10 Award of Contract - Replace the paragraph that begins "The Agency will provide Notice of Intent to Award…" with the following bullet:

The Agency will provide Notice of Intent to Award on the Agency's website.

00130.15 Right to Protest Award - Replace this subsection number and title and replace the sentence that begins "Before the Agency will..." with the following number and title and sentence:

00130.15 Right to Protest Award - Adversely affected or aggrieved Bidders, limited to the here apparent lowest Bidders and any other Bidder directly in for Contract Award, may submit to the Agency a written protest of the Agency's intent to Award within 3 working days following posting of the Notice of Intent to Award on the Agency's website. The protest shall specify the grounds upon which it is based.

The Agency is not obligated to consider late protests.

00130.50(a) By the Bidder - In the paragraph that begins "The successful Bidder…", replace the words "ODOT Procurement Office – Construction Contract Unit" with the words "Agency's Project Manager".

SECTION 00140 - SCOPE OF WORK

Comply with Section 00140 of the Standard Specifications.

SECTION 00150 - CONTROL OF WORK

00150.10(a) Order of Precedence – Replace the listed items with the following:

1. Permits from governmental agencies;
2. Engineer's written interpretations and clarifications issued on or after the Date of Contract;
3. Contract Change Orders;
4. This Contract, Addenda;
5. Bid Proposal;
6. Drawings (including written amendments) in the following order:
    - Project Specific Stamped Drawings
    - Reviewed and accepted stamped Working (Shop) Drawings
    - 3D Engineered Models and supplemental Agency-prepared line, grade and Cross Section data applicable to the Project
    - Agency-prepared Standard Drawings
    - Other agency-incorporated generic drawings
7. Technical Specifications;
8. Special Provisions;
9. General Conditions;
10. ODOT APWA Standard Specifications;
11. Geotechnical Data Reports;
12. Bonds (if required);
13. Notice to Proceed;
14. Solicitation Documents;
15. All other Contract Documents not listed above.

00150.30 Delivery of Notices - Add the following to the end of this subsection:

For purposes of this subsection, the time zone is Pacific Standard Time (PST) to determine time of receipt of notices and other documents. For purposes of this subsection, non-business days are Saturdays, Sundays and legal holidays as defined by ORS 187.010 and 187.020.

Following Notice to Proceed, all notices and other documents submitted to the Contractor by the Engineer, or to the Engineer by the Contractor, electronically under 00170.08:

- If recorded in Doc Express® as received before 5:00 p.m. PST on a business day it shall be considered as received on the business day on which it was actually received in Doc Express®.

- If recorded in Doc Express® as received on a non-business day, or after 5:00 p.m. PST on a business day, it shall be considered as received at 8:00 a.m. PST on the next business day.

Claims must be submitted on paper documents according to Section 00199.

00150.50 Cooperation with Utilities - Add the following subsection:

00150.50(f) Utility Information:

Contact those Utilities having buried facilities and request that they locate and mark them for their protection prior to construction.

UTILITY	**CONTACT PERSON**	**PHONE NUMBER**
Century Link	Josh Fallin	503.399.4931
AT&T	Tom Normoyle	503.588.1899
NWN Gas	Daniel Kizer	503.226.4211ext8166
PGE	Darrin Perkins	503.463.4325
DataVision	Dennis Weddle	503-949-9701
Wave Cable/Internet	Derek Anderson	503.798-6651
City Water	Curtis Stultz	503.982.5268
City Sewer Collections and Streets	Curtis Stultz	503.982.5268

This Project is located within the Oregon Utility Notification Center area which is a Utilities notification system for notifying owners of Utilities about Work being performed in the vicinity of their facilities. The Utilities notification system telephone number is 811 (or use the old number which is 1-800-332-2344).

SECTION 00160 - SOURCE OF MATERIALS

Comply with Section 00160 of the Standard Specifications.

SECTION 00165 - QUALITY OF MATERIALS

Comply with Section 00165 of the Standard Specifications.

SECTION 00170 - LEGAL RELATIONS AND RESPONSIBILITIES

Comply with Section 00170 of the Standard Specifications modified as follows:

00170.05 Assignment of Antitrust Rights - Replace the bullet that reads "ORS 646.725; and" with the following bullet:

- ORS 646.725

00170.07 Record Requirements - In the paragraph that begins "For purposes of this Subsection, the term…", replace the words "OAR 731-005-0780" with the words "OAR 734-010-0400".

00170.07(a) Records Required - In the paragraph that begins "These records shall include…", replace the bullet that begins "Contracts or documents of other…", with the following bullet:

- Contracts or documents of other arrangements with any Related Entity as defined in OAR 734-010-0400.

In the paragraph that begins "The Contractor shall include…", replace the words "OAR 731-005-0780" with the words "OAR 734-010-0400".

00170.07(b) Access to Records - In the paragraph that begins "The Contractor shall provide…", replace the words "OAR 731-005-0780(9)" with the words "OAR 734-010-0400(9)".

00170.60 Safety, Health and Sanitation Provisions – Add the following paragraph to the end of this subsection:

The Contractor is responsible to require each subcontractor at every tier to comply with the requirements of OAR 437-002-0146, Oregon OSHA's Confined Space Rule including a copy of all closed permit entry forms to the Agency Project Manager within 24 hours of closing the permit.

00170.62 Labor Nondiscrimination - Add the following sentence to the end of this subsection:

It is a material term of this Contract that the Contractor certifies by entering into this Contract that the Contractor has a written policy and practice that meets the requirements described in Chapter 212, Oregon Laws 2017 (House Bill 3060) for preventing sexual harassment, sexual assault and discrimination against employees who are members of a protected class and that the Contractor shall maintain the policy and practice in force during the entire term of this Contract.

00170.70(a) Insurance Coverages - The following insurance coverages and dollar amounts are required pursuant to this subsection:

Coverages	per Occurrence	Limit
Commercial General Liability	$1,000,000.00	$2,000,000.00

Commercial Automobile Liability $1,000,000.00 (aggregate limit not required)

00170.70(d) Additional Insured - Add the following paragraph and bullet*(*s*)* to the end of this subsection:

Add the following as Additional Insureds under the Contract:

- The City of _Woodburn, OR and its officers, agents, representatives, volunteers and employees
- Murraysmith, Inc., Portland, OR
- R&W Engineering, Beaverton, OR
- Peterson Structural Engineering, Portland, OR

00170.72 Indemnity/Hold Harmless - Add the following paragraph and bullet*(*s*)* to the end of this subsection:

Extend indemnity, defense and hold harmless to the Agency and the following:

- The City of _Woodburn, OR and its officers, agents, representatives, volunteers and employees
- Murraysmith, Inc., Portland, OR
- R&W Engineering, Beaverton, OR
- Peterson Structural Engineering, Portland, OR

SECTION 00180 - PROSECUTION AND PROGRESS

Comply with Section 00180 of the Standard Specifications modified as follows:

00180.40(a) In General – Add the following bullets to this subsection:

- Provide and maintain access to all homes, School and Business at all times.
- All work shall be accomplished between 7:00 AM and 7:00 PM every day from Monday through Friday, excluding Legal Holidays.

Add the following subsection:

00180.40(c) Specific Limitations - Limitations of operations specified in these Special Provisions include, but are not limited to, the following:

Limitations	Subsection
Cooperation with Utilities	00150.50
Cooperation with Other Contractors	00150.55
On-Site Work	00180.40(b)
Contract Time	00180.50(h)
Right-of-Way and Access Delays	00180.65
Special Events	00220.40(e)(2)(b)
Regulated Work Areas	00290.34(a)
Noise Control	00290.32

00180.41 Project Work Schedules - After the paragraph that begins "One of the following Type…" add the following paragraph:

In addition to the "look ahead" Project Work schedule, a Type A schedule as detailed in the Standard Specifications is required on this Contract.

00180.42 Preconstruction Conference - Add the following paragraph to the end of this subsection:

A mandatory pre-construction conference shall be scheduled no less than two weeks prior to the start of work. At this conference, the Contractor shall provide the following pre-construction submittals in addition to submittals mentioned elsewhere in the Contract Documents:

Construction Schedule: A detailed construction schedule, which shall be followed by the Contractor throughout the duration of the contract, and updated as needed.

Weekend/Emergency Contacts: The names, addresses, and telephone numbers of two or more persons employed by the Contractor who can be reached during evening and weekend hours to handle emergency matters.

00180.50(c) Beginning of Contract Time - Replace this subsection, except for the subsection number and title, with the following:

When the Contract Time is stated in Calendar Days, counting of Contract Calendar Days will begin on the day the Contractor begins On-Site Work as defined in 00110.20.

Add the following subsection:

00180.50(h) Contract Time - There is one Contract Time on this Project as follows:

Complete all Work to be done under the Contract within 450 days of the Notice to Proceed, to a level of Substantial Completion, which is defined as successful installation, connection, and pressure testing of the 3,300-linear-feet replacement 16-inch sewer force main, completion of operational testing of the pump station facility and completion of paving at the I-5 Pump Station site.

00180.85(b)(1) Single Contract Time - Replace this subsection, except for the subsection number and title, with the following:

The Liquidated Damages per Calendar Day* are 15.0 percent of C divided by T as defined in this Section.

C = The Contractor's Bid amount for the Contract.

T = The total Calendar Days between the latest completion date or time listed under 00180.50(h) in the Solicitation Documents and the Bid Opening that will result in the greatest value for T.

* Calendar Day amounts are applicable when the Contract time is expressed on the Calendar Day or fixed date basis.

Liquidated damage amount per day shall be determined by the above formula, but shall be no less than $1,000 per day.

00180.90(a) Termination for Default - In the paragraph that begins "Termination of the Contract for default…", add the following bullet to the end of the bullet list:

- Has liquidated and delinquent debt owed to the State or any department or agency of the State.

SECTION 00190 - MEASUREMENT OF PAY QUANTITIES

Comply with Section 00190 of the Standard Specifications.

SECTION 00195 - PAYMENT

Comply with Section 00195 of the Standard Specifications modified as follows:

00195.10 Payment for Changes in Materials Costs - Replace this subsection with the following subsection:

00195.10 Payment for Changes in Materials Costs – There are no changes in payments for escalation/De-Escalation of materials in this Contract.

Additional work required by the Agency will be negotiated on a case by case basis for all changes in materials costs and shall be agreed upon, in writing, before the work is accomplished.

All materials are subject to change in costs and conditions, as specified in subsection 00195.20 Changes in Plans or Character of Work, including but not limited to:

- Steel Materials Price Adjustment
- Asphalt Cement Price Adjustment
- Fuel Price Adjustment

The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this escalation/de-escalation provision shall not limit those rights.

00195.12 Steel Material Price Escalation/De-Escalation – Remove this subsection in its entirety.

00195.50 (a) Progress Payments - Replace the paragraph that begins with "At the same time each month…" of this subsection with the following:

At the same time each month, the Contractor will make an estimate of the amount and value of the Pay Item Work completed. The Contractor will submit this estimation of quantities to the Engineer for agreement on the number of estimated units completed for unit price Pay Items plus the estimated percentage completed of lump sum Pay Items.

00195.50 (a-2) Value of Materials on Hand – Replace the paragraph that begins with "The Engineer will…" of this subsection with the following:

The Contractor will also make an estimate of the amount and value of acceptable Materials on hand, i.e., already delivered and stored according to 00195.60(a), to be incorporated into the Work and submit this estimation to the Engineer for agreement for Pay Items for this progress payment.

00195.50(b) Retainage - Replace the paragraph that begins "The amount to be retained…" with the following paragraph:

The amount to be retained from progress payments will be 5% of the value of Work accomplished, and will be retained by the Agency until completion of the Work as specified in (c) below.

00195.50(c) Forms of Retainage - Replace this entire subsection through and including 00195.50(3) Bonds, Securities, and Other Instruments with the following:

The Agency will withhold payment of 5% of all progress payments until completion of the project as is described in (c) below.

Insert the following:

00195.50 (c) Release of Retainage – The Agency will make payment to the Contractor after the Contractor has made application for payment to the Engineer upon issuance of the Third Notification.

00195.50 (e) Withholding Payments – Change (e) to (d) in the title of this subsection.

00195.50 (f) Prompt Payment Policy – Change the (f) to (e) in the title of this subsection.

00195.90(c) No Waiver of Right to Make Adjustment - Replace this subsection, except for the subsection number and title, with the following:

The fact that the Agency has made any measurement, estimate, determination or certification either before or after completion of the Project, Final Acceptance, Agency assumption of possession of the Project Site, determination of satisfactory completion of Pay Items or Work or release of retainage under 00195.50(c) or payment for any part of the Work, shall not prevent either party from:

- Showing the true amount and character of the Work;
- Showing that any measurement, estimate, determination or certification is incorrect;
- Recovering from the other party damages that may have been suffered because the other party failed to comply with the Contract.

SECTION 00196 - PAYMENT FOR EXTRA WORK

Comply with Section 00196 of the Standard Specifications.

SECTION 00197 - PAYMENT FOR FORCE ACCOUNT WORK

Comply with Section 00197 of the Standard Specifications.

PART 00200 – TEMPORARY FEATURES and APPURTENANCES

SECTION 00210 – MOBILIZATION

Comply with Section 00210 of the Standard Specifications.

SECTION 00220 – ACCOMODATIONS FOR PUBLIC TRAFFIC

Comply with Section 00220 of the Standard Specifications. Comply with City traffic and access requirements for Special Events that may occur on City property near the Project Site.

SECTION 00225 – WORK ZONE TRAFFIC CONTROL

Comply with Section 00225 of the Standard Specifications.

SECTION 00280 – EROSION and SEDIMENT CONTROL

Comply with Section 00280 of the Standard Specifications.

SECTION 00290 – ENVIRONMENTAL PROTECTION

Comply with Section 00290 of the Standard Specifications.

SECTION 00310 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Comply with Section 00310 of the Standard Specifications.

SECTION 00320 – CLEARING and GRUBBING

Select clearing and grubbing is included in the Contractor's Work under this Contract. Comply with Section 00320 of the Standard Specifications modified as follows:

00320.40(b)(3) Vegetation and Materials to be Saved - Replace this subsection with the following subsection:

00320.40(b)(3) Vegetation and Materials to be Saved - The Engineer will designate no work zones and identify and mark trees, existing landscaping, vegetation, or other natural materials to be saved. Do not begin construction activity or move equipment into existing landscaped or vegetated areas until the work zone fencing is in place to designate and protect no work and critical root zones.

Do not work within the no work zones or critical root zone of marked trees unless written approval is obtained from the Engineer. Be responsible for all damage to and removal of trees, landscaping, vegetation or other natural materials designated to be saved. Damage will be determined by a specialist selected by the Engineer.

SECTION 00330 – EARTHWORK

Comply with Section 00330 of the Standard Specifications.

SECTION 00331 – SUBGRADE STABILIZATION

Comply with Section 00331 of the Standard Specifications.

SECTION 00340 – WATERING

Comply with Section 00340 of the Standard Specifications.

PART 02000 – MATERIALS

Concrete Materials and Additives

SECTION 02001 – CONCRETE

Comply with Section 002001 of the Standard Specifications.

SECTION 02010 – PORTLAND CEMENT

Comply with Section 002001 of the Standard Specifications.

SECTION 02015 – PORTLAND CEMENT CONCRETE REPAIR MATERIAL

Comply with Section 002001 of the Standard Specifications.

SECTION 02020 – WATER

Comply with Section 002020 of the Standard Specifications.

SECTION 02030 – MODIFIERS

Comply with Section 002030 of the Standard Specifications.

SECTION 02040 – CHEMICAL ADMIXTURES

Comply with Section 002040 of the Standard Specifications.

SECTION 02050 – CURING MATERIALS

Comply with Section 002050 of the Standard Specifications.

SECTION 02070 – BONDING AGENT

Comply with Section 002070 of the Standard Specifications.

SECTION 02080 – GROUT

Comply with Section 002080 of the Standard Specifications.

SECTION 02090 – LIME

Comply with Section 002090 of the Standard Specifications.

Geosynthetics and Slope Protection

SECTION 02320 – GEOSYNTHETICS

Comply with Section 002320 of the Standard Specifications.

PART 03000 – MATERIALS

SECTION 03020 – EROSION MATERIALS

Comply with Section 003020 of the Standard Specifications.

SECTION 15
OREGON PREVAILING WAGE RATES
FOR
I-5 PUMP STATION AND FORCE MAIN UPGRADES
FOR
CITY OF WOODBURN, OREGON

The applicable Oregon prevailing wage rates are contained in the publication *Prevailing Wage Rates for Public Works Contracts in Oregon, Effective July 1, 2021* and are incorporated herein as though fully set forth as of the date the Bidding Documents are first advertised.

See Oregon Bureau of Labor and Industries website links at:

https://www.oregon.gov/boli/employers/Pages/prevailing-wage-rates.aspx

NOTE: THIS FORM TO BE COMPLETED BY OWNER. IT IS INCLUDED IN THE CONTRACT DOCUMENTS FOR BIDDERS' INFORMATION ONLY.

SECTION 16
RESPONSIBILITY DETERMINATION FORM
FOR
I-5 PUMP STATION AND FORCE MAIN UPGRADES
FOR
CITY OF WOODBURN, OREGON

Project Name: I-5 Pump Station and Force Main Upgrades

Bid Number: 2021-05

Bidder's Business Entity Name: _____

Bidder's CCB License Number: _____

Form Submitted By (Contracting Agency): City of Woodburn

Form Submitted By (Representative Name): Dago Garcia

Title: City Engineer

Date: ---

OWNER has:

[ ] Checked the list created by the Construction Contractors Board under ORS 701.227 for bidders who are not qualified to hold a public improvement contract.

[ ] Determined whether the Bidder has met the standards of responsibility. In doing so, OWNER has considered whether the Bidder:

- [ ] Has available the appropriate financial, material, equipment, facility and personnel resources and expertise, or the ability to obtain the resources and expertise, necessary to meet all contractual responsibilities.
- [ ] Holds current licenses that businesses or service professionals operating in this state must hold in order to undertake or perform the work specified in the contract.
- [ ] Is covered by liability insurance and other insurance in amounts required in the solicitation documents.
- [ ] Qualifies as a carrier-insured employer or a self-insured employer under ORS 656.407 or has elected coverage under ORS 656.128.
- [ ] Has disclosed the bidder's first-tier subcontractors in accordance with ORS 279C.370.
- [ ] Has a satisfactory record of performance.
- [ ] Has a satisfactory record of integrity.
- [ ] Is qualified legally to contract with OWNER.
- [ ] Has supplied all necessary information in connection with the inquiry concerning responsibility.

NOTE: THIS FORM TO BE COMPLETED BY OWNER. IT IS INCLUDED IN THE CONTRACT DOCUMENTS FOR BIDDERS' INFORMATION ONLY.

[ ] Determined the Bidder to be (check only one of the following):

[ ] Responsible under ORS 279C.375 (3)(a) and (b).

[ ] Not responsible under ORS 279C.375 (3)(a) and (b).
(Attach documentation if OWNER finds the bidder not to be responsible)

This form and any attachments must be submitted within 30 days after the date of Contract Award to the Oregon Construction Contractors Board, PO Box 14140, Salem, OR 97309-5052, Phone (503) 378-4621, Fax (503) 373-2007.

Foundation Engineering, Inc.
Professional Geotechnical Services

Memorandum

Date: June 1, 2021

To: Mike Carr, P.E.
Principal Engineer
Murraysmith, Inc.

From: Erin J. Gillaspie, P.E.
James K. Maitland, P.E., G.E.

Subject: Geotechnical Investigation

Project: I-5 Pump Station and Force Main Upgrades
Project No.: 2191135

We have completed the request geotechnical investigation for the above-referenced project. Details of our findings and recommendations are provided below.

BACKGROUND

The City of Woodburn (City) plans to construct a new sewage pump station and force main near I-5 in Woodburn, Oregon. The site location is shown in Figure 1A (Appendix A). Key project elements include:

- A new ±45-foot deep, 15-foot diameter, cast-in-place concrete wet well
- A new ±19x35-foot CMU control building
- A new ±8x14-foot buried valve vault
- A new at-grade pad for 500-kW diesel fuel generator
- A new paved or gravel parking/access area
- About 3,100 feet of 16-inch diameter PVC sewer force main

The pump station and CMU building will be located adjacent to Stacy Allison Way, ±300 feet north of Center Street. The new force main will extend along W Hayes Street, N Cascade Drive, and W Lincoln Street. Future (Phase 2) work will include an additional ±3,250-foot long force main extension. That extension is not included in the current work scope.

The City is the project owner and Murraysmith, Inc. is the prime consultant. Murraysmith retained Foundation Engineering as the geotechnical consultant. Our scope of work was detailed in a proposal dated October 15, 2019, and authorized by a signed agreement dated November 15, 2019.

FIELD EXPLORATION

Borings

We completed five exploratory borings (BH-1, BH-2, and BH-4 through BH-6) along the planned force main route on November 26, 2019. Their approximate locations are shown in Figure 2A (Appendix A). We had originally planned to drill a sixth boring (BH-3) along the alignment. However, that boring was eliminated due to time constraints. The borings along the force main route typically extended to a maximum depth of ±11.5 feet.

Two exploratory borings (BH-7 and BH-8) were completed at the existing pump station site on November 25, 2019. Figure 3A (Appendix A) shows their approximate locations. The borings at the pump station site extended to maximum depths of ±16.5 and 66.5 feet.

All borings were advanced using a CME 55 truck-mounted drill rig with mud-rotary drilling methods. Samples were typically obtained at 2.5-foot intervals to the bottom of the shallow borings. In BH-7, samples were obtained at 2.5-foot intervals to a depth of 25 feet and at 5-foot intervals thereafter. Disturbed samples were obtained using a split-spoon sampler in conjunction with the Standard Penetration Test (SPT). The SPT provides an indication of the relative stiffness or density of the soils. Relatively undisturbed samples were also obtained at various depths using thin-walled Shelby tubes. The soil profiles were logged during drilling.

Upon drilling completion, a 1-inch (I.D.) standpipe piezometer was installed in BH-7 to allow monitoring of groundwater levels. The slotted screen was installed between a depth of ±30 and 40 feet. The piezometer was capped with a locking cap and flush steel monument set in concrete. The other boreholes were backfilled with bentonite chips in accordance with Oregon Water Resources Department (OWRD) guidelines. In the roadways, the borings were capped with gravel and asphaltic concrete (AC) cold patch.

The final logs (Appendix B) were prepared based on a review of the field logs and laboratory test results and an examination of the soil samples in our office.

Cone Penetrometer Testing

The borings at the pump station site encountered potentially liquefiable soil. Subsequently, we completed a Cone Penetrometer Tests (CPT) probe at the site on March 26, 2020, to further evaluate the liquefaction potential of the foundation soils. The CPT extended to a depth to a depth of ±75.5 feet and terminated very dense sand. A summary of the CPT data is provided in Appendix B.

FIELD AND LABORATORY TESTING

Resistivity and pH Tests

In-situ resistivity testing (ASTM G57) was completed at the pump station site. Figure 3A shows the approximate test location. The resistivity testing was completed using a Nilsson 400 4-pin soil resistance meter. The 4–pin resistance meter provides an estimate of the average resistivity of a soil profile extending to a depth equal to the spacing between the pins. The tests were performed with the pins spaced at 2, 5, and 10 feet. The recorded resistivity values are summarized in Table 1C (Appendix C).

pH testing (ASTM G51) was completed on selected samples from the borings. The recorded pH values ranged from 7.1 to 8.5, suggesting neutral to slightly alkaline soil conditions. The results are summarized in Table 2C (Appendix C).

DCP Testing

Dynamic Cone Penetration (DCP) Tests were run at the pump station site to characterize the existing surficial granular fill and to estimate the subgrade resilient modulus (M_R) for pavement analysis and design. The DCP test consists of driving the cone of the DCP apparatus into the soil and recording the penetration versus blow count (mm/blow) as the DCP value. The Oregon Department of Transportation (ODOT) Pavement Design Guide (2019) provides a correlation for estimating the M_R from the DCP results. A summary of the DCP test depths, soil conditions, test results, and the correlated M_R values are summarized in Table 3C (Appendix C).

Laboratory Tests

Laboratory testing included moisture contents, percent fines, and Atterberg limits tests to classify the foundation soils and estimate their engineering properties. The laboratory test results are summarized in Table 4C (Appendix C).

Atterberg Limits tests could be run on only one of the soil samples due to the relatively high sand content in all of the specimens. Sample SH-2-2 had a liquid limit of 45 and a Plasticity Index (PI) of 12. These values correspond to an ML designation according to the Unified Soil Classification System.

Field vane tests were run on relatively undisturbed Shelby tube samples to evaluate the undrained shear strength of the soil. Those test results are summarized in Table 5C (Appendix C). It should be noted the tested soils typically have low plasticity and contain significant amounts of fine sand (see Table 4C). Field vane tests tend to underestimate shear strength for these types of soils.

DISCUSSION OF SUBSURFACE CONDITIONS

Conditions along the Force Main Route

The borings completed along the force main route encountered a pavement section typically consisting of ±5 to 6 inches of AC over 6 inches of base rock. The pavement section is underlain by predominantly medium-stiff silt with some sand typically extending to a depth of ±10 feet. SPT N-values of 5 to 10 blows per foot (bpf) of sampler penetration were typically encountered within the anticipated trenching depth, suggesting a medium stiff to stiff consistency. The silt is followed by silty sand with sandy silt interbeds to the limits of our exploration (±11.5 feet). The layer of sandy soil was shallower (±7 feet) at BH-5.

Conditions at the Pump Station Site

A portion of the existing pump station site is covered with crushed gravel (base rock). The base rock is ±6 inches thick at BH-7. There was no base rock in BH-8. The soil in the upper ±8 to 10 feet of BH-7, BH-8, and CPT-1 consists of silt with some sand (ML). SPT N-values in the upper silt in the borings ranged from 5 to 7 bpf, suggesting medium stiff consistency. However, a field vane test on SH-8-1 indicated an undrained shear strength of >1.0 tons per square foot (tsf), which corresponds to very stiff consistency. The CPT data also suggests stiff to very stiff consistency in the silt. We believe the SPT N-values underrepresent the soil strength due to the high moisture content and sensitivity of the soil. Considering the additional CPT and field vane data information, we have described the upper silt as having stiff or very stiff consistency.

The soil below depths of ±8 to 9 feet was described as silt with some sand or sandy silt in the boring logs. The boring logs were developed based on observation of samples taken at 2.5 to 5-foot intervals, which were predominantly silt. The CPT data, which includes tip and side friction resistance on a continuously pushed probe, indicates the subsurface profile is more variable and consists of ±2 to 24-inch thick interbeds of silt, sandy silt, silty sand, and sand. The SPT and CPT data indicate the silty soil is medium stiff to stiff and the sandy soil is loose to medium dense. The CPT data indicates dense to very dense sand follows from 70 to 75 feet.

Groundwater

The piezometer was installed on November 25, 2019, and was bailed and measured that day. Additional measurements were made the following day and in December 2019, January 2020, and February 2020. Water table depths measured to date are summarized in Table 1. Measurements to date indicate the groundwater level can rise to within ±7 feet of the ground surface.

Table 1. Groundwater Summary

Boring	Location	Date	Depth Below Monument (ft)	Groundwater Elev. (ft.)
BH-7	Pump Station	11/25/19	15.9	163.1
		11/26/19	15.9	163.1
		12/17/19	13.1	165.9
		1/21/20	7.7	171.3
		2/6/20	6.9	172.1
		12/3/20	12.9	166.3
CPT-1	Pump Station	3/26/20	10.7	168.3

Note: Groundwater elevation was calculated using an estimated surface elevation of El. 179.0 for BH-7, taken from available topographic contours.

The groundwater information provided above is intended for preliminary planning. Piezometer readings to date suggest at least 9 feet of seasonal fluctuations in groundwater levels at the pump station site with groundwater levels as shallow as ±7 feet. Contractors and their design consultants should independently measure the water level in the piezometer prior to bidding the project and designing the shoring and dewatering systems.

ENGINEERING ANALYSIS AND DISCUSSION OF GEOTECHNICAL CONSIDERATIONS

Bearing Capacity

The strucutal engineer indicated they plan to use an allowable bearing pressure of 1,500 lb/ft^2 (psf) for the jib crane and generator foundations. This value is appropriate, assuming any soft or disturbed soil is removed from beneath foundations or footings.

Seismic Evaluation

The borings indicate the site is underlain by potentially liquefiable soil which includes saturated, loose to medium dense sand and non-plastic or low plasticity silt and sandy silt with a plasticity index (PI) less than 8. Therefore, we completed an analysis to evaluate the liquefaction hazard and develop a site response spectrum. Liquefaction analysis was initially completed using the SPT data from the borings. Subsequent analysis was completed using the CPT data to refine the evaluation.

Seismic Sources. The potential seismic sources, design bedrock accelerations, and earthquake magnitudes for the liquefaction analysis were evaluated based on the current 2014 USGS seismic maps (USGS, 2014a and USGS, 2014b). Each seismic source can be identified on the basis of its magnitude (M) and source-to-site distance (R). The sources that have the greatest contribution to the overall uniform seismic

hazard are highlighted in a process termed deaggregation. This allows specific earthquake scenarios to be evaluated. The interactive deaggregation on the USGS website (USGS, 2014b) indicates the probabilistic seismic risk at the site is dominated by Cascadia Subduction Zone (CSZ) interface earthquakes with a moment magnitude (M_w) between 8 and 9.2. A M_w 6.6 crustal earthquake on the Mount Angel fault is also a credible seismic hazard.

We used a deterministic approach to select the seismic sources for the liquefaction analysis. Our analyses included a M_w 9.0 CSZ interface earthquake and a M_w 6.6 crustal earthquake. The selected magnitude-distance (M-R) pairs are summarized in Table 2. For each of the scenarios, the PGA values on rock were calculated using the ground motion prediction equations (GMPE's) and weighting factors used in the development of the 2014 USGS (USGS, 2014a) maps with some exceptions, as indicated below. Mean (50^{th} percentile) and mean plus one standard deviation (84^{th} percentile) ground motions were used.

- For the crustal earthquake, the PGA on bedrock was calculated using the weighted average of the current Next Generation GMPE's (NGA West-2) relationships of Abrahamson et al. (2014), Boore et al. (2014), Campbell and Borzognia (2014), Chiou and Youngs (2014), and Idriss (2014). This is consistent with the GMPE's and weighting used in the development of the USGS 2014 hazard maps.

- For the CSZ interface earthquake, PGA values on bedrock were calculated using most of the same GMPE's and weighting used in the development of the USGS 2014 hazard maps, including Atkinson and Boore (2003) Global, Zhao et al. (2006), and Atkinson and Macias (2009). The exception was the updated 2016 version of the BC Hydro GMPE (Abrahamson et al., 2016) was substituted for the 2012 BC Hydro GMPE used in USGS 2014. The 2016 version of the BC Hydro GMPE contains updated data from subduction zone earthquakes in Chile (2010) and Japan (2011) that may better predict a subduction zone earthquake in the Cascadia region.

The PGA values at the ground surface were calculated using the estimated peak bedrock accelerations multiplied by F_{pga} factors from ASCE 7-16 Table 11.8-1. A Site Class D was assumed in selecting the F_{pga} values. This Site Class is consistent with the soil conditions prior to the initiation of liquefaction. Calculated PGA values on bedrock and at the ground surface are summarized in Table 1.

Table 2. Selected Magnitude, Distance and PGA for Liquefaction Analysis

Earthquake Source/ M-R Pair, Depth	Ground Motion Criterion	Estimated PGA on Bedrock (g)	Estimated PGA at Ground Surface (g)
Crustal (Mount Angel) M_w = 6.6, R = 4.2 km, D = 0 km	50th Percentile	0.38	0.46
	84th Percentile	0.69	0.76
CSZ Interface M_w = 9, R = 70 km D = 25 km	50th Percentile	0.21	0.29
	84th Percentile	0.41	0.49

Liquefaction and Liquefaction-Induced Settlement. The subsurface profiles from BH-7 and CPT-1 were used to evaluate the liquefaction hazard at the site. The risk of liquefaction depends on the groundwater depth at the time of the earthquake. Based on the available groundwater data (Table 1), we assumed a depth of 10 feet as an upper-bound average annual groundwater level.

Liquefaction analysis was completed using the SPT-based procedure established from the findings of a 1996 National Center for Earthquake Engineering Research (NCEER) workshop and a 1998 NCEER/NSF workshop (Youd et al., 2001) with recent updates by Boulanger and Idriss (2014). The SPT N-values recorded in the borings were corrected for an effective overburden pressure of 1 tsf and a hammer energy of 60%, as well as additional factors including the type of hammer, borehole diameter, rod length, and sampling method. Analysis using the CPT data was based on the CPT procedure outlined in Boulanger and Idriss (2014).

The calculations using the CPT and SPT data indicate potential liquefaction to depths of up to 70 feet for each of the earthquake scenarios listed in Table 2. However, we believe it is unlikely liquefaction and liquefaction-induced settlement will extend below 50 feet at this site because the abundance of fine-grained soil layers in the 50-foot deep soil column would hinder the dissipation of any excess pore pressure that may develop in the underlying soils during a seismic event. Therefore, we limited the liquefaction depth in our analysis to 50 feet.

It is difficult to predict the liquefaction settlement of silty soils. Laboratory data indicate liquefaction typically ranging from ±1 to 3% percent volumetric strain for non-plastic silt. Volumetric strain of low plasticity silt is anticipated to be less and volumetric strain in sandy soils may be higher (up to 5%). Based on the available laboratory data and our calculated factors of safety (FS) against liquefaction, we developed a range of estimated settlement assuming 1 to 3% volumetric strain in the liquefiable soil layers. The estimated settlement for each of the earthquake scenarios is summarized in Table 3.

Table 3. Estimated Liquefaction-Induced Settlement

Earthquake Source/ M-R Pair, Depth	Ground Motion Criterion	Estimated Settlement Range (inches)
Crustal (Mount Angel) M_w = 6.6, R = 4.2 km, D = 0 km	50th Percentile	2 to 6
	84th Percentile	2 to 7
CSZ Interface M_w = 9, R = 70 km D = 25 km	50th Percentile	2 to 7
	84th Percentile	3 to 8

Site Response. The presence of liquefiable soils at the wet well site would trigger the requirement of classifying the soil profile as a Site Class F per the current Oregon Structural Specialty Code (OSSC, 2019). However, we anticipate the highest seismic loads are likely to occur prior to the development of liquefaction. Soil strength loss during and following liquefaction is likely to reduce the spectral accelerations in the period of interest for the structures. Therefore, we believe it is reasonable to design the structures for the pre-liquefaction site response.

We developed site response spectra for the site in accordance with Section 1613 of OSSC 2019, which is based on the 2018 International Building Code (IBC) and ASCE 7-16. The CPT shear wave velocity data indicates a Site Class D is appropriate for the pump station and control building prior to the initiation of liquefaction. Once liquefaction occurs, the softening typically results in a reduction in the short period spectral accelerations and an increase in long period spectral accelerations. We believe an OSSC 2018 Site Class E site response spectrum will likely provide a reasonable upper bound for spectral accelerations once liquefaction occurs. Site Class D and E response spectra are shown in Figure 4A (Appendix A).

When developing the design response spectrum for a Site Class D or E, OSSC 2019 requires the criteria of ASCE 7-16 Section 11.4.8 be considered. ASCE 7-16 Section 11.4.8 requires a ground motion hazard analysis be performed in accordance with ASCE 7-16 Section 21.2 at sites where the 1.0 second spectral acceleration on rock (S_1) is greater than or equal to 0.2g. However, an exception in Section 11.4.8 stipulates a ground motion hazard analysis is not required when the seismic response coefficient C_s is calculated based on Eq. 12.8-2 for values of $T \leq 1.5T_S$ and taken as equal to 1.5 times the value computed using either Eq. 12.8-3 for $T > 1.5T_S$ or Eq. 12.8-4 for $T \geq 1.5T_L$ (where $T_S = S_{D1}/S_{DS}$ and T_L is the long-period transition period shown on Figure 22-14 in Chapter 22). The T_L value for Oregon is 16 seconds.

The adjustment in the C_s value is intended to better model long-period spectral accelerations for softer soils coupled with strong ground motions. However, the adjustment applies only to the design of long-period structures (i.e., typically structures with a height of five stories or greater). For a single-story electrical building and a below-grade wet well, we anticipate the period of interest will be less than $1.5T_S$. Consequently, there is no C_s adjustment necessary when using the exception in Section 11.4.8. Therefore, we developed the site response spectrum using the mapped risk-targeted maximum considered earthquake (MCE_R) ground motions and the general procedure in Section 11.4.6 with F_a selected based on Table 11.4-1 and F_v selected based on Table 11.4-2.

The risk-targeted maximum considered earthquake (MCE_R) ground motions were obtained from modified USGS 2014 maps with a 2% probability of exceedance in 50 years (i.e., a ±2,475-year return period). The modifications include factors to adjust the spectral accelerations to account for directivity and risk.

Liquefaction Mitigation

Based on the results of analysis, it is apparent the credible earthquake sources will trigger liquefaction of the zones susceptible to liquefaction, and the magnitude of settlement at the ground surface will range from ±3 to 8 inches for all scenarios.

The base of the wet well will be seated at a depth of ±42 to 43 feet, where high confining pressures will help limit the magnitude of liquefaction. Therefore, liquefaction settlement is not expected to significant impact the wet well. However, the ground surface surrounding the wet well may settle differentially with respect to the wet well. Because the site is essentially flat, there is negligible potential for lateral spread.

Because the control building will be built at grade, it is likely to be subjected to differential settlement during a large, long-duration earthquake. Mitigation options to reduce the potential adverse impacts due to liquefaction-induced settlement include supporting the control building on piles or using a relatively rigid mat slab. Pile foundations are not considered feasible due to the depth to a suitable bearing stratum (±70 feet). The design team elected to support the control building on a thick, reinforced concrete mat.

We understand a buried vault is also planned adjacent to the new wet well. The vault will be ±10x16 feet in plan and ±10 feet deep. Three, 12-inch diameter ductile iron pipe will connect the vault to the wet well. Since the vault will be located near the ground surface, we estimate the potential liquefaction-induced settlement will be similar to the control building (i.e., in the range of ±2 to 8 inches). Therefore, we recommend flexible connections for the valve vault piping. The vault is expected to be designed to resist forces caused by differential settlement.

Control Building Slab-on-Grade Design

Plans provided by Murraysmith dated May 2021 indicate the control building floor slab will be 18 inches thick with top and bottom reinforcing steel. This should help resist damage due to potential liquefaction-induced differential settlement. We recommend supporting the control building floor slab on a minimum of 24 inches of compacted Select Fill underlain by undisturbed native soil. A modulus of subgrade reaction of 250 lbs/in^3 (pci) is appropriate for the design of this slab.

Vault Design

The vault is going to be a precast, relatively rigid, concrete structure which will be designed to resist differential settlement. The plans show the vault floor bearing on 12 inches of open-graded aggregate over a separation geotextile.

Wet Well Shoring

The laboratory tests indicate the soils contain between ±58 and 94% fines (i.e., contain ±6 to 42% fine sand). The relatively high sand content and low plasticity suggests the soil will have low cohesion and be susceptible to internal piping or erosion in the presence of flowing groundwater. For that reason, we do not recommend using a slide rail system for shoring.

A sheet pile cofferdam is expected to be a viable option for shoring the wet well excavation because interlocking sheet piles will limit seepage or groundwater infiltration and help prevent internal piping of fines. We anticipate the cofferdam would be internally braced as the excavation progresses. The cofferdam should be designed to accommodate the hydraulic pressures from groundwater and the sheet pile tips should be driven sufficiently deep to avoid a quick or heaving condition in the soil at the bottom of the excavation. External or internal dewatering wells will be required to lower groundwater levels to acceptable levels. Based on the expected size of the excavation and elevation of groundwater, we anticipate a minimum of four dewatering wells will be required outside of the excavation to dewater the exterior of the cofferdam during construction of the wet well and connecting pipes. Additional interior sumps or well points may also be needed within the excavation. Dewatering should be designed by the contractor's engineer. The required pumping rate will depend on the number, depth, and arrangement of dewatering wells. No testing was completed to determine the permeability or hydraulic conductivity of the soils. However, we estimate the Willamette silt will have a hydraulic conductivity (k) in the range of 10^{-4} to 10^{-5} centimeters per second (cm/s). This range is approximate and based on the predominantly type of soil within the limits of wet well construction.

Contractors may elect to construct the wet well using the caisson method. Current groundwater levels would represent a differential head at the base of the caisson (at an assumed depth of ±43 feet) of ±36 feet, or about 2,245 psf. Consequently, the drilling contractor would have to maintain a suitable level of water inside the caisson as it is advanced and provide measures to prevent a quick condition or heave occurring at the base during drilling and prior to pouring a base plug.

Force Main Trenching

Trenching for the force main should encounter predominantly sandy silt to a depth of ±10 feet. However, at some locations (e.g., BH-5) the trenching will extend into silty sand. Therefore, side wall stability is likely to be an issue and vertical trench walls are not expected to stand. The issue of limited standup time creates significant potential for trench side walls to undermine adjacent pavements if only a trench box (or coffin) is used. Therefore, in areas where predominantly sandy soils are encountered, a shoring system that provides intimate contact with the trench side walls will be required to limit undermining of adjacent roadways. From a safety standpoint, contractors should assume shoring will be required to protect workers along the entire force main alignment.

Construction Timing

Our experience with projects at similar sites suggests the fine-grained soils are moisture-sensitive and will be highly susceptible to pumping and rutting when wet. To reduce the risk of subgrade softening and maximize the reuse of on-site soils, we recommend completing the earthwork in the dry summer months (typically June through the end of September). If earthwork will extend into wet weather, building pads and access roads will need to be prepared to support construction traffic during wet weather and a thickened building pad and construction staging area will be required. Our explorations at the pump station site suggest the thickness of the existing surface gravel is less than 12 inches. A minimum of 24 inches of Select Fill over a Separation Geotextile is recommended to protect the fine-grained subgrade from disturbance in the building and construction staging areas.

RECOMMENDATIONS

Construction Timing

1. Restrict earthwork and excavation activities to the dry summer months (approximately June 1 to October 15).

2. Contractors bidding on the project, selecting construction means and methods, and designing dewatering and shoring systems should read the piezometer to confirm groundwater level to confirm the groundwater depth at the time of construction.

General Earthwork and Material Recommendations

3. Select Fill, as defined in this report, should consist of ¾ or 1-inch minus, clean (i.e., less than 5% passing the #200 U.S. Sieve), well-graded crushed gravel or rock. A material gradation sheet should be provided to us for approval prior to delivery to the site.

4. Open-graded Aggregate should consist of 2-inch minus, clean (less than 2% passing the #200 sieve), open-graded crushed gravel or rock. The actual gradation and maximum aggregate size will depend on availability by local suppliers. We should be provided a sample of the intended fill and gradation curve for approval, prior to delivery to the site.

5. Controlled Low Strength Material (CLSM) or commonly called Controlled Density Fill (CDF) should consist of a flowable mixture of cement, sand, and fine aggregate with a 7-day compressive strength of 300 psi. The strength of this material can be adjusted, if needed, where it requires subsequent excavation or removal. The term CLSM is used hereinafter in this report.

6. The Separation Geotextile should be a woven geotextile with Mean Average Roll Value (MARV) strength properties meeting the requirements of an AASHTO M 288-17 Class 2 geotextile. The geotextile should have MARV hydraulic properties meeting the requirements of AASHTO M 288-17 with a minimum permittivity of 0.1 $sec.^{-1}$ and an Apparent Opening Size (AOS) less than 0.6 mm (max average roll value). We should be provided a specification sheet on the selected geotextile for approval prior to delivery to the site.

   The geotextile should be laid smooth, without wrinkles or folds, in the direction of construction traffic. Overlap adjacent rolls a minimum of 2 feet. Pin fabric overlaps or place the Select Fill in a manner that will not separate the overlap during construction. Seams that have separated will require removal of the Select Fill to establish the required overlap.

7. Compact the Select Fill, trench bedding, and pipe zone backfill in loose lifts, not exceeding 12 inches. Thinner lifts may be required if light or hand-operated equipment is used. Compact all fill to a minimum of 95% relative compaction. The maximum dry density of ASTM D 698 should be used as the standard for estimating relative compaction.

   Field density tests should be run frequently to confirm adequate compaction of the imported granular fills. Once completed, the prepared base rock in pavements should be proof-rolled using a loaded ±10-yd^3 dump truck or other approved vehicle prior to paving. Areas of pumping or deflection observed beneath the truck wheels should be

reworked or overexcavated and replaced with additional compacted Select Fill and proof-rolled again.

Pump Station Design and Construction

We understand the pump station wet well will be a concrete structure. The wet well excavation will extend to a nominal depth of ±43 feet (including the thickness of the base slab and ±1 to 2 feet of granular fill beneath the base slab). The method of construction had not been selected at the time this report was prepared. As discussed above, a slide rail shoring system is not recommended for pump station construction due to the presence of sandy soils and a relatively shallow water table. For purposes of this report, we have assumed an internally braced sheet pile cofferdam will be used to support the excavation. However, we have provided some preliminary geotechnical parameters for possible use of caisson construction methods. Some modifications in the recommendations below may be required depending on the method selected.

8. Design the shoring for an internally braced cofferdam using the lateral loads for the pump station shown on Figure 5A (Appendix A). The shoring system should be designed by an experienced engineer licensed in the State of Oregon. A nominal water table depth of 7 feet was assumed for design based on available measurements. This value represents the shallowest groundwater level recorded to date. As indicated in Table 1, the groundwater level may be significantly lower during dry months. Prior to construction, the contractor should independently confirm the water level in the BH-7 piezometer.

9. Provide a relatively watertight cofferdam for the wet well construction. The cofferdam should be able to prevent sustained groundwater flow through the side walls and any loss of ground due to internal piping through the bottom.

   If an internally braced sheet pile cofferdam is planned, use a section with a minimum web thickness of at least 3/8 inch or as required based on the selected spacing of the internal bracing. However, a thicker web may be required to allow for harder driving below 40 feet. Contractors bidding on the project should review the boring logs and contents of this report, and independently confirm the groundwater level prior to construction.

10. Drive the sheet piles at least 15 feet below the base of the planned excavation. This depth is intended to increase the seepage path and prevent upwelling or a quick condition developing in the bottom of the excavation. The design tip elevation should be confirmed by the contractor's design engineer based on the groundwater levels at the time of construction and the planned dewatering system, if any.

11. Install a minimum of four dewatering wells outside of the cofferdam (as required for effective dewatering), possibly in combination with additional interior well points or deep sumps. The system should be designed and installed to allow continuous pumping of groundwater until the entire structure is backfilled and capable of withstanding the hydrostatic pressures. The dewatering system should maintain the groundwater level at least 3 feet below the bottom of the excavation. It should not allow continuous upward flow of groundwater that could cause a loosening or heaving of the soils, which could destabilize the bottom of the excavation. Excavation inside the shoring system should be discontinued until the dewatering system is improved if there is any evidence of seepage or internal piping of sand into the cofferdam or ground loss around its perimeter.

12. Backfill the sides of the pump station excavations with crushed rock or Controlled Low Strength Material (CSLM). Crushed rock, if used as backfill, place in 12-inch thick maximum lifts and compact with 1 pass of a jumping-jack type compactor. A hoe-pack style compactor should only be used with extreme caution to avoid overstressing the wet well structure. If sheet piles are used, they should be extracted in a manner that will not lift or loosen the backfill. CLSM is preferable to crushed rock because it eliminates the need for compaction in lifts and the risk to workers and would facilitate the removal of the sheetpiles.

13. If the wet well is backfilled with CLSM, the structure will be subject to fluid pressure from the CLSM prior to it curing. We recommend the wet well structure be designed using an equivalent fluid density of 90 pcf to represent the CLSM in a fluid condition.

14. Design the wet well structure assuming a Site Class D and the response spectrum and seismic parameters summarized in Figure 4A. Liquefaction of the site to a nominal depth of 50 feet should be assumed based on currently available information. Assume up to 6 inches of differential settlement of the ground surface surrounding the wet well can occur during a large earthquake.

15. Assume the buoyant weight of the backfill mass ($\pm$63 pcf if crushed rock is used) will resist the uplift forces. This assumes the backfill material and the base will extend to the sidewalls of the cofferdam. Assume a buoyant weight of 30 pcf if CLSM is used as backfill.

Caisson Option

Contractors may elect to bid a caisson as an alternative construction method. The means and methods for construction are typically selected by the contractor and designed by the contractor or their consultants. For this construction option, we recommend the following general guidelines:

16. Assume a groundwater table at a depth of ±7 feet (reflecting the level during wet weather). This depth fluctuates seasonally and should be confirmed by the contractor prior to construction by measuring the water level in the piezometer installed in BH-7.

17. Assume a side friction distribution to resist uplift shown in Figure 6A (Appendix A).

18. Contractors should review the boring logs provided in Appendix B. Soil samples are available for review at our office.

Vault Construction

Plans provided by Murraysmith indicate the base of the vault will be set ±10 feet below the surrounding grade. We understand the vault will be a relatively rigid, precast concrete structure designed to resist differential settlements. Construct the vault foundation as follows:

19. Assume the vault could experience up to 8 inches of total settlement. Assume a potential differential settlement of up to 8 inches between the vault and wet well. Provide flexible connections for rigid pipes connecting the structures to accommodate this potential degree of differential settlement.

20. Excavate to the required subgrade elevation using an excavator equipped with a smooth-edged bucket to minimize subgrade disturbance.

21. Cover the prepared subgrade with a Separation Geotextile.

22. Provide at least 18 inches of Open-graded Aggregate capped with a leveling course of Select Fill beneath the base of the vault.

Control Building Foundation Design and Construction

The control building will be supported by a thickened mat foundation. Design and construct the control building as follows:

23. Provide a base slab thickness of at least 18 inches and include both top and bottom reinforcing steel.

24. Provide at least 24 inches of Select Fill beneath the mat.

25. Use a modulus of subgrade reaction of 250 pci for slab design.

26. Assume the corners of the floor slab could deflect or warp up to 3 inches with respect to the center.

27. Assume liquefaction can result in up to 8 inches of total settlement and 8 inches of differential settlement between the control building and the wet well.

28. Excavate to the required subgrade elevation using an excavator equipped with a smooth-edged bucket to minimize subgrade disturbance.

29. Cover the prepared subgrade with a Separation Geotextile.

30. Compact the Select Fill in lifts as recommended above.

Force Main Construction

31. Contractors should expect force main trenching extending to nominal depths ranging from 4 to 8 feet will encounter existing pavement (in roadways) followed by predominantly sandy silt with seams or interbeds of silty fine sand. The sandy silty is underlain by loose, fine silty sand at depths of ±7 to 10 feet.

32. Shoring for utility trenches and temporary excavations should conform to Oregon OSHA regulations. An OSHA Type C soil is appropriate for the medium stiff to stiff fine-grained soils and underlying sands. Temporary cuts in Type C soils should be no steeper than 1.5:1(H:V). Sandy soils are susceptible to caving and very limited standup time should be expected. Therefore, the stability of the slopes will need to be verified at the time of construction. Contractors bidding on the project should anticipate that shoring will be required, and that unsupported sidewalls could cave beneath existing pavements.

33. Install the pipeline only during dry weather due to the sensitivity of the soils in the trench bottom and the potential for caving trench walls.

34. Excavate the bottom of the trench using an excavator equipped with smooth-edged bucket. Trench bottom stabilization should be expected for all trenches extending into the silt sand. Trench stabilization should include 12 inches of pipe bedding material. We recommend a Foundation Engineering representative be present during the early stages of the trenching to confirm the absence of groundwater and evaluate the need for trench bottom stabilization.

35. Use 1 or ¾-inch minus, clean (i.e., less than 5% passing the No. 200 sieve), well-graded crushed gravel or crushed rock conforming to City standards for pipe bedding, pipe zone material, and trench backfill in all roadway areas. Soil generated from trench excavations should not be re-used as trench backfill.

    To avoid overstressing the pipe, we recommend using relatively light compaction equipment within 2 feet of the top of the pipe and using maximum 6-inch thick (loose) lifts.

Pavement Design and Construction

A paved driveway and parking lot are planned at the pump station site. A portion of the site contain ±6 inches of base rock. Where present, the existing base rock could be left in place and incorporated into the pavement section. The paved areas should be constructed as follows:

36. Excavate to the required grades to provide a minimum flexible pavement section of 3 inches of AC over 12 inches of compacted Select Fill.

37. Depending on the planned site grading, it may be possible to leave the existing base rock in place and place additional base rock over it to construct the new pavement section.

38. Where base rock is currently absent, we recommended compacting the subgrade surface and covering the subgrade with a Separation Geotextile placed as recommended in Item 5. Place the base rock over the Separation geotextile and compact as recommended in Item 6.

39. Proof-roll the completed base rock prior to paving. Overexcavate and replace any areas of base rock and/or subgrade pumping with compacted Select Fill.

40. Compact the AC to a minimum of 91% relative compaction according to the theoretical maximum density calculated from the Rice specific gravity.

41. The minimum pavement section is not intended to support heavy construction traffic. We recommend providing at least 24 inches of

Select Fill over a Separation Geotextile for all staging areas or temporary haul roads.

DESIGN REVIEW/CONSTRUCTION OBSERVATION/TESTING

Foundation Engineering should be provided the opportunity to review all drawings and specifications that pertain to new foundations. We recommend we be present to confirm the soil conditions in the bottom of the force main trenches and in the foundation excavation for the new pump station. It is assumed the design of the method of construction and the shoring and dewatering systems for the new pump station will be completed by others. Mitigation of any unexpected foundation conditions such as unsuitable fill, high plasticity clay, soft soils, or persistent groundwater infiltration will also require engineering review and judgment by a Foundation Engineering representative.

VARIATION OF SUBSURFACE CONDITIONS, USE OF REPORT, AND WARRANTY

The analyses, conclusions, and recommendations contained herein assume the soil conditions and groundwater levels encountered in the exploratory borings and CPT are representative of the site conditions at the pump station and along the force main alignment. The above recommendations assume we will have the opportunity to review final drawings, approve imported fill material, and be present during construction to confirm the assumed foundation conditions. We should be contacted to review our recommendations if anticipated foundation loads and dimensions differ significantly from the values assumed in this report. No changes in the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection, or testing performed by others.

This report was prepared for the exclusive use of Murraysmith for the I-5 Pump Station and Force Main project in Woodburn, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning and design purposes. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or groundwater by hazardous or toxic materials. We assume those services, if needed, have been completed by others.

Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or groundwater by hazardous or toxic materials. We assume that those services if needed, have been completed by others. Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

Attachments

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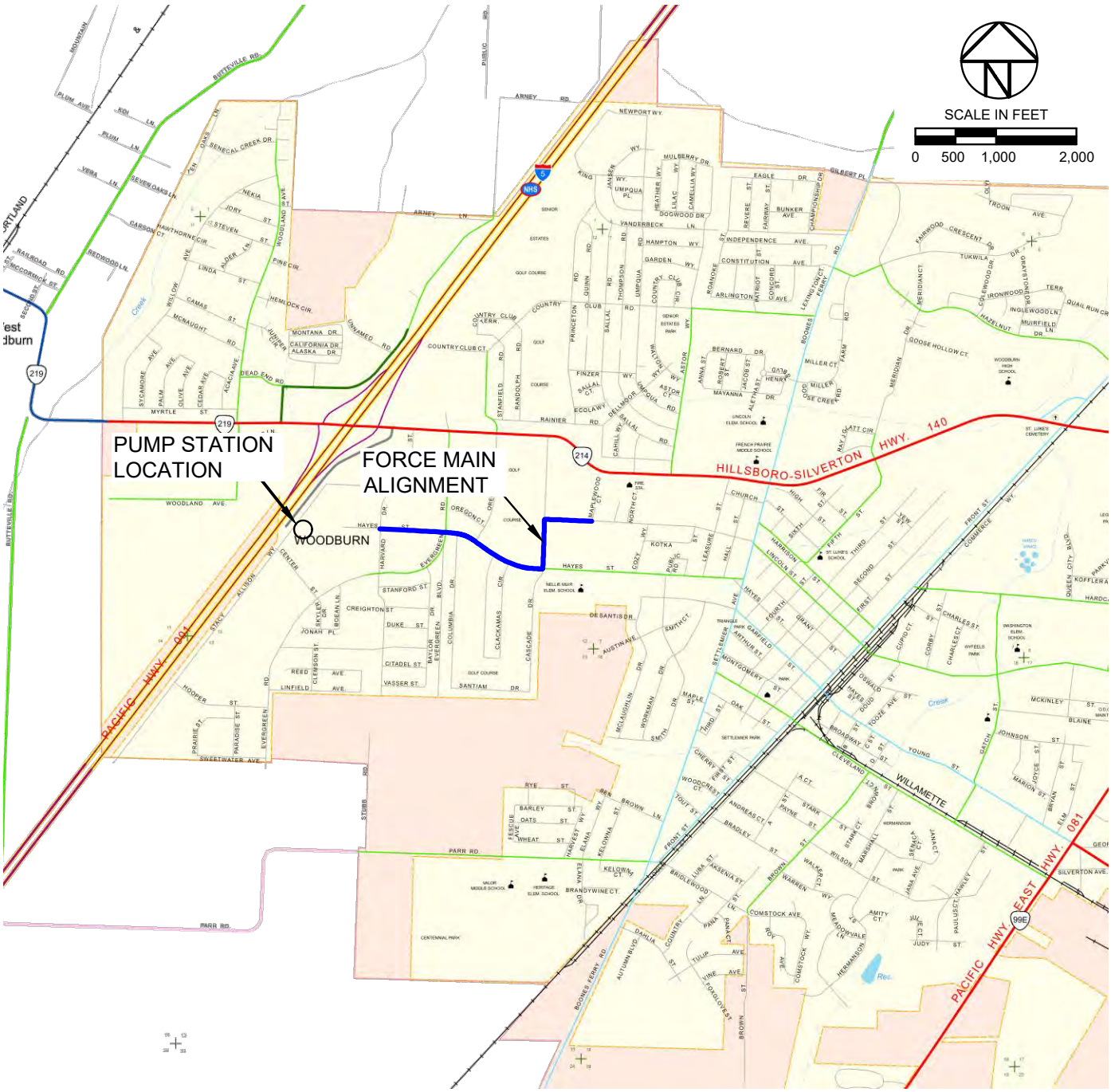
Appendix A

Figures

Foundation Engineering, Inc.
Professional Geotechnical Services



Note: Base map obtained from Oregon Department of Transportion website.

DATE NOV 2019
DWN. EJG
APPR.
REVIS.
PROJECT NO.
2191135

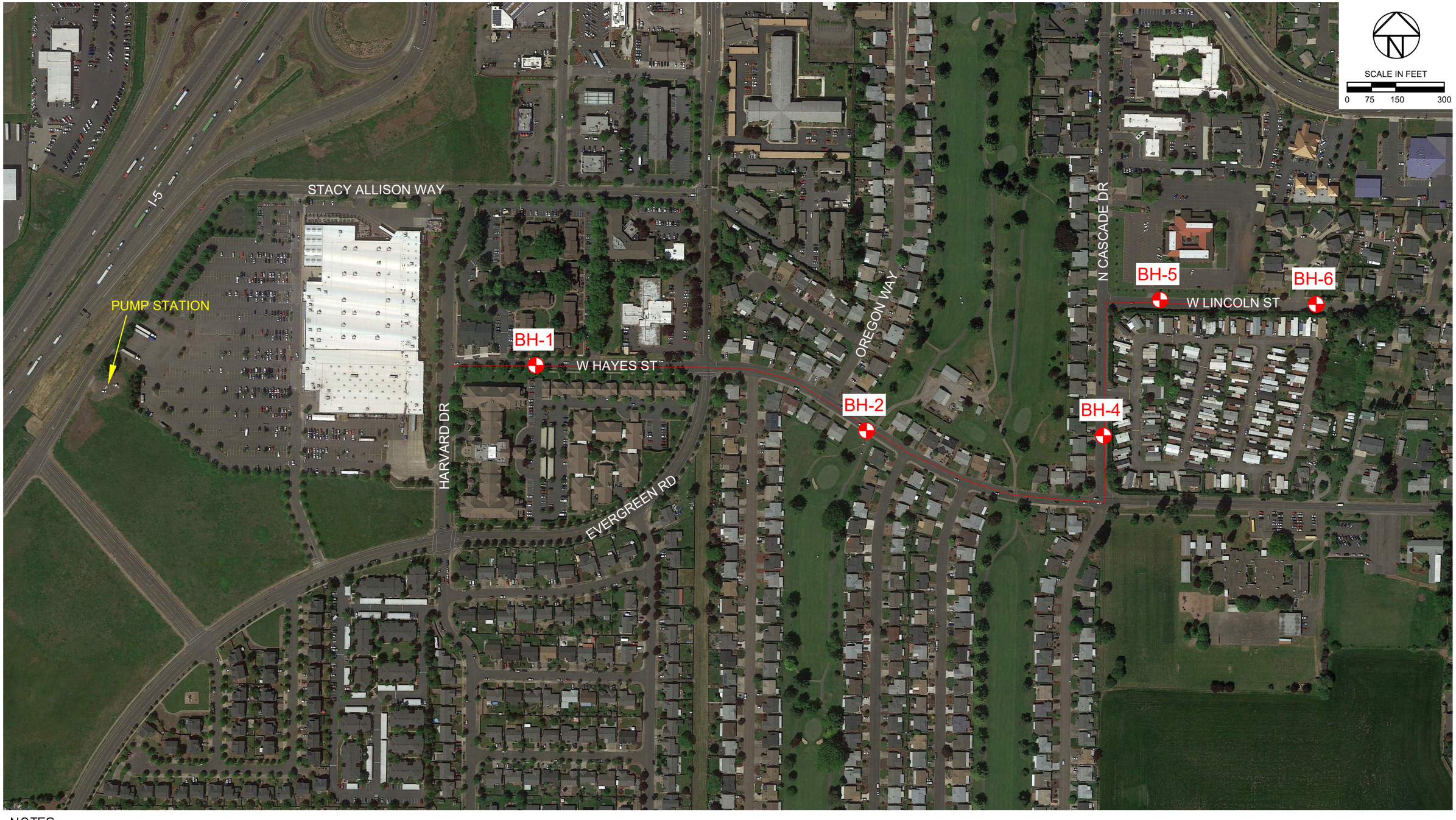
FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
820 NW CORNELL AVENUE
CORVALLIS, OR 97330-4517
BUS. (541) 757-7845 FAX (541) 757-7850

SITE LOCATION

I-5 PUMP STATION & FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO.
1A

FILE NAME: FIG 1A



NOTES:

1. BORING LOCATIONS WERE ESTABLISHED USING A METAL TAPE AND MEASURING WHEEL AND ARE APPROXIMATE.
2. AERIAL IMAGE OBTAINED FROM GOOGLE EARTH.
3. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
4. BH-3 NOT COMPLETED DUE TO TIME RESTRICTION.

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DATE DEC 2019
DWN. EJG
APPR.
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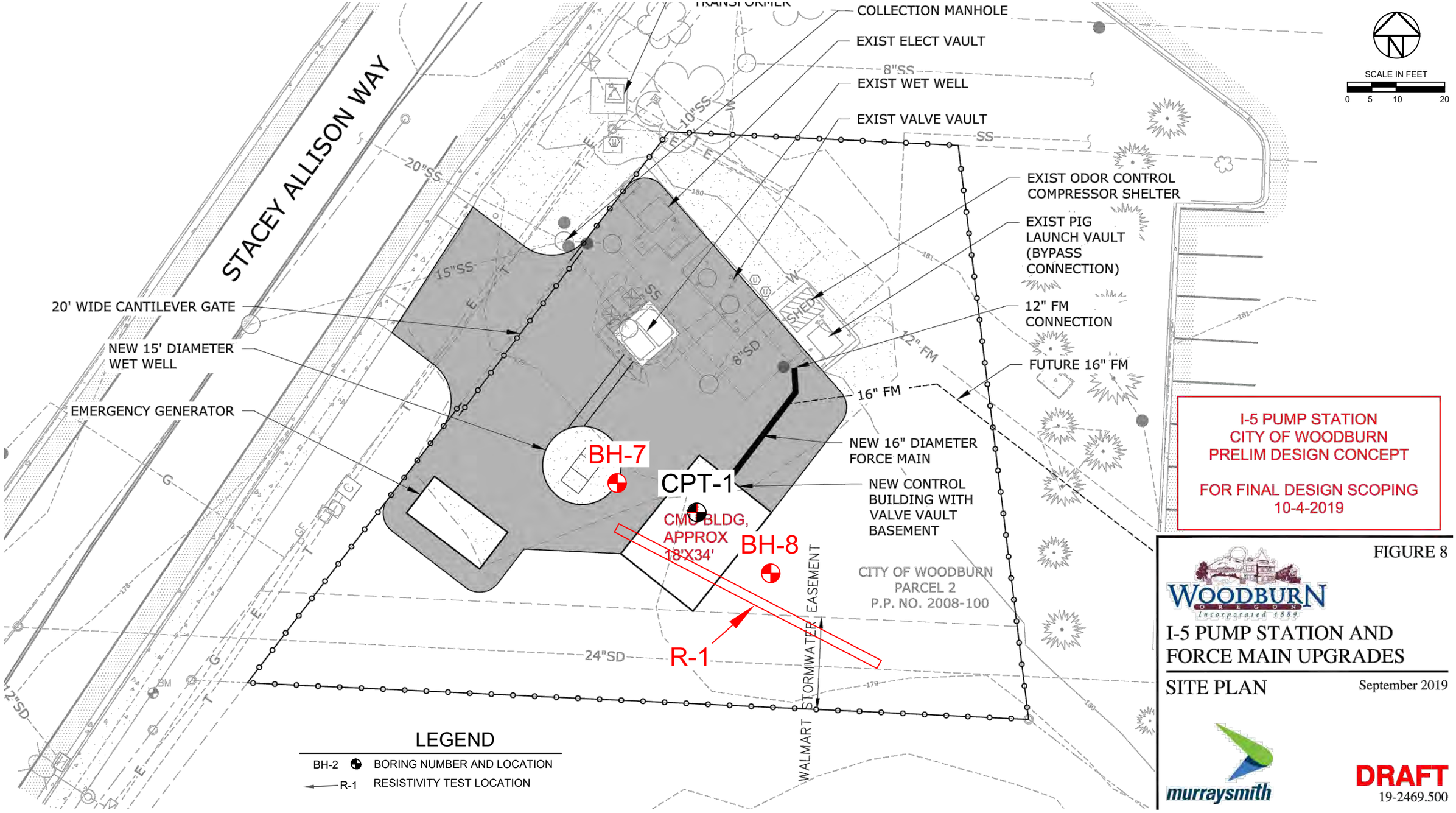
PROJECT NO. 2191135

FORCE MAIN BORING LOCATIONS

I-5 PUMP STATION & FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO. **2A**

FILE NAME:FIG 2A



I-5 PUMP STATION
CITY OF WOODBURN
PRELIM DESIGN CONCEPT

FOR FINAL DESIGN SCOPING
10-4-2019

FIGURE 8

WOODBURN OREGON Incorporated 1889

I-5 PUMP STATION AND FORCE MAIN UPGRADES

SITE PLAN

September 2019

murraysmith

DRAFT
19-2469.500

NOTES:
1. BORING LOCATIONS WERE ESTABLISHED USING A METAL TAPE AND MEASURING WHEEL AND ARE APPROXIMATE.
2. BASE MAP PROVIDED BY MURRAYSMITH.
3. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.

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DATE DEC 2019
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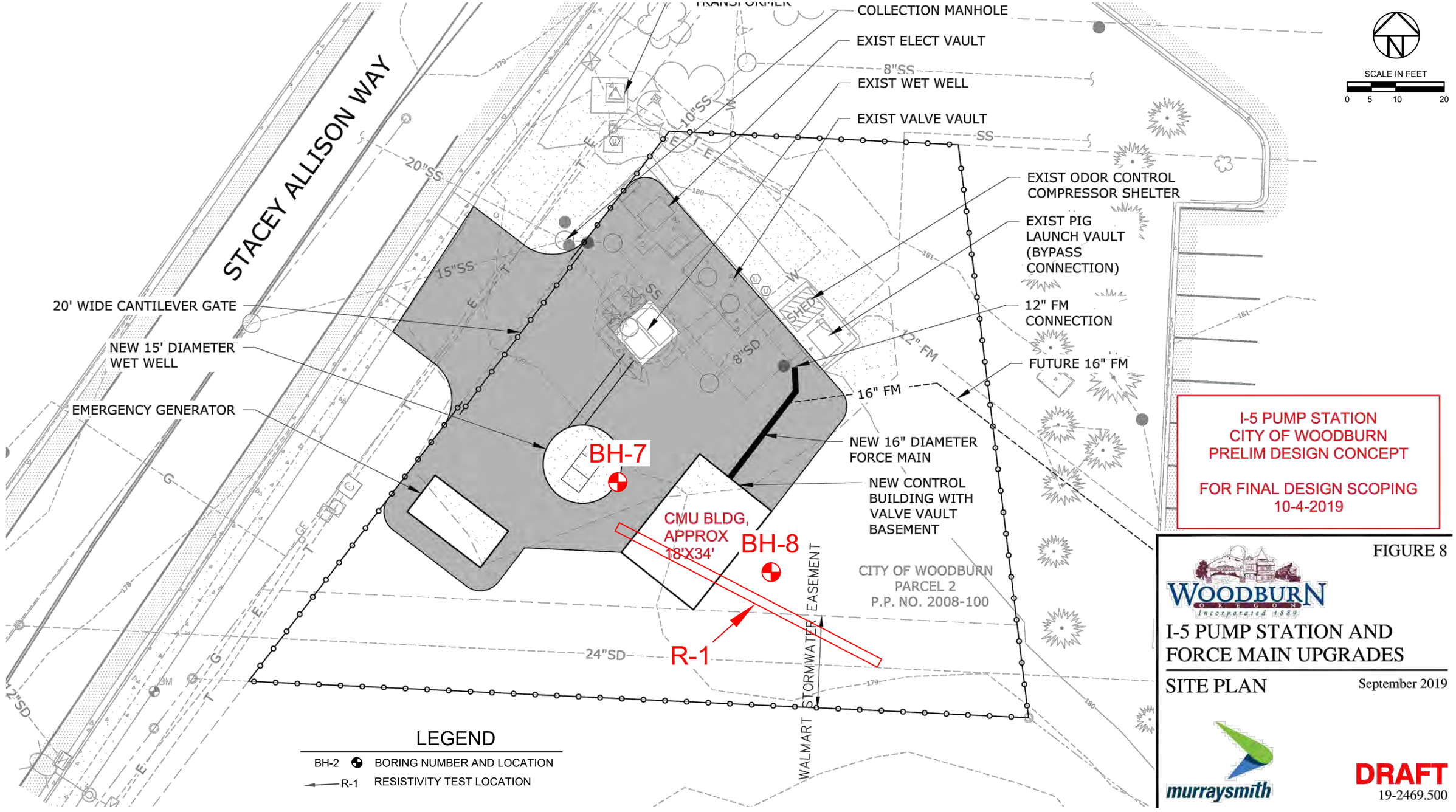
PUMP STATION SITE LAYOUT
AND EXPLORACTION LOCATIONS
I-5 PUMP STATION & FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO. 3A

FILE NAME:FIG 3A



I-5 PUMP STATION
CITY OF WOODBURN
PRELIM DESIGN CONCEPT

FOR FINAL DESIGN SCOPING
10-4-2019

FIGURE 8

WOODBURN OREGON Incorporated 1889

I-5 PUMP STATION AND FORCE MAIN UPGRADES

SITE PLAN

September 2019

murraysmith

DRAFT
19-2469.500

NOTES:
1. BORING LOCATIONS WERE ESTABLISHED USING A METAL TAPE AND MEASURING WHEEL AND ARE APPROXIMATE.
2. BASE MAP PROVIDED BY MURRAYSMITH.
3. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.

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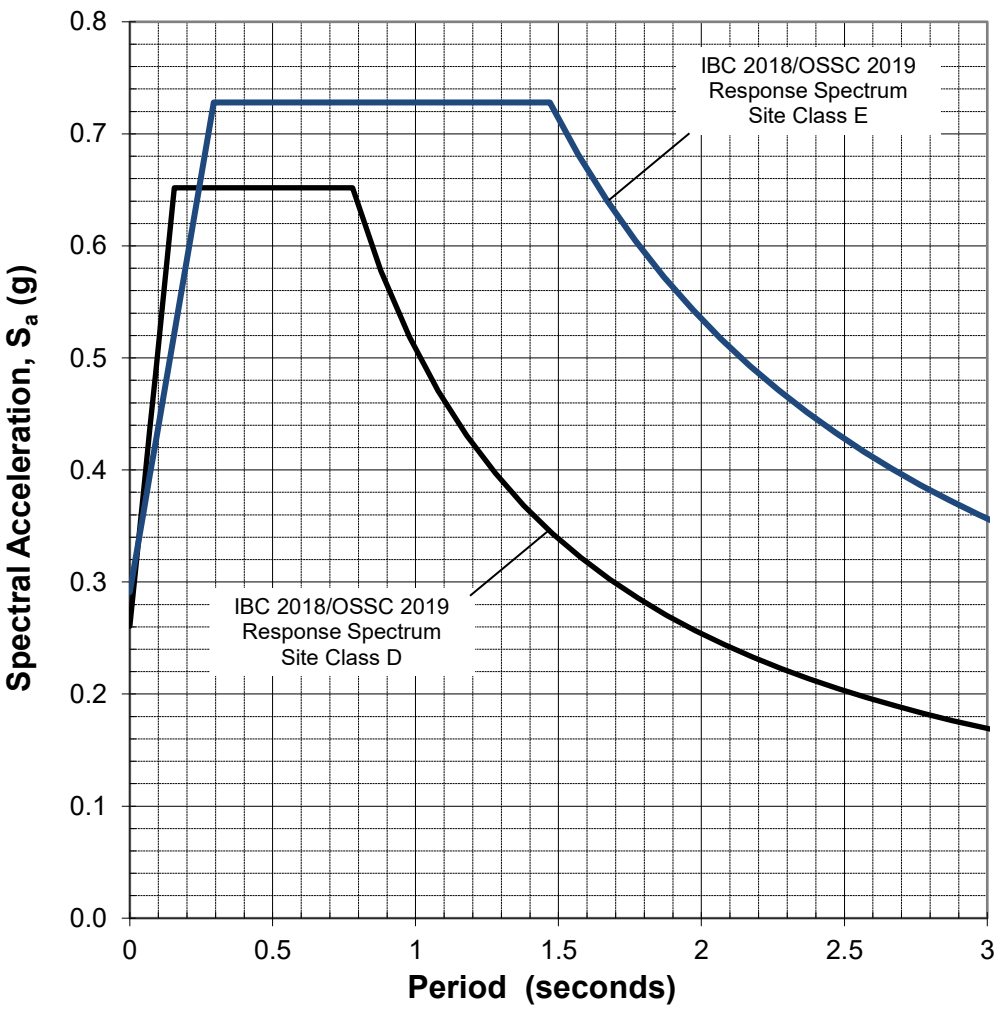
DATE DEC 2019
DWN. EJG
APPR.
REVIS.
PROJECT NO. 2191135

PUMP STATION SITE LAYOUT
AND BORING LOCATIONS
I-5 PUMP STATION & FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO. 3A

FILE NAME:FIG 3A



Notes:

1. The Design Response Spectrum is based on the IBC 2018, Section 1613.2 which is based on ASCE 7-16 Section 11.4.

2. The following parameters are based on the modified USGS 2014 maps provided in OSSC 2019::

   Site Class= **D** Damping = 5%

S_S =	0.84	F_a =	1.16	S_{MS} =	0.98	S_{DS} =	0.65
S_1 =	0.40	F_v =	1.90	S_{M1} =	0.76	S_{D1} =	0.51

3. The following parameters are based on the modified USGS 2014 maps provided in OSSC 2019::

   Site Class= **E** Damping = 5%

S_S =	0.84	F_a =	1.30	S_{MS} =	1.09	S_{DS} =	0.73
S_1 =	0.40	F_v =	4.00	S_{M1} =	1.60	S_{D1} =	1.07

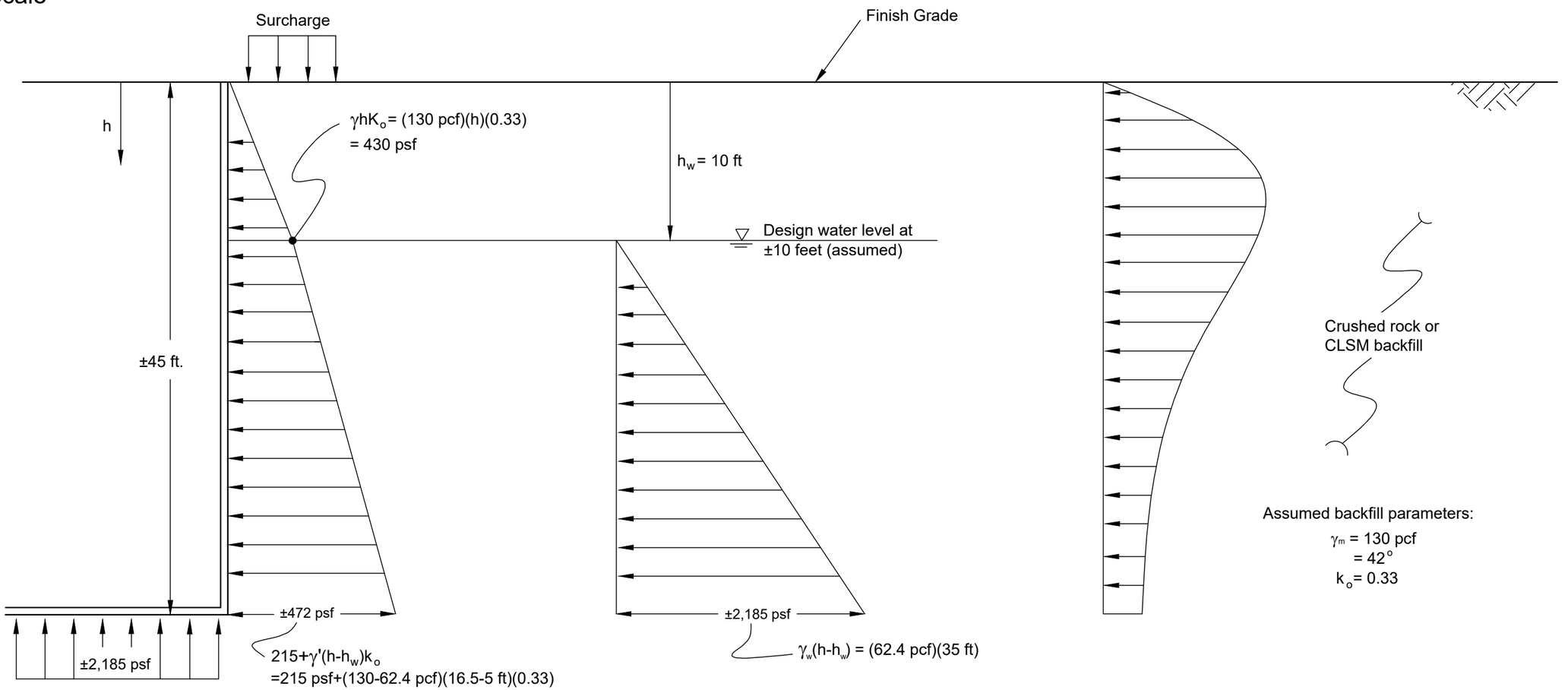
4. S_S and S_1 values indicated in Note 2 are the mapped, risk-targeted maximum considered earthquake spectral acclerations for 2% probability of exceedence in 50 years.

5. F_a and F_v were established based on OSSC 2019 Tables 1613.2.3(1) and 1613.2.3(2) using the selected S_S and S_1 values. S_{DS} and S_{D1} values include a 2/3 reduction on S_{MS} and S_{M1} as discussed in OSSC 2019 Section 1613.2.3.

6. Site location is: Latitude 45.1472, Longitude -122.8833.

FIGURE 4A
IBC 2018/OSSC 2019 SITE RESPONSE SPECTRA
I-5 PUMP STATION AND FORCE MAIN UPGRADES
Woodburn, Oregon
Project No. 2191135

Not to Scale



Hydrostatic Uplift Pressure | At-Rest Earth Pressure | Hydrostatic Pressure | Surcharge Pressure

Notes:

1. Lateral earth pressure assumes a ±45–foot excavation depth and the walls will be backfilled with compacted granular fill or Controlled Low Strength Material (CLSM).
2. The hydrostatic pressure on the base and walls was calculated assuming the ground water rises to ±10 feet below the ground surface.
3. Surcharge pressure is based on AASHTO LRFD Bridge Design Specifications (2012) Section 3.11.6.2, p. 3–124.
4. All units in feet, pounds, and pounds per square foot (psf).
5. See report for additional comments regarding this figure.

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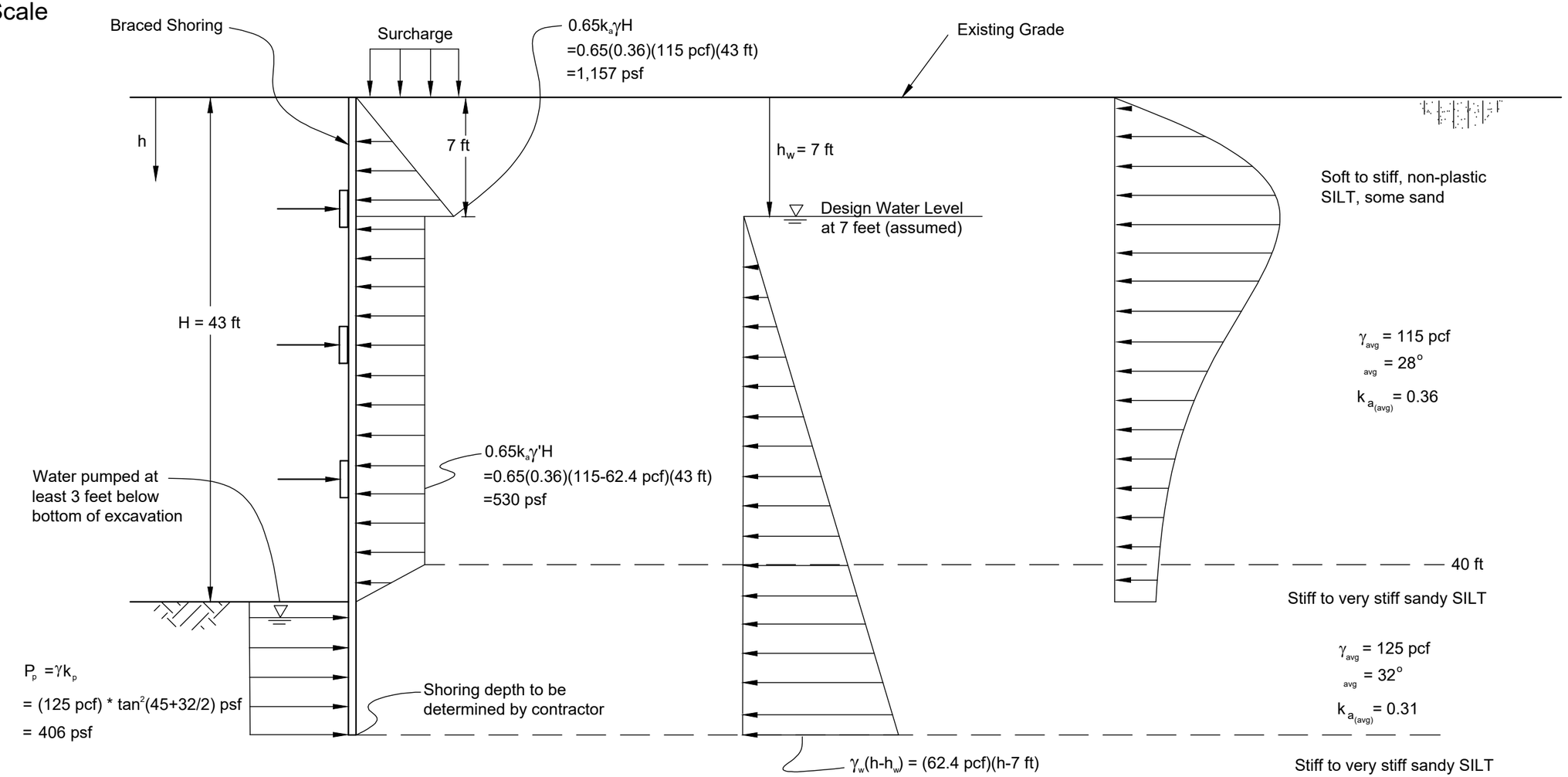
LATERAL EARTH PRESSURE DIAGRAM
PERMANENT STRUCTURE
I–5 PUMP STATION AND FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO. **4A**

FILE NAME: FIG 4A

Not to Scale



Notes:

1. Apparent earth pressure diagram is based on recommendations by Peck (1969) for sand.
2. The soil profile shown is generalized based on the average subsurface conditions in BH–7. The dimensions should be adjusted based on the actual shoring depth and soil profile encountered.
3. Hydrostatic pressure is based on ground water levels measured in BH–3. The actual ground water level should be confirmed at the time of construction.
4. Surcharge pressure is based on AASHTO LRFD Bridge Design Specifications (2012) Section 3.11.6.2, p. 3–124.
5. All units in feet, pounds, and pounds per square foot (psf).
6. See report for additional comments regarding this figure.

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DATE DEC 2019
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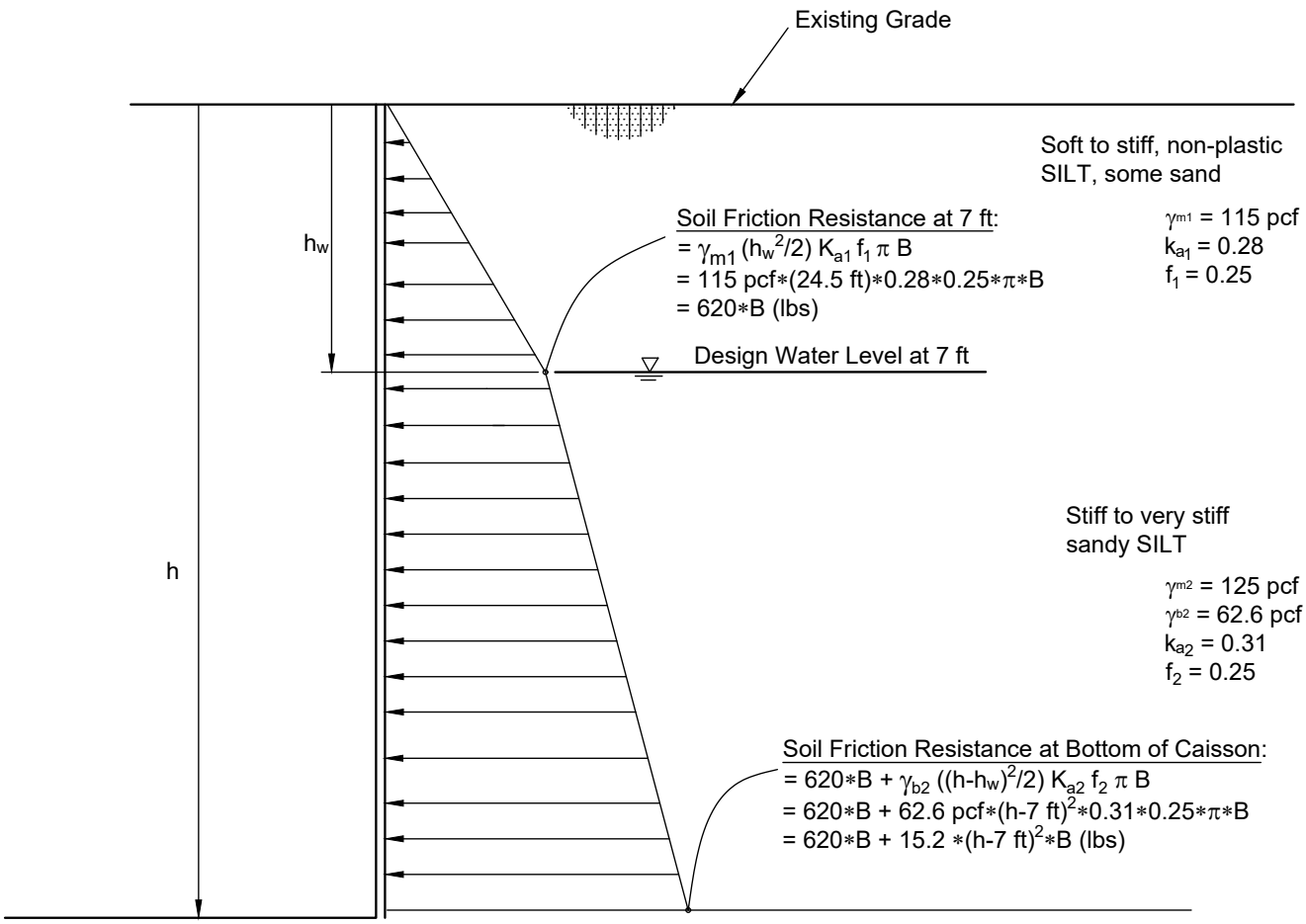
LATERAL EARTH PRESSURE DIAGRAM
TEMPORARY EXCAVATION
I–5 PUMP STATION AND FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO. 5A

FILE NAME: FIG 5A

Not to Scale



Notes:

1. The side friction on the walls was calculated assuming ground water at 7 feet below the ground surface. Uplift resistances shown are ultimate values. Use a factor of safety of 2 to calculate an allowable uplift resistance.
2. All units in feet, pounds, pounds per square foot (psf), and pounds per cubic foot (pcf).
3. The soil profile shown is generalized based on the subsurface conditions in BH–7. The dimensions should be adjusted based on the caisson depth.

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SIDE FRICTION FOR CAISSON

I–5 PUMP STATION & FORCE MAIN UPGRADES
WOODBURN, OREGON

FIGURE NO.
6A

FILE NAME: FIG 6A

Appendix B

Boring Logs and CPT Data

Foundation Engineering, Inc.
Professional Geotechnical Services

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the sample examinations and laboratory test results. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

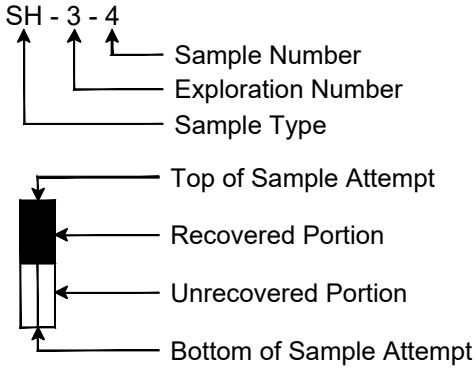
VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



C - Pavement Core Sample
CS - Rock Core Sample
OS - Oversize Sample (3-inch O.D. split-spoon)
S - Grab Sample
SH - Thin-walled Shelby Tube Sample
SS - Standard Penetration Test Sample (2-inch O.D. split-spoon)

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split-spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%)

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or Field Vane shear devices.

WATER TABLE

▼ Water Table Location

(1/31/16) Date of Measurement

TYPICAL SOIL/ROCK SYMBOLS

Concrete	Silt	Basalt
Organics	Sand	Sandstone
Clay	Gravel	Siltstone

UNIFIED SOIL CLASSIFICATION SYMBOLS

G - Gravel	W - Well Graded
S - Sand	P - Poorly Graded
M - Silt	L - Low Plasticity
C - Clay	H - High Plasticity
Pt - Peat	O - Organic

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT*	S_u** (tsf)	Term	SPT*	Term
Easily penetrated several inches by fist.	0 - 2	< 0.125	Very Soft	0 - 4	Very Loose
Easily penetrated several inches by thumb.	2 - 4	0.125 - 0.25	Soft	4 - 10	Loose
Can be penetrated several inches by thumb with moderate effort.	4 - 8	0.25 - 0.50	Medium Stiff	10 - 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	8 - 15	0.50 - 1.0	Stiff	30 - 50	Dense
Readily indented by thumbnail.	15 - 30	1.0 - 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	> 30	> 2.0	Hard		

* SPT N-value in blows per foot (bpf)
** Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Non-plastic	0 - 3	Cannot be rolled into a thread at any moisture.
Low Plasticity	3 - 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 - 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and re-rolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least ¼ inch thick.
Laminated	Alternating layers less than ¼ inch thick.
Fissured	Contains shears and partings along planes of weakness.
Slickensided	Partings appear glossy or striated.
Blocky	Breaks into small lumps that resist further breakdown.
Lensed	Contains pockets of different soils.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
	ASPHALTIC CONCRETE (±5 inches).		0.0			Capped with AC cold patch and gravel
1	BASE ROCK (±6 inches).		0.4			
2	Medium stiff to stiff sandy SILT (ML); brown and iron-stained, wet, low plasticity, fine sand, (Willamette Silt).		0.9			
3				SS-1-1	7	
4						
5				SS-1-2	8	Backfilled with bentonite chips
6						
7						
8				SS-1-3	8	
9						
10	Loose silty SAND (SM) stratified with sandy SILT (ML); brown and iron-stained, wet, low plasticity silt, fine sand, (alluvium).		10.0	SS-1-4	10	
11	BOTTOM OF BORING		11.5			

Project No.: 2191135

Surface Elevation: N/A

Date of Boring: November 26, 2019

Boring Log: BH-1

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
	ASPHALTIC CONCRETE (±5 inches).		0.0			Capped with AC cold patch and gravel
1	BASE ROCK (±6 inches).		0.4			
2	Stiff SILT, some sand (ML) stratified with silty SAND (SM); brown and iron-stained, wet, low plasticity, fine sand, (Willamette Silt).		0.9			
3				SS-2-1	▲ 8	
4						
5	Field vanes on SH-2-2: S_u = ±0.66 tsf at ±5 feet; S_u = ±0.54 at ±7 feet.			SH-2-2	●	Backfilled with bentonite chips
6						
7				SS-2-3	▲ 6 ●	
8						
9						
10	Stiff below ±10 feet.			SS-2-4	▲ 12 ●	
11						
	BOTTOM OF BORING.		11.5			

Project No.: 2191135

Surface Elevation: N/A

Date of Boring: November 26, 2019

Foundation Engineering, Inc.

Boring Log: BH-2

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
	ASPHALTIC CONCRETE (±6 inches).		0.0			Capped with AC cold patch and gravel
1	BASE ROCK (±5 inches).		0.5			
2	Medium stiff to stiff SILT, some sand (ML); brown and iron-stained, wet, low plasticity, fine sand, (Willamette Silt).		0.9			
3				SS-4-1	8	
4						
5				SS-4-2	5	Backfilled with bentonite chips
6						
7	Sandy below ±7 feet.					
8				SS-4-3	5	
9						
10						
11	Loose silty SAND (SM); brown and iron-stained, wet, low plasticity silt, fine sand, (alluvium).		10.0	SS-4-4	6	
	BOTTOM OF BORING		11.5			

Project No.: 2191135

Surface Elevation: N/A

Date of Boring: November 26, 2019

Boring Log: BH-4

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
1	ASPHALTIC CONCRETE (±3 inches).		0.0			Capped with AC cold patch and gravel
	BASE ROCK (±12 inches).		0.3			
2	Stiff SILT, some sand (ML); brown, moist, low plasticity, fine sand, (Willamette Silt).		1.3			
3				SS-5-1	9	
4						
5	Sandy below ±5 feet.			SS-5-2	6	Backfilled with bentonite chips
6						
7						
8	Loose silty SAND (SM) stratified with sandy SILT (ML); brown, wet, non-plastic silt, fine sand, (alluvium).		7.0	SS-5-3	8	
9						
10				SS-5-4	6	
11						
	BOTTOM OF BORING		11.5			

Project No.: 2191135

Surface Elevation: N/A

Date of Boring: November 26, 2019

Boring Log: BH-5

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
	ASPHALTIC CONCRETE (±6 inches).		0.0			Capped with AC cold patch and gravel
1	BASE ROCK (±6 inches).		0.5			
2	Stiff sandy SILT (ML); brown and iron-stained, wet, low plasticity, fine sand, (Willamette Silt).		1.0			
3				SS-6-1	10	
4						
5	Field vanes on SH-6-2: S_u = ±0.64 tsf at ±5 feet; S_u = ±0.63 tsf at ±7 feet.			SH-6-2		Backfilled with bentonite chips
6						
7				SS-6-3	8	
8						
9						
10	Soft to medium stiff, no iron-staining, non-plastic to low plasticity silt below ±10 feet.			SS-6-4	4	
11						
	BOTTOM OF BORING		11.5			

Project No.: 2191135

Surface Elevation: N/A

Date of Boring: November 26, 2019

Boring Log: BH-6

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value / Recovery; Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
			179			
1	Dense CRUSHED ROCK (GP); grey, wet, ±2-inch minus angular rock, (fill).		178.5 0.5			Morris Monument set in PCC
2	Stiff SILT, some sand (ML); brown mottled dark brown, moist, low plasticity, fine sand, (Willamette Silt).			SS-7-1	7	
3						
4						
5	Sandy below ±5 feet.			SS-7-2	5	Bentonite chips
6						
7						
8	Field vane on SH-7-3: S_u = ±0.44 tsf at ±7.5 feet.		171.0 8.0	SH-7-3		
9	Medium stiff to stiff SILT, some sand (ML); brown, wet, non-plastic to low plasticity, fine sand, (Willamette Silt).					
10	Field vane on SH-7-3: S_u = ±0.33 tsf at ±9.5 feet.			SS-7-4	3	±1-inch I.D. PVC
11						
12	Iron-stained below ±12.5 feet.					
13				SS-7-5	5	
14						
15				SS-7-6	6	
16						Ground water (11/26/19)
17						
18				SS-7-7	4	
19						
20	Stiff and sandy below ±20 feet.			SH-7-8		
21						
22	Field vane on SH-7-8: S_u = ±0.23 tsf at ±20 feet; S_u = ±0.37 tsf at ±22 feet.			SS-7-9	11	
23						
24						
25				SS-7-10	6	
26	Soft to medium stiff SILT, some sand (ML); grey, wet, low to medium plasticity, fine sand, (alluvium).		153.0 26.0			
27						Silica Sand
28						
29						
30				SS-7-11	9	Machine slot screen (0.010)
31						
32						
33						

Project No.: 2191135

Surface Elevation: 179.0 feet (Approx.)

Date of Boring: November 25, 2019

Boring Log: BH-7

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value / Recovery / Moisture, % / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
35		145	SH-7-12		
36	Field vanes on SH-7-12: S_u = ±0.23 tsf at ±35 feet; S_u = ±0.30 tsf at ±37 feet.				
37			SS-7-13	4	
38					
39					
40		139.0			
41	Stiff to very stiff sandy SILT (ML); grey, wet, low plasticity to non-plastic silt, fine sand, (alluvium).	40.0	SS-7-14	19	
42					
43					Bentonite chips
44					
45			SS-7-15	17	
46					
47					
48					
49					
50			SS-7-16	13	
51					
52					
53					
54					
55			SS-7-17	5	
56					
57					
58					
59					
60			SS-7-18	16	
61					
62					
63					
64		115.0			
65	Medium stiff SILT, trace sand (ML); grey, moist to wet, low plasticity, fine sand, (alluvium).	64.0	SS-7-19	5	
66					
	BOTTOM OF BORING	112.5 / 66.5			

Project No.: 2191135

Surface Elevation: 179.0 feet (Approx.)

Date of Boring: November 25, 2019

Boring Log: BH-7

I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth 179	Samples	SPT, N-Value / Moisture, % / Recovery / RQD., % (0 – 50 – 100)	Backfill/ Installations/ Water Table
1	Very stiff SILT, some sand (ML); brown, moist, low plasticity, fine sand, (Willamette Silt).		0.0			Backfilled with bentonite chips
2	Field vanes on SH-8-1: S_u = >1.0 tsf at ±2.5 and 4.5 feet.					
3				SH-8-1		
4						
5				SS-8-2	7	
6						
7	Grey-brown, iron-stained, and sandy/silty sand lenses below ±7 feet.					
8				SS-8-3	7	
9			170.0			
9	Medium stiff SILT, some sand (ML); brown, wet, non-plastic to low plasticity silt, fine sand, (Willamette Silt).		9.0			
10				SS-8-4	7	
11						
12	Iron-stained below ±12 feet.					
13	Very soft sandy silt lens from ±13 to 13.5 feet.			SS-8-5	4	
14						
15				SS-8-6	5	
16	Grey with no iron-staining below ±16 feet.		162.5			
	BOTTOM OF BORING		16.5			

Project No.: 2191135

Surface Elevation: 179.0 feet (Approx.)

Date of Boring: November 25, 2019

Boring Log: BH-8

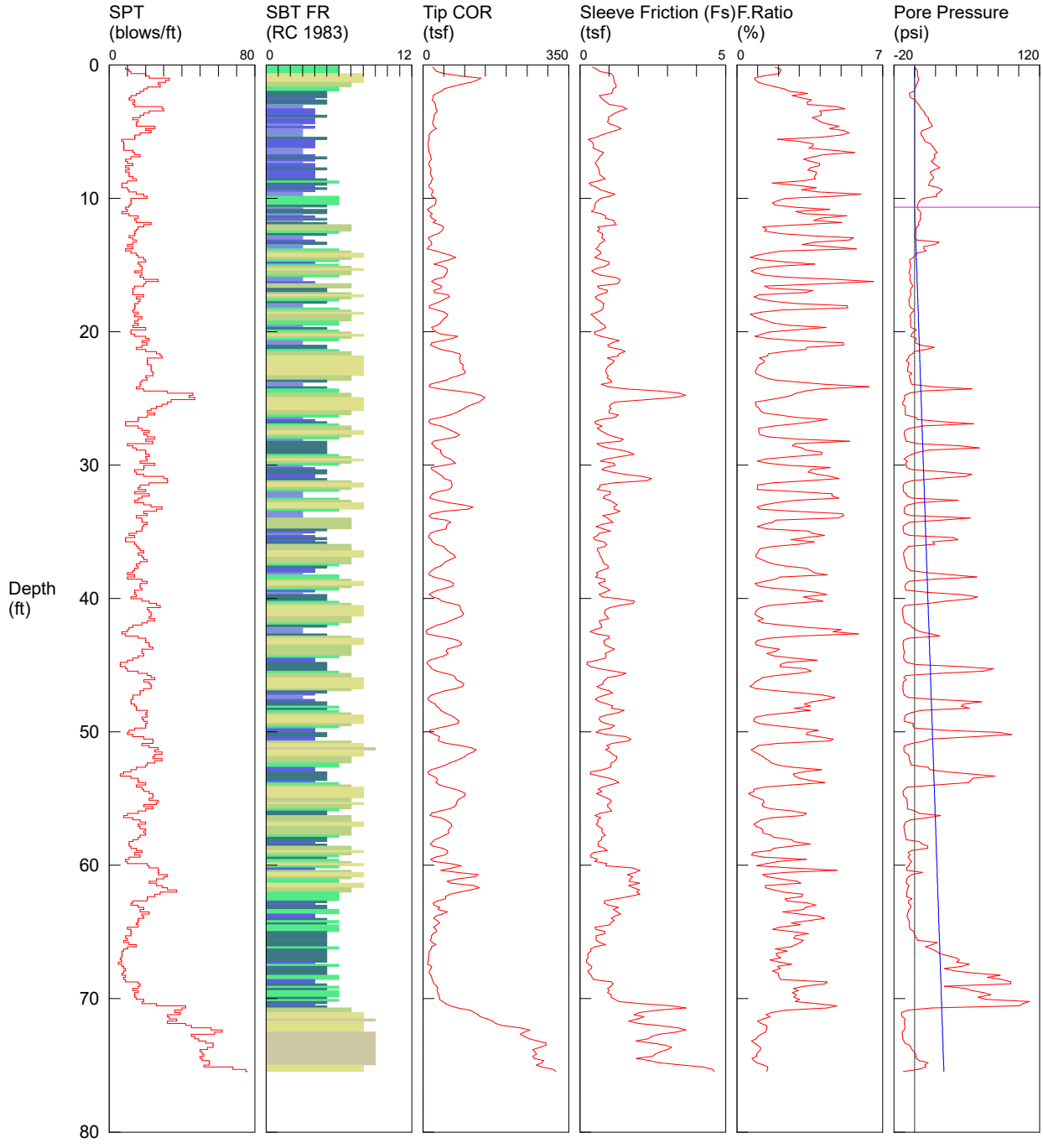
I-5 Pump Station & Force Main Upgrades

Woodburn, Oregon

Foundation Engineering, Inc.

Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodburn

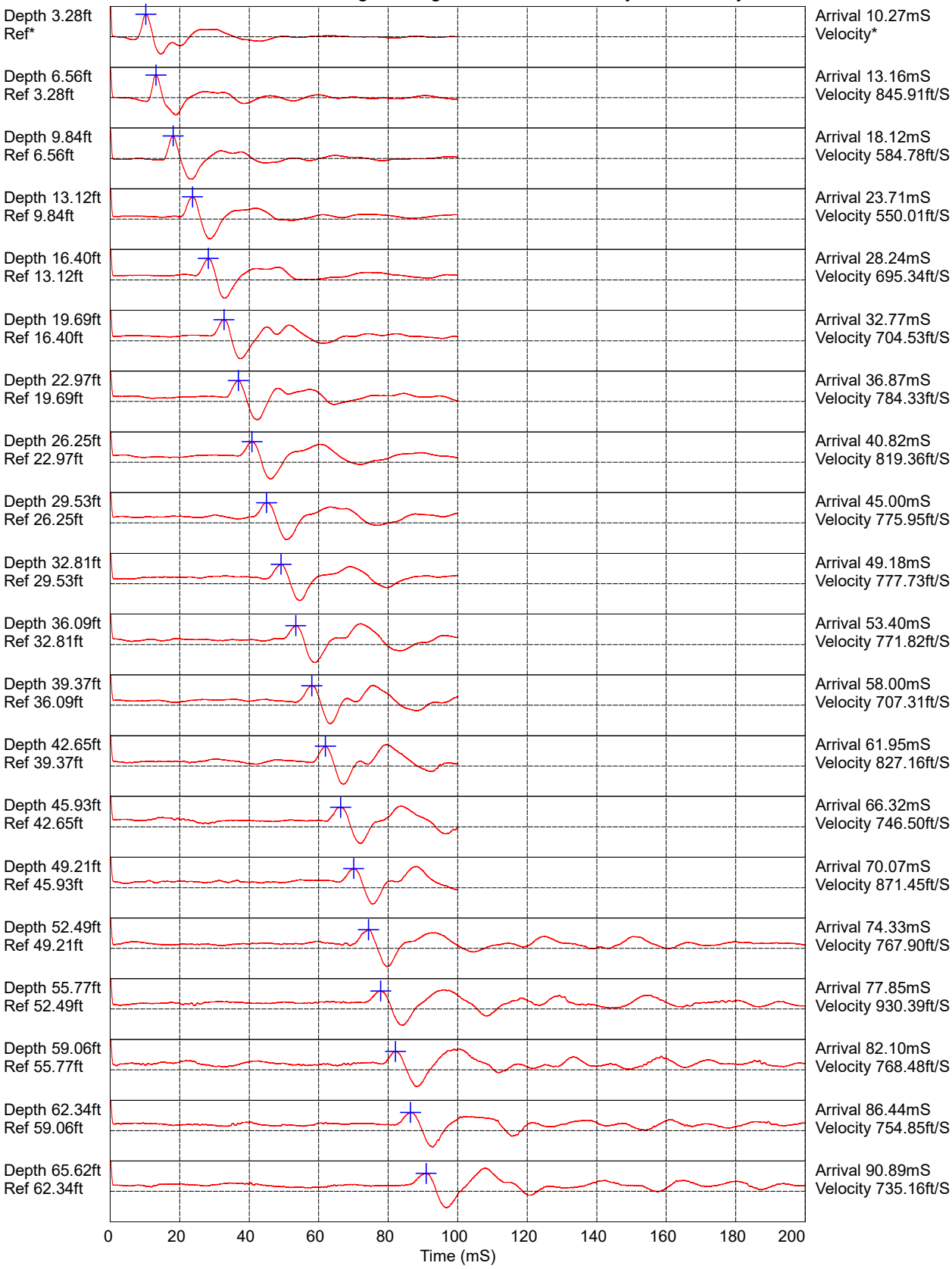
OPERATOR: OGE BAK
CONE ID: DDG1296
HOLE NUMBER: CPT-1
TEST DATE: 3/26/2020 9:14:49 AM
TOTAL DEPTH: 75.459 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

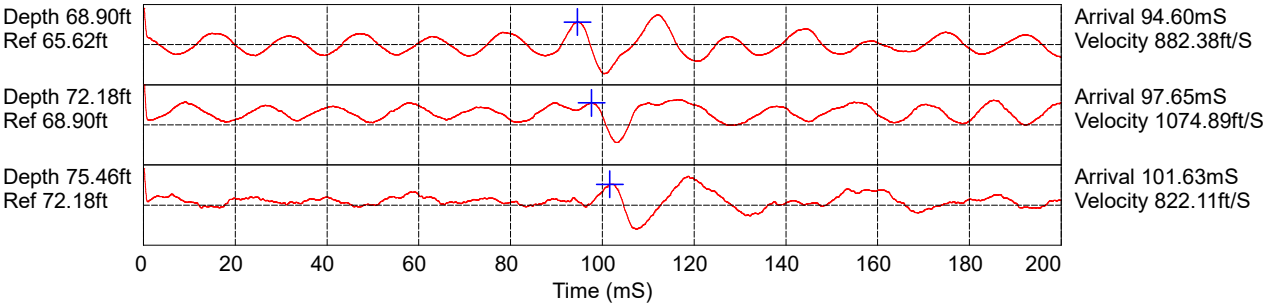
*SBT/SPT CORRELATION: UBC-1983

COMMENT: Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodburn



Hammer to Rod String Distance (ft): 4.27
* = Not Determined

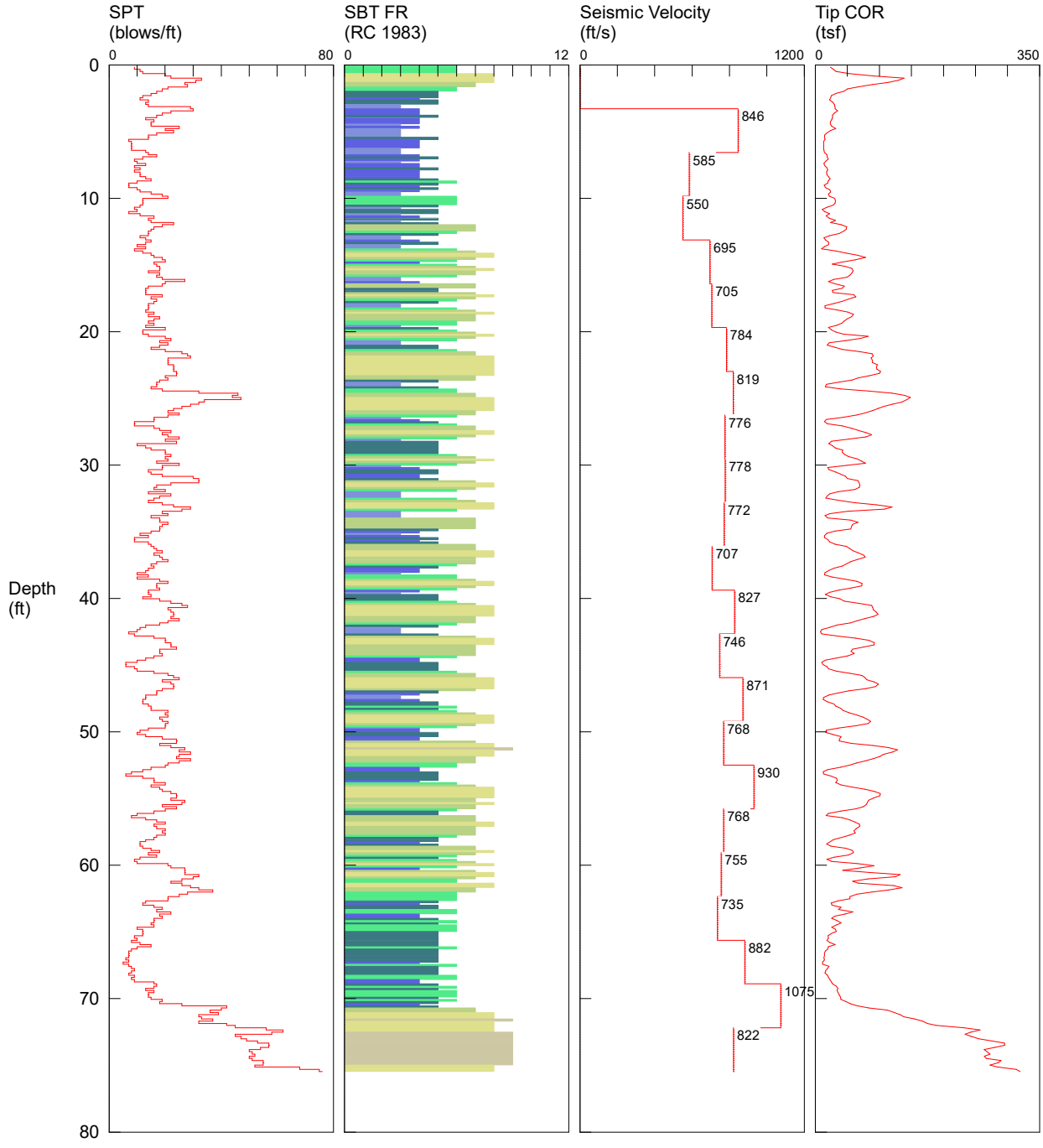
COMMENT: Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodburn



Hammer to Rod String Distance (ft): 4.27
* = Not Determined

Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodburn

OPERATOR: OGE BAK
CONE ID: DDG1296
HOLE NUMBER: CPT-1
TEST DATE: 3/26/2020 9:14:49 AM
TOTAL DEPTH: 75.459 ft

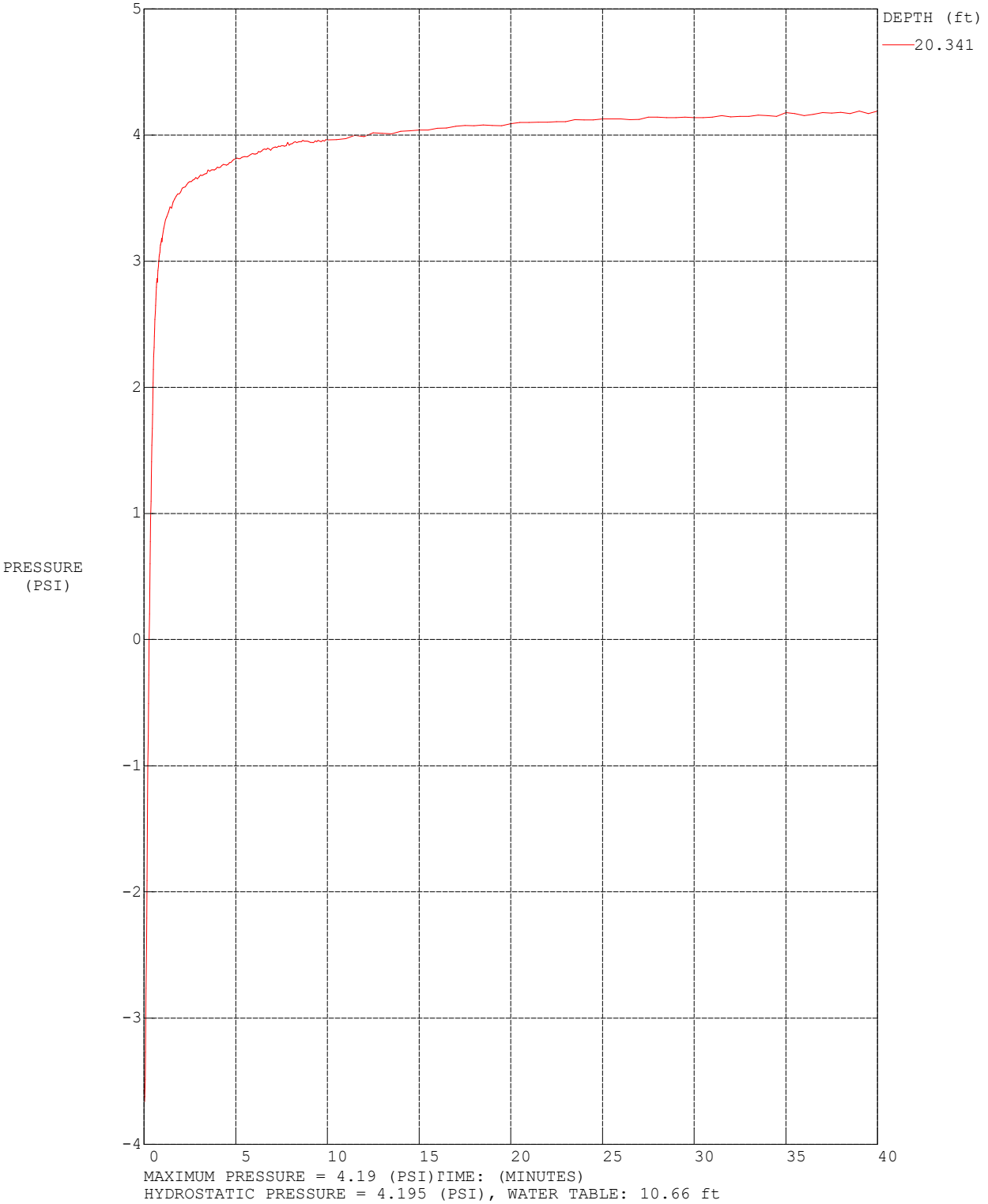


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

MENT: Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodb

TEST DATE: 3/26/2020 9:14:49 AM



Foundation Engineering / CPT-1 / 3098 Stacy Allison Way Woodburn

OPERATOR: OGE BAK
CONE ID: DDG1296
HOLE NUMBER: CPT-1
TEST DATE: 3/26/2020 9:14:49 AM
TOTAL DEPTH: 75.459 ft

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	23.18	0.4260	1.838	0.010	9	6	sandy silt to clayey silt
0.328	28.17	0.5924	2.103	1.800	11	6	sandy silt to clayey silt
0.492	32.25	0.6735	2.089	2.833	12	6	sandy silt to clayey silt
0.656	52.66	1.0591	2.011	2.859	20	6	sandy silt to clayey silt
0.820	91.12	1.1461	1.258	2.745	22	8	sand to silty sand
0.984	138.43	1.1557	0.835	3.853	33	8	sand to silty sand
1.148	129.07	1.1686	0.905	3.387	31	8	sand to silty sand
1.312	113.17	1.1702	1.034	2.613	27	8	sand to silty sand
1.476	88.73	1.2403	1.398	1.685	28	7	silty sand to sandy silt
1.640	65.69	1.2336	1.878	0.879	21	7	silty sand to sandy silt
1.804	50.07	1.1389	2.274	0.082	19	6	sandy silt to clayey silt
1.969	44.10	1.1132	2.525	-0.731	17	6	sandy silt to clayey silt
2.133	32.07	1.0898	3.398	-5.204	15	5	clayey silt to silty clay
2.297	24.92	0.6631	2.661	-4.689	12	5	clayey silt to silty clay
2.461	23.96	0.7331	3.060	-3.646	11	5	clayey silt to silty clay
2.625	22.09	0.7936	3.592	0.348	14	4	silty clay to clay
2.789	27.06	0.9129	3.374	1.872	13	5	clayey silt to silty clay
2.953	29.60	1.0060	3.398	3.869	14	5	clayey silt to silty clay
3.117	30.46	1.4592	4.790	5.105	29	3	clay
3.281	31.00	1.6068	5.184	6.171	30	3	clay
3.445	34.75	1.3856	3.988	8.516	22	4	silty clay to clay
3.609	29.68	1.2029	4.053	9.063	19	4	silty clay to clay
3.773	26.66	1.0783	4.045	10.640	17	4	silty clay to clay
3.937	26.73	0.9701	3.629	12.946	13	5	clayey silt to silty clay
4.101	25.34	0.9770	3.856	13.405	16	4	silty clay to clay
4.265	23.38	0.9418	4.028	14.451	15	4	silty clay to clay
4.429	23.42	1.0204	4.356	15.884	15	4	silty clay to clay
4.593	25.69	1.2579	4.896	16.926	25	3	clay
4.757	31.67	1.4153	4.468	12.660	20	4	silty clay to clay
4.921	23.98	1.2313	5.134	7.460	23	3	clay
5.085	17.80	0.9595	5.389	5.738	17	3	clay
5.249	14.61	0.7298	4.994	6.447	14	3	clay
5.413	14.20	0.5756	4.054	7.781	14	3	clay
5.577	14.75	0.2867	1.944	8.876	7	5	clayey silt to silty clay
5.741	13.15	0.3980	3.026	10.031	8	4	silty clay to clay
5.906	12.68	0.4652	3.669	15.398	8	4	silty clay to clay
6.070	12.70	0.4634	3.650	16.920	8	4	silty clay to clay
6.234	13.07	0.4525	3.462	18.382	8	4	silty clay to clay
6.398	13.32	0.6239	4.684	19.720	13	3	clay
6.562	14.16	0.8004	5.651	21.546	14	3	clay
6.726	17.74	0.7442	4.195	18.684	17	3	clay
6.890	18.30	0.6722	3.673	19.481	12	4	silty clay to clay
7.054	19.81	0.6338	3.199	18.294	9	5	clayey silt to silty clay
7.218	15.91	0.5630	3.539	15.854	10	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.382	13.33	0.5294	3.971	18.287	13	3	clay
7.546	14.67	0.5806	3.956	21.048	9	4	silty clay to clay
7.710	17.71	0.6263	3.536	24.052	11	4	silty clay to clay
7.874	19.34	0.6590	3.408	18.559	9	5	clayey silt to silty clay
8.038	17.51	0.6671	3.809	14.788	11	4	silty clay to clay
8.202	17.87	0.6766	3.788	15.893	11	4	silty clay to clay
8.366	20.61	0.7659	3.717	18.021	13	4	silty clay to clay
8.530	22.85	0.8596	3.762	17.835	15	4	silty clay to clay
8.694	19.89	0.6201	3.118	14.762	10	5	clayey silt to silty clay
8.858	18.99	0.3197	1.683	14.097	7	6	sandy silt to clayey silt
9.022	13.84	0.3885	2.807	13.273	7	5	clayey silt to silty clay
9.186	15.65	0.5960	3.808	22.409	10	4	silty clay to clay
9.350	22.75	0.7048	3.098	26.458	11	5	clayey silt to silty clay
9.514	23.82	0.9323	3.914	24.081	15	4	silty clay to clay
9.678	20.16	1.2019	5.961	20.684	19	3	clay
9.843	21.65	1.0189	4.706	21.192	21	3	clay
10.007	30.24	0.7075	2.340	7.834	12	6	sandy silt to clayey silt
10.171	31.23	0.6206	1.987	4.820	12	6	sandy silt to clayey silt
10.335	30.68	0.5242	1.709	3.515	12	6	sandy silt to clayey silt
10.499	28.13	0.5159	1.834	2.823	11	6	sandy silt to clayey silt
10.663	18.27	0.5076	2.778	2.413	9	5	clayey silt to silty clay
10.827	10.76	0.4804	4.466	3.079	10	3	clay
10.991	14.29	0.4045	2.831	5.414	7	5	clayey silt to silty clay
11.155	22.12	0.7186	3.249	5.817	11	5	clayey silt to silty clay
11.319	16.74	0.8830	5.276	5.410	16	3	clay
11.483	21.72	0.8696	4.004	5.597	14	4	silty clay to clay
11.647	31.29	1.1537	3.687	5.112	15	5	clayey silt to silty clay
11.811	23.76	1.1931	5.022	3.574	23	3	clay
11.975	40.22	1.2414	3.087	3.889	19	5	clayey silt to silty clay
12.139	49.11	0.6109	1.244	2.594	16	7	silty sand to sandy silt
12.303	48.03	0.6833	1.423	1.282	15	7	silty sand to sandy silt
12.467	44.57	0.5918	1.328	0.941	14	7	silty sand to sandy silt
12.631	36.98	0.7614	2.059	-0.039	14	6	sandy silt to clayey silt
12.795	22.19	0.7780	3.506	-0.600	11	5	clayey silt to silty clay
12.959	13.18	0.7370	5.593	-0.102	13	3	clay
13.123	15.88	0.8581	5.402	1.649	15	3	clay
13.287	20.50	0.7734	3.773	23.494	13	4	silty clay to clay
13.451	20.88	0.6554	3.139	18.949	10	5	clayey silt to silty clay
13.615	13.96	0.6235	4.465	8.601	13	3	clay
13.780	9.58	0.5502	5.741	8.598	9	3	clay
13.944	31.77	0.6852	2.157	11.021	12	6	sandy silt to clayey silt
14.108	48.00	0.7160	1.492	2.541	15	7	silty sand to sandy silt
14.272	66.02	0.6323	0.958	0.128	16	8	sand to silty sand
14.436	78.22	0.5040	0.644	-1.476	19	8	sand to silty sand
14.600	62.46	0.7563	1.211	-4.640	20	7	silty sand to sandy silt
14.764	42.78	1.0016	2.342	-4.699	16	6	sandy silt to clayey silt
14.928	26.43	0.9875	3.737	-4.345	17	4	silty clay to clay
15.092	45.83	0.8560	1.868	-3.820	18	6	sandy silt to clayey silt
15.256	56.87	0.5716	1.005	-4.496	18	7	silty sand to sandy silt
15.420	58.92	0.4067	0.690	-5.082	14	8	sand to silty sand
15.584	57.16	0.4888	0.855	-5.358	18	7	silty sand to sandy silt
15.748	54.05	0.6983	1.292	-4.266	17	7	silty sand to sandy silt
15.912	49.22	1.1890	2.416	-4.492	19	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
16.076	28.62	1.3727	4.796	-4.745	27	3	clay
16.240	20.65	1.3549	6.562	-4.345	20	3	clay
16.404	30.20	1.2893	4.269	-2.902	19	4	silty clay to clay
16.568	45.02	0.5977	1.327	-1.931	14	7	silty sand to sandy silt
16.732	41.65	0.6523	1.566	-3.377	13	7	silty sand to sandy silt
16.896	26.16	0.9512	3.636	-4.076	13	5	clayey silt to silty clay
17.060	27.62	0.9110	3.299	-3.915	13	5	clayey silt to silty clay
17.224	59.69	0.6557	1.098	-3.761	19	7	silty sand to sandy silt
17.388	63.32	0.5238	0.827	-4.440	15	8	sand to silty sand
17.552	52.08	0.5659	1.087	-5.407	17	7	silty sand to sandy silt
17.717	41.23	0.7216	1.750	-5.433	16	6	sandy silt to clayey silt
17.881	28.75	0.8218	2.858	-5.338	14	5	clayey silt to silty clay
18.045	14.92	0.7890	5.289	-5.112	14	3	clay
18.209	14.88	0.7931	5.329	-3.518	14	3	clay
18.373	34.14	0.7464	2.187	-0.459	13	6	sandy silt to clayey silt
18.537	51.17	0.5960	1.165	-2.430	16	7	silty sand to sandy silt
18.701	59.28	0.3807	0.642	-3.869	14	8	sand to silty sand
18.865	56.44	0.4776	0.846	-4.774	18	7	silty sand to sandy silt
19.029	49.77	0.5574	1.120	-3.807	16	7	silty sand to sandy silt
19.193	45.08	0.6589	1.462	-3.866	14	7	silty sand to sandy silt
19.357	41.28	0.7319	1.773	-3.869	16	6	sandy silt to clayey silt
19.521	33.44	0.8357	2.499	-3.895	13	6	sandy silt to clayey silt
19.685	20.57	0.8812	4.284	-3.728	20	3	clay
19.849	25.21	0.7193	2.854	1.774	12	5	clayey silt to silty clay
20.013	31.54	0.4935	1.565	-1.272	12	6	sandy silt to clayey silt
20.177	44.05	0.5220	1.185	-3.030	14	7	silty sand to sandy silt
20.341	82.48	0.7107	0.862	-3.577	20	8	sand to silty sand
20.505	70.31	1.0477	1.490	1.364	22	7	silty sand to sandy silt
20.669	47.45	1.3359	2.815	0.675	18	6	sandy silt to clayey silt
20.833	21.56	1.1008	5.105	0.735	21	3	clay
20.997	18.57	0.9498	5.116	5.650	18	3	clay
21.161	30.35	1.0224	3.369	18.759	15	5	clayey silt to silty clay
21.325	42.33	1.3946	3.295	10.726	20	5	clayey silt to silty clay
21.490	68.45	1.5498	2.264	-0.400	26	6	sandy silt to clayey silt
21.654	88.04	1.3332	1.514	-2.230	28	7	silty sand to sandy silt
21.818	90.16	1.3113	1.454	-5.483	29	7	silty sand to sandy silt
21.982	87.04	0.9432	1.084	-6.060	21	8	sand to silty sand
22.146	88.93	1.1607	1.305	-8.037	21	8	sand to silty sand
22.310	88.93	1.1450	1.288	-5.715	21	8	sand to silty sand
22.474	96.48	1.0277	1.065	-6.079	23	8	sand to silty sand
22.638	95.50	0.9442	0.989	-6.420	23	8	sand to silty sand
22.802	95.61	0.9091	0.951	-6.637	23	8	sand to silty sand
22.966	101.47	0.8913	0.878	-6.811	24	8	sand to silty sand
23.130	99.80	0.9045	0.906	-2.600	24	8	sand to silty sand
23.294	84.14	0.9673	1.150	-5.246	20	8	sand to silty sand
23.458	66.88	0.9308	1.392	-4.800	21	7	silty sand to sandy silt
23.622	57.18	1.0501	1.836	-4.092	18	7	silty sand to sandy silt
23.786	36.32	1.0937	3.012	-3.558	17	5	clayey silt to silty clay
23.950	17.25	0.7322	4.245	-2.617	17	3	clay
24.114	15.30	0.9724	6.356	17.451	15	3	clay
24.278	38.95	1.5676	4.025	54.914	19	5	clayey silt to silty clay
24.442	83.32	2.7333	3.281	6.017	32	6	sandy silt to clayey silt
24.606	119.50	3.4064	2.850	-5.082	46	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
24.770	138.96	3.6320	2.614	-9.640	44	7	silty sand to sandy silt
24.934	148.24	3.2519	2.194	-9.749	47	7	silty sand to sandy silt
25.098	142.87	2.2931	1.605	-9.942	34	8	sand to silty sand
25.262	134.97	1.2041	0.892	-11.375	32	8	sand to silty sand
25.427	120.36	1.0733	0.892	-11.283	29	8	sand to silty sand
25.591	107.07	1.0075	0.941	-9.017	26	8	sand to silty sand
25.755	97.93	1.0630	1.085	-9.122	23	8	sand to silty sand
25.919	89.12	0.9912	1.112	-9.116	21	8	sand to silty sand
26.083	76.84	1.0085	1.312	-9.112	25	7	silty sand to sandy silt
26.247	65.32	1.3108	2.007	-8.965	21	7	silty sand to sandy silt
26.411	42.99	1.2095	2.813	1.289	16	6	sandy silt to clayey silt
26.575	16.86	0.7302	4.331	2.587	16	3	clay
26.739	13.92	0.5053	3.631	25.606	9	4	silty clay to clay
26.903	18.73	0.5315	2.838	56.691	9	5	clayey silt to silty clay
27.067	41.98	0.7594	1.809	8.148	16	6	sandy silt to clayey silt
27.231	56.70	0.5913	1.043	-5.007	18	7	silty sand to sandy silt
27.395	67.45	0.7031	1.042	-9.450	22	7	silty sand to sandy silt
27.559	78.85	0.8399	1.065	-10.106	19	8	sand to silty sand
27.723	87.76	0.9700	1.105	-9.778	21	8	sand to silty sand
27.887	78.77	1.2075	1.533	-9.394	25	7	silty sand to sandy silt
28.051	52.16	1.4850	2.847	-8.830	20	6	sandy silt to clayey silt
28.215	25.45	1.3770	5.411	-8.112	24	3	clay
28.379	20.98	0.5875	2.800	3.109	10	5	clayey silt to silty clay
28.543	26.50	0.7059	2.664	42.624	13	5	clayey silt to silty clay
28.707	30.62	0.9553	3.120	62.013	15	5	clayey silt to silty clay
28.871	42.81	1.4126	3.300	13.431	20	5	clayey silt to silty clay
29.035	41.89	1.7053	4.071	3.154	20	5	clayey silt to silty clay
29.199	45.48	1.8482	4.063	-2.938	22	5	clayey silt to silty clay
29.364	51.34	1.4007	2.728	-7.086	20	6	sandy silt to clayey silt
29.528	65.36	0.9139	1.398	-10.385	21	7	silty sand to sandy silt
29.692	72.05	0.7059	0.980	-7.142	17	8	sand to silty sand
29.856	78.08	1.1602	1.486	-8.588	25	7	silty sand to sandy silt
30.020	48.83	1.2116	2.481	-8.237	19	6	sandy silt to clayey silt
30.184	19.42	0.8748	4.504	-7.424	19	3	clay
30.348	21.35	0.7602	3.561	-2.177	14	4	silty clay to clay
30.512	31.98	1.0932	3.419	31.075	15	5	clayey silt to silty clay
30.676	39.55	1.5257	3.857	54.773	19	5	clayey silt to silty clay
30.840	47.20	2.1269	4.506	48.769	30	4	silty clay to clay
31.004	49.92	2.4473	4.903	20.448	32	4	silty clay to clay
31.168	66.30	2.3045	3.476	-2.079	32	5	clayey silt to silty clay
31.332	68.27	1.1895	1.742	-9.247	22	7	silty sand to sandy silt
31.496	69.56	0.6832	0.982	-11.008	17	8	sand to silty sand
31.660	68.32	0.6836	1.001	-11.073	16	8	sand to silty sand
31.824	61.46	0.5936	0.966	-10.922	20	7	silty sand to sandy silt
31.988	35.91	1.0435	2.905	-10.575	14	6	sandy silt to clayey silt
32.152	22.59	1.0345	4.580	-7.991	22	3	clay
32.316	18.50	0.8443	4.564	-7.293	18	3	clay
32.480	16.31	0.7989	4.899	-2.328	16	3	clay
32.644	35.48	1.0142	2.858	41.853	14	6	sandy silt to clayey silt
32.808	60.77	1.1504	1.893	3.633	19	7	silty sand to sandy silt
32.972	95.45	1.2709	1.331	-6.568	23	8	sand to silty sand
33.136	119.61	1.1586	0.969	-9.214	29	8	sand to silty sand
33.301	108.42	1.1824	1.091	-10.149	26	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
33.465	50.60	1.3778	2.723	-10.172	19	6	sandy silt to clayey silt
33.629	22.36	1.1347	5.074	-9.735	21	3	clay
33.793	15.24	0.7809	5.124	-3.673	15	3	clay
33.957	19.29	0.9377	4.862	53.333	18	3	clay
34.121	55.20	1.0348	1.875	25.973	18	7	silty sand to sandy silt
34.285	66.29	1.1395	1.719	-5.315	21	7	silty sand to sandy silt
34.449	58.05	0.7449	1.283	-8.991	19	7	silty sand to sandy silt
34.613	56.44	0.5523	0.979	-11.037	18	7	silty sand to sandy silt
34.777	55.38	0.8111	1.465	-11.195	18	7	silty sand to sandy silt
34.941	30.38	1.0472	3.447	-10.978	15	5	clayey silt to silty clay
35.105	17.93	0.6505	3.628	-10.217	11	4	silty clay to clay
35.269	14.40	0.6060	4.209	-4.860	14	3	clay
35.433	14.08	0.4642	3.298	36.640	9	4	silty clay to clay
35.597	19.65	0.5105	2.597	41.778	9	5	clayey silt to silty clay
35.761	22.11	0.8199	3.709	17.225	14	4	silty clay to clay
35.925	30.69	0.9112	2.969	19.159	15	5	clayey silt to silty clay
36.089	48.74	0.8582	1.761	-6.194	16	7	silty sand to sandy silt
36.253	53.37	0.5928	1.111	-7.538	17	7	silty sand to sandy silt
36.417	58.56	0.6104	1.042	-9.768	19	7	silty sand to sandy silt
36.581	66.86	0.6664	0.997	-10.785	16	8	sand to silty sand
36.745	75.55	0.6859	0.908	-10.627	18	8	sand to silty sand
36.909	77.94	0.7218	0.926	-10.283	19	8	sand to silty sand
37.073	65.22	0.7678	1.177	-9.801	21	7	silty sand to sandy silt
37.238	54.62	0.7826	1.433	-9.198	17	7	silty sand to sandy silt
37.402	48.43	0.8365	1.727	-8.611	15	7	silty sand to sandy silt
37.566	42.26	0.9696	2.294	-7.975	16	6	sandy silt to clayey silt
37.730	29.17	0.9636	3.303	-7.099	14	5	clayey silt to silty clay
37.894	20.80	0.7397	3.556	-4.177	13	4	silty clay to clay
38.058	15.14	0.5611	3.707	11.982	10	4	silty clay to clay
38.222	14.17	0.6130	4.326	36.617	14	3	clay
38.386	25.91	0.5407	2.087	59.793	10	6	sandy silt to clayey silt
38.550	45.80	0.8482	1.852	19.241	18	6	sandy silt to clayey silt
38.714	64.44	0.8638	1.341	-5.584	21	7	silty sand to sandy silt
38.878	72.66	0.6409	0.882	-8.080	17	8	sand to silty sand
39.042	72.19	0.7275	1.008	-9.358	17	8	sand to silty sand
39.206	55.89	0.9221	1.650	-9.165	18	7	silty sand to sandy silt
39.370	36.42	1.0215	2.804	-8.440	14	6	sandy silt to clayey silt
39.534	22.56	0.8601	3.812	11.850	14	4	silty clay to clay
39.698	15.30	0.6583	4.302	43.339	15	3	clay
39.862	24.21	0.7765	3.207	60.259	12	5	clayey silt to silty clay
40.026	37.82	1.3365	3.534	54.425	18	5	clayey silt to silty clay
40.190	45.14	1.8603	4.121	29.462	22	5	clayey silt to silty clay
40.354	67.50	1.8324	2.714	14.172	26	6	sandy silt to clayey silt
40.518	87.91	1.3782	1.568	-9.240	28	7	silty sand to sandy silt
40.682	89.69	1.0279	1.146	-11.119	21	8	sand to silty sand
40.846	90.29	0.8790	0.974	-11.785	22	8	sand to silty sand
41.011	95.06	0.8448	0.889	-11.568	23	8	sand to silty sand
41.175	97.79	0.8523	0.872	-11.385	23	8	sand to silty sand
41.339	90.73	0.9298	1.025	-11.119	22	8	sand to silty sand
41.503	77.34	0.9750	1.261	-10.736	25	7	silty sand to sandy silt
41.667	65.23	0.6628	1.016	-10.204	21	7	silty sand to sandy silt
41.831	54.95	0.6806	1.239	-9.506	18	7	silty sand to sandy silt
41.995	33.68	0.7289	2.164	-4.394	13	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
42.159	22.03	0.7485	3.397	-2.276	11	5	clayey silt to silty clay
42.323	10.17	0.5090	5.003	1.026	10	3	clay
42.487	7.61	0.3519	4.622	5.473	7	3	clay
42.651	9.71	0.5668	5.835	15.975	9	3	clay
42.815	34.46	1.0011	2.905	24.061	16	5	clayey silt to silty clay
42.979	63.38	0.9970	1.573	-5.942	20	7	silty sand to sandy silt
43.143	83.58	0.8274	0.990	-10.772	20	8	sand to silty sand
43.307	92.21	0.8187	0.888	-11.198	22	8	sand to silty sand
43.471	91.41	0.8547	0.935	-11.244	22	8	sand to silty sand
43.635	75.12	1.0158	1.352	-11.004	24	7	silty sand to sandy silt
43.799	57.95	1.1805	2.037	-10.595	18	7	silty sand to sandy silt
43.963	55.44	1.0282	1.855	-9.962	18	7	silty sand to sandy silt
44.127	60.57	0.8664	1.430	-10.227	19	7	silty sand to sandy silt
44.291	50.43	0.8925	1.770	-10.745	16	7	silty sand to sandy silt
44.455	32.85	0.8778	2.672	-10.568	13	6	sandy silt to clayey silt
44.619	15.49	0.5945	3.838	-9.827	10	4	silty clay to clay
44.783	9.93	0.2372	2.390	-7.899	6	4	silty clay to clay
44.948	11.63	0.2437	2.096	0.197	6	5	clayey silt to silty clay
45.112	17.76	0.3674	2.068	44.870	9	5	clayey silt to silty clay
45.276	20.53	0.6772	3.298	75.814	10	5	clayey silt to silty clay
45.440	32.84	1.1721	3.569	65.944	16	5	clayey silt to silty clay
45.604	53.99	1.5795	2.926	24.134	21	6	sandy silt to clayey silt
45.768	72.99	1.3647	1.870	-8.361	23	7	silty sand to sandy silt
45.932	77.48	0.9455	1.220	-10.381	25	7	silty sand to sandy silt
46.096	80.32	0.8647	1.076	-7.932	19	8	sand to silty sand
46.260	91.84	0.7918	0.862	-10.870	22	8	sand to silty sand
46.424	98.15	0.7810	0.796	-11.227	23	8	sand to silty sand
46.588	94.08	0.5793	0.616	-11.247	23	8	sand to silty sand
46.752	78.93	0.7218	0.915	-11.254	19	8	sand to silty sand
46.916	52.82	1.0009	1.895	-11.145	17	7	silty sand to sandy silt
47.080	36.03	1.1107	3.083	-10.713	17	5	clayey silt to silty clay
47.244	20.80	0.8615	4.142	-10.057	13	4	silty clay to clay
47.408	13.06	0.6138	4.701	-6.033	13	3	clay
47.572	12.05	0.5279	4.380	18.064	12	3	clay
47.736	18.76	0.6777	3.612	63.987	12	4	silty clay to clay
47.900	28.86	0.9346	3.238	47.392	14	5	clayey silt to silty clay
48.064	31.65	1.1147	3.522	44.693	15	5	clayey silt to silty clay
48.228	39.26	1.0796	2.750	52.569	15	6	sandy silt to clayey silt
48.392	43.06	1.5147	3.518	5.994	21	5	clayey silt to silty clay
48.556	52.63	1.2963	2.463	-3.722	20	6	sandy silt to clayey silt
48.720	64.43	0.9299	1.443	-8.532	21	7	silty sand to sandy silt
48.885	74.10	0.6809	0.919	-9.706	18	8	sand to silty sand
49.049	80.60	0.6584	0.817	-10.044	19	8	sand to silty sand
49.213	86.39	0.7081	0.820	-10.113	21	8	sand to silty sand
49.377	82.40	0.8922	1.083	-0.800	20	8	sand to silty sand
49.541	64.05	1.1917	1.860	-1.908	20	7	silty sand to sandy silt
49.705	36.07	1.0490	2.909	-0.341	14	6	sandy silt to clayey silt
49.869	17.21	0.6732	3.911	27.462	11	4	silty clay to clay
50.033	16.33	0.5549	3.397	80.467	10	4	silty clay to clay
50.197	27.76	0.9249	3.332	93.150	13	5	clayey silt to silty clay
50.361	40.27	1.5767	3.915	58.026	19	5	clayey silt to silty clay
50.525	37.69	1.7456	4.631	14.441	24	4	silty clay to clay
50.689	37.35	1.6705	4.472	10.427	24	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
50.853	56.23	1.1054	1.966	-2.259	18	7	silty sand to sandy silt
51.017	90.45	0.9259	1.024	-9.362	22	8	sand to silty sand
51.181	114.63	1.0075	0.879	-10.444	27	8	sand to silty sand
51.345	128.00	0.8849	0.691	-10.398	25	9	sand
51.509	120.83	1.0353	0.857	-10.060	29	8	sand to silty sand
51.673	106.16	1.1204	1.055	-6.522	25	8	sand to silty sand
51.837	100.32	1.2602	1.256	-5.653	24	8	sand to silty sand
52.001	90.17	1.2492	1.385	-5.145	29	7	silty sand to sandy silt
52.165	78.08	1.2060	1.545	-4.617	25	7	silty sand to sandy silt
52.329	64.61	1.0742	1.663	-3.909	21	7	silty sand to sandy silt
52.493	53.39	1.0612	1.988	-3.184	20	6	sandy silt to clayey silt
52.657	39.25	1.0440	2.660	12.890	15	6	sandy silt to clayey silt
52.822	19.25	0.7824	4.064	14.575	12	4	silty clay to clay
52.986	11.81	0.3779	3.201	30.075	8	4	silty clay to clay
53.150	13.10	0.3549	2.709	53.687	6	5	clayey silt to silty clay
53.314	24.42	0.6764	2.770	77.316	12	5	clayey silt to silty clay
53.478	33.16	1.0028	3.024	55.897	16	5	clayey silt to silty clay
53.642	34.43	1.2141	3.526	53.641	16	5	clayey silt to silty clay
53.806	31.51	1.3311	4.225	52.143	20	4	silty clay to clay
53.970	39.92	1.0348	2.592	20.638	15	6	sandy silt to clayey silt
54.134	57.61	0.7680	1.333	-7.093	18	7	silty sand to sandy silt
54.298	77.49	0.6297	0.813	-9.958	19	8	sand to silty sand
54.462	92.01	0.7448	0.809	-11.083	22	8	sand to silty sand
54.626	101.15	0.5670	0.561	-11.050	24	8	sand to silty sand
54.790	101.00	0.7419	0.735	-10.713	24	8	sand to silty sand
54.954	90.13	0.9293	1.031	-8.125	22	8	sand to silty sand
55.118	83.34	1.0713	1.285	-7.653	27	7	silty sand to sandy silt
55.282	80.89	1.0479	1.295	-7.076	26	7	silty sand to sandy silt
55.446	79.54	0.9539	1.199	-6.958	19	8	sand to silty sand
55.610	74.73	0.9484	1.269	-7.017	24	7	silty sand to sandy silt
55.774	63.31	1.0360	1.636	-7.040	20	7	silty sand to sandy silt
55.938	40.66	1.0893	2.679	0.502	16	6	sandy silt to clayey silt
56.102	20.19	0.6737	3.337	4.273	10	5	clayey silt to silty clay
56.266	16.53	0.5222	3.159	24.891	8	5	clayey silt to silty clay
56.430	41.79	0.7130	1.706	12.106	13	7	silty sand to sandy silt
56.594	53.45	0.6145	1.150	-3.869	17	7	silty sand to sandy silt
56.759	61.65	0.6163	1.000	-8.463	20	7	silty sand to sandy silt
56.923	68.55	0.5582	0.814	-9.742	16	8	sand to silty sand
57.087	69.20	0.6311	0.912	-10.411	17	8	sand to silty sand
57.251	63.71	0.7663	1.203	-10.260	20	7	silty sand to sandy silt
57.415	60.41	0.7481	1.238	-9.860	19	7	silty sand to sandy silt
57.579	62.30	0.7837	1.258	-9.394	20	7	silty sand to sandy silt
57.743	53.22	0.8663	1.628	-9.037	17	7	silty sand to sandy silt
57.907	41.84	0.7382	1.764	-8.634	16	6	sandy silt to clayey silt
58.071	27.95	0.7368	2.637	-8.011	13	5	clayey silt to silty clay
58.235	23.55	0.6430	2.730	4.358	11	5	clayey silt to silty clay
58.399	17.50	0.6167	3.523	7.276	11	4	silty clay to clay
58.563	24.06	0.6404	2.661	12.424	12	5	clayey silt to silty clay
58.727	47.77	0.8390	1.756	12.464	15	7	silty sand to sandy silt
58.891	57.61	0.9351	1.623	-2.872	18	7	silty sand to sandy silt
59.055	59.35	0.4637	0.781	-6.230	14	8	sand to silty sand
59.219	51.99	0.3615	0.695	-4.564	17	7	silty sand to sandy silt
59.383	29.47	0.3773	1.280	-6.325	11	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
59.547	18.01	0.6016	3.341	-5.046	9	5	clayey silt to silty clay
59.711	25.25	0.5056	2.003	-2.817	10	6	sandy silt to clayey silt
59.875	65.75	0.9230	1.404	-4.712	21	7	silty sand to sandy silt
60.039	91.77	0.8727	0.951	-5.617	22	8	sand to silty sand
60.203	70.40	1.7949	2.550	-7.716	27	6	sandy silt to clayey silt
60.367	42.65	2.0536	4.814	-7.627	27	4	silty clay to clay
60.532	83.49	1.8980	2.273	7.335	27	7	silty sand to sandy silt
60.696	132.04	1.6325	1.236	-2.620	32	8	sand to silty sand
60.860	124.99	1.8080	1.447	-5.837	30	8	sand to silty sand
61.024	82.41	1.7209	2.088	-7.647	26	7	silty sand to sandy silt
61.188	58.29	1.6886	2.897	-8.099	22	6	sandy silt to clayey silt
61.352	67.05	2.0489	3.056	-8.181	26	6	sandy silt to clayey silt
61.516	122.26	1.6734	1.369	-5.483	29	8	sand to silty sand
61.680	135.16	1.8452	1.365	-6.424	32	8	sand to silty sand
61.844	115.22	2.0334	1.765	-7.020	37	7	silty sand to sandy silt
62.008	88.19	1.9408	2.201	-7.417	28	7	silty sand to sandy silt
62.172	64.95	2.0538	3.162	-7.640	25	6	sandy silt to clayey silt
62.336	54.00	1.6740	3.100	-7.781	21	6	sandy silt to clayey silt
62.500	54.15	1.2489	2.307	-2.692	21	6	sandy silt to clayey silt
62.664	35.02	0.8376	2.392	-5.889	13	6	sandy silt to clayey silt
62.828	24.44	0.8307	3.399	-5.942	12	5	clayey silt to silty clay
62.992	25.75	0.9779	3.798	-3.945	16	4	silty clay to clay
63.156	40.04	1.3182	3.292	-3.623	19	5	clayey silt to silty clay
63.320	35.78	1.1463	3.203	-5.666	17	5	clayey silt to silty clay
63.484	58.41	1.2842	2.199	-6.302	22	6	sandy silt to clayey silt
63.648	46.47	1.3883	2.988	-7.020	18	6	sandy silt to clayey silt
63.812	30.05	1.1919	3.967	-7.230	19	4	silty clay to clay
63.976	25.55	1.0757	4.210	-6.450	16	4	silty clay to clay
64.140	33.55	1.1736	3.498	-5.519	16	5	clayey silt to silty clay
64.304	40.23	1.0535	2.619	-5.046	15	6	sandy silt to clayey silt
64.469	33.58	1.0191	3.035	-5.342	16	5	clayey silt to silty clay
64.633	25.49	0.5199	2.039	-5.007	10	6	sandy silt to clayey silt
64.797	31.44	0.5400	1.718	-3.997	12	6	sandy silt to clayey silt
64.961	32.37	0.8499	2.626	-0.757	12	6	sandy silt to clayey silt
65.125	24.82	0.8507	3.428	-0.692	12	5	clayey silt to silty clay
65.289	19.76	0.5548	2.808	0.685	9	5	clayey silt to silty clay
65.453	20.29	0.5540	2.730	1.774	10	5	clayey silt to silty clay
65.617	17.74	0.5658	3.188	2.705	8	5	clayey silt to silty clay
65.781	22.41	0.6802	3.036	21.605	11	5	clayey silt to silty clay
65.945	30.94	0.8729	2.821	16.828	15	5	clayey silt to silty clay
66.109	19.89	0.5184	2.606	10.509	10	5	clayey silt to silty clay
66.273	19.73	0.3630	1.840	16.034	8	6	sandy silt to clayey silt
66.437	15.61	0.3765	2.412	20.169	7	5	clayey silt to silty clay
66.601	14.24	0.2674	1.878	24.189	7	5	clayey silt to silty clay
66.765	14.09	0.2718	1.929	31.361	7	5	clayey silt to silty clay
66.929	13.28	0.2794	2.104	39.634	6	5	clayey silt to silty clay
67.093	13.94	0.2223	1.595	42.539	7	5	clayey silt to silty clay
67.257	11.22	0.2277	2.030	40.470	5	5	clayey silt to silty clay
67.421	11.09	0.2912	2.626	52.199	7	4	silty clay to clay
67.585	21.05	0.4111	1.953	45.303	8	6	sandy silt to clayey silt
67.749	18.85	0.3914	2.076	28.632	9	5	clayey silt to silty clay
67.913	15.82	0.2706	1.711	38.427	8	5	clayey silt to silty clay
68.077	15.03	0.2968	1.975	57.268	7	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
68.241	18.83	0.3764	1.999	82.035	9	5	clayey silt to silty clay
68.406	20.54	0.4160	2.025	69.869	8	6	sandy silt to clayey silt
68.570	22.36	0.4693	2.099	84.179	9	6	sandy silt to clayey silt
68.734	24.88	1.0769	4.329	92.262	16	4	silty clay to clay
68.898	26.88	1.1368	4.229	91.862	17	4	silty clay to clay
69.062	32.66	1.0598	3.245	28.537	16	5	clayey silt to silty clay
69.226	35.20	0.9563	2.717	48.631	13	6	sandy silt to clayey silt
69.390	33.89	0.9989	2.948	54.546	16	5	clayey silt to silty clay
69.554	35.55	0.9475	2.665	66.276	14	6	sandy silt to clayey silt
69.718	37.28	1.0641	2.854	72.968	14	6	sandy silt to clayey silt
69.882	39.21	1.0715	2.733	60.895	15	6	sandy silt to clayey silt
70.046	39.76	1.1977	3.012	68.440	19	5	clayey silt to silty clay
70.210	47.54	1.3387	2.816	110.096	18	6	sandy silt to clayey silt
70.374	54.42	2.0899	3.840	103.742	26	5	clayey silt to silty clay
70.538	65.47	3.1396	4.795	100.656	42	4	silty clay to clay
70.702	83.47	3.6383	4.359	16.490	40	5	clayey silt to silty clay
70.866	112.12	2.6719	2.383	-6.224	36	7	silty sand to sandy silt
71.030	123.13	2.0394	1.656	-12.821	39	7	silty sand to sandy silt
71.194	132.07	1.8646	1.412	-12.467	32	8	sand to silty sand
71.358	138.24	2.1940	1.587	-12.067	33	8	sand to silty sand
71.522	154.97	1.9747	1.274	-9.027	37	8	sand to silty sand
71.686	167.23	1.6698	0.999	-9.824	32	9	sand
71.850	174.84	2.0247	1.158	-9.909	42	8	sand to silty sand
72.014	188.90	2.6757	1.416	-9.647	45	8	sand to silty sand
72.178	232.46	3.3614	1.446	-9.385	56	8	sand to silty sand
72.343	256.92	3.6258	1.411	-10.211	62	8	sand to silty sand
72.507	242.80	3.3074	1.362	-12.037	58	8	sand to silty sand
72.671	233.64	2.7168	1.163	-12.047	45	9	sand
72.835	243.48	2.4602	1.010	-11.722	47	9	sand
72.999	255.40	2.3296	0.912	-11.306	49	9	sand
73.163	275.31	1.9179	0.697	-10.496	53	9	sand
73.327	295.07	2.4889	0.844	-9.391	57	9	sand
73.491	295.54	2.9460	0.997	-4.781	57	9	sand
73.655	280.17	3.1455	1.123	-3.758	54	9	sand
73.819	263.49	3.0054	1.141	-2.699	50	9	sand
73.983	267.94	2.7594	1.030	-0.702	51	9	sand
74.147	272.37	2.5816	0.948	1.007	52	9	sand
74.311	263.56	2.4965	0.947	0.925	50	9	sand
74.475	266.78	1.9322	0.724	1.833	51	9	sand
74.639	289.65	2.3722	0.819	4.246	55	9	sand
74.803	285.38	2.6938	0.944	12.762	55	9	sand
74.967	272.29	3.5238	1.294	9.670	52	9	sand
75.131	284.24	4.2264	1.487	10.795	68	8	sand to silty sand
75.295	313.37	4.5511	1.452	3.348	75	8	sand to silty sand
75.459	319.26	4.6012	1.441	-10.995	76	8	sand to silty sand

Appendix C

Field and Laboratory Testing

Foundation Engineering, Inc.
Professional Geotechnical Services

Table 1C. Summary of Resistivity Testing

Location	Pin Spacing (ft.)	Resistivity (Ω-cm)
R-1	2	8,043
	5	6,223
	10	4,692

Table 2C. pH Test Results (ASTM G51)

Sample Number	Sample Depth (ft)	Sample Description	pH
SS-4-2	5.0 – 6.5	Brown SILT, some sand	7.7
SS-6-2	5.0 – 7.0	Brown SILT, some sand	7.1
SS-7-10	26.0 – 26.5	Grey SILT, some sand	8.5
SS-8-5	12.5 – 14.0	Brown sandy SILT	7.1

Table 3C. Summary of DCP Test Results

Location	Test Depth (inches)	Soil Description	[1]Average DCP (mm/blow)	[2]Average M_r (psi)	[3]Corrected M_r (psi)
20′ NW of BH-7	0 to 6	Dense to very dense CRUSHED ROCK (fill)	5.9	24,520	15,200
20′ SE of BH-8	2 to 12	Medium stiff sandy SILT (alluvium)	27.3	13,505	4,730

Notes:
1. DCP (mm/blow) based on the average reading at the test depth.
2. M_r value based on average DCP value at the test depth and the ODOT recommended correlation: $M_r = 49023(DCP)^{-0.39}$. Values may vary slightly due to rounding.
3. Corrected M_r values are based on the ODOT recommended correction factor of and 0.62 for base rock and 0.35 for subgrade.

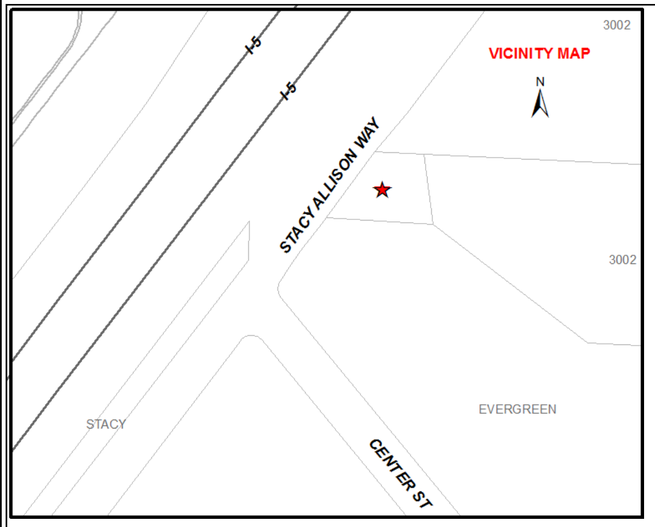
Table 4C. Moisture Contents and Percent Fines

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	Percent Fines
SS-1-1	2.5-4	40.5	
SS-1-2	5-6.5	33.4	63.1
SS-1-3	7.5-9	38.4	
SS-1-4	10-11.5	39.8	
SS-2-1	2.5-4	38.6	
SH-2-2	5-7.0	37.3	
SS-2-3	7-8.5	36.8	
SS-2-4	10-11.5	35.8	
SS-4-1	2.5-4	35.6	
SS-4-2	5-6.5	39.9	
SS-4-3	7.5-9	36.4	
SS-4-4	10-11.5	35.8	
SS-5-1	2.5-4	33.5	78.5
SS-5-2	5-6.5	38.0	
SS-5-3	7.5-9	34.1	49.4
SS-5-4	10-11.5	36.7	
SS-6-1	2.5-4	35.6	61.2
SH-6-2	5-7.0	36.7	
SS-6-3	7-8.5	33.8	
SS-6-4	10-11.5	39.4	
SS-7-1	2.5-4	31.6	
SS-7-2	5-6.5	35.2	74.5
SH-7-3	7.5-9.5	40.3	
SS-7-4	9.5-11	38.6	82.5
SS-7-5	12.5-14	39.3	53.4
SS-7-6	15-16.5	40.1	
SS-7-7	17.5-19	38.7	94.3
SH-7-8	20-22	39.6	
SS-7-9	22-23.5	38.2	57.8
SS-7-10	25-26.5	36.3	
SS-7-11	30-31.5	37.0	82.1
SH-7-12	35-37.0	32.3	
SS-7-13	37-38.5	38.1	68.6

SS-7-14	40-41.5	33.5	63.9
SS-7-15	45-46.5	31.1	
SS-7-16	50-51.5	35.4	69.7
SS-7-17	55-56.5	38.0	
SS-7-18	60-61.5	33.2	
SS-7-19	65-66.5	33.5	
SH-8-1	2.5-4.5	33.5	
SS-8-2	4.5-6	33.6	
SS-8-3	7.5-9	33.5	
SS-8-4	10-11.5	33.2	
SS-8-5	12.5-14	39.8	
SS-8-6	15-16.5	40.2	

Table 5C. Field Vane Measurements (ASTM D2573)

Sample Number	Sample Depth (ft)	Measurement Depth (ft)	Undrained Shear Strength (tsf)
SH-2-2	5-7.0	5.0	0.66
SH-2-2	5-7.0	7.0	0.54
SH-6-2	5-7.0	5.0	0.64
SH-6-2	5-7.0	7.0	0.63
SH-7-3	7.5-9.5	7.5	0.44
SH-7-3	7.5-7.5	9.5	0.33
SH-7-8	20-22.0	20.0	0.23
SH-7-8	20-22.0	22.0	0.37
SH-7-12	35-37	35.0	0.23
SH-7-12	35-37.0	37.0	0.30
SH-8-1	2.5-4.5	2.5	>1.0
SH-8-1	2.5-4.5	4.5	>1.0



A 4/0 AL-TX
45
35'-Unknown
2001

**NOTE: CUSTOMER CHANGED PANEL SIZE FROM 1000A TO 800A

WL 2 PD-166:
Install:
3P 12.5/7.2 480/277 PM 300KVA NTLB
166KVA ESTIMATED DEMAND

3002

CUSTOMER TO INSTALL BOLLARDS AROUND TRANSFORMER PAD IF WITHIN 5' OF DRIVABLE ROAD

ABC 225 692
PD-7
C5 2-12C
STACY ALLISON WAY
ABC 300
PD-166
ABC 2/0 AL
ABC 2 AL
45'
ABC 2 AL
ABC 350 AL QX
70'
VT-662

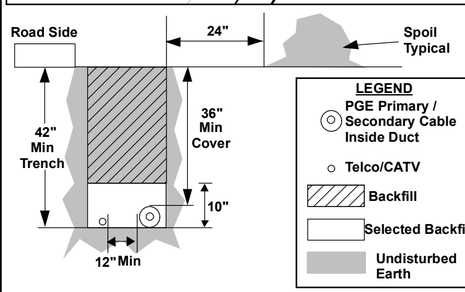
CUSTOMER TO PROVIDE PGE TRUCK ACCESS TO TRANSFORMER PAD AND METER

800A
~~1000A~~ 3PH 277/480V
SWITCHBOARD METERING CABINET
2-140HP PUMPS
15,158A ~~15,571A~~ AFC
MAX 365A MOTOR STARTING CURRENT TO MAINTAIN < 4% FLICKER

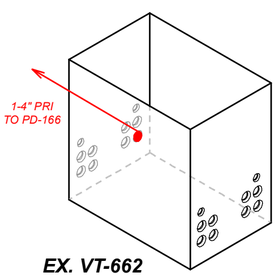
NEED EASEMENT FOR EXISTING PRIMARY AND SECONDARY WIRE

3002

107
30'-Unknown
2007
C 10 CU TX
VT-108
C 4/0 AL-TX

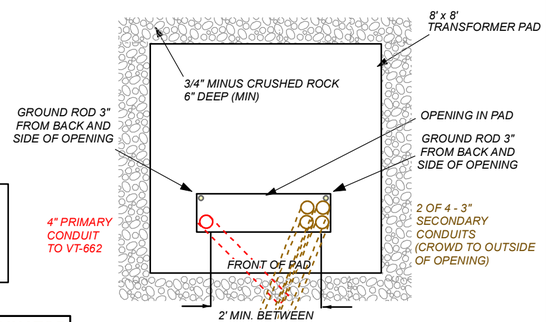


Joint Use Trench W/O Gas



EX. VT-662

CONTACT FIELD CONSTRUCTION COORDINATOR
AND/OR CONDUIT INSPECTOR 7 TO 10 WORKING DAYS PRIOR TO EXCAVATION. CONDUIT INSPECTION REQUIRED PRIOR TO BACKFILL. PGE WILL NOT INSTALL WIRE UNTIL TRENCH IS 100% BACKFILLED.
TONY STUCKART CONDUIT INSPECTOR CELL: 971-803-2642



3-PHASE TRANSFORMER PAD-CONDUIT CONFIGURATION
(TOP VIEW)
PD- 166

FIGURE 6-4 HEAVY DUTY BARRIER POST

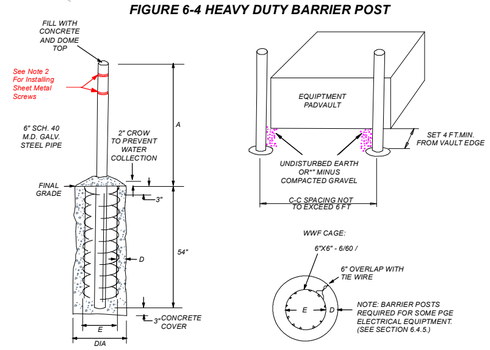


TABLE 6-3. BARRIER POST DETAILS

TYPE	DIMENSIONS	HOLE DIA.	HEIGHT "A"	CONCRETE SPACE "D"	WWF DIA "E"
LOADING DOCKS (HEAVY TRAFFIC)	6" DIA.x 9'	30"	54"	6"	18"
PARKING LOTS	6" DIA.x 8'	24"	42"	NOT NEEDED	NOT NEEDED

1. PLACE 6" SCHEDULE 40 M.D. GALVANIZED STEEL POSTS FILLED WITH CONCRETE A MAXIMUM OF SIX FEET APART ON ALL SIDES EXPOSED TO VEHICLES.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AFTER 28 DAYS.
3. BARRIER POSTS INSTALLATION SHALL BE IN UNDISTURBED EARTH. HOWEVER, THE AREA BETWEEN THE VAULT WALL AND BARRIER HOLE MAY BE FILLED WITH "" MINUS COMPACTED GRAVEL IF THREE FEET OF UNDISTURBED AREA IS NOT AVAILABLE AFTER THE VAULT IS SET.
4. STEEL REINFORCEMENT SHALL BE WELDED WIRE FABRIC (WWF), 6" X 6" GRID OF 6/60 ROUND, FORMED IN A CAGE AS SHOWN ABOVE. REINFORCEMENT NOT REQUIRED FOR AREAS HAVING ONLY CAR TRAFFIC.
5. POSTS SHALL BE PAINTED BRIGHT YELLOW. MARK TOP OF POSTS WITH TWO 3" WARNING BANDS OF CONTRASTING COLORS.

ANY DEVIATION FROM THIS DESIGN MUST BE APPROVED BY THE PGE PROJECT MANAGER

CALL 811 BEFORE YOU DIG
ATTENTION:
OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH 952-001-0090 YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE OREGON UTILITY NOTIFICATION CENTER ADMINISTRATION @ (502-232-1987)
TO REQUEST UTILITY LOCATES CALL THE OREGON UTILITY NOTIFICATION CENTER, 811 AT LEAST 2 BUSINESS DAYS PRIOR TO EXCAVATION
811 Know what's below. Call before you dig.

CONTACT SERVICE COORDINATOR
FOR TRENCH AND CONDUIT INSPECTION PRIOR TO BACKFILL. PGE WILL NOT INSTALL WIRE UNTIL TRENCH IS 100% BACKFILLED.
SERVICE COORDINATOR
503-323-6700 OR 1-800-542-8818

CUSTOMER TO CALL PGE AT 503-323-6700 FOR PRE-CONSTRUCTION MEETING AND FOR HELP INSTALLING CONDUIT INTO ENERGIZED PGE VAULT

COMMERCIAL LEGEND

NEW PGE FACILITIES TO BE INSTALLED
(UNLESS OTHERWISE SPECIFIED)

- REMOVE FACILITIES / INSTALL FACILITIES
- 8'x8' TRANSFORMER PAD, 9696-1554-TRANSPAD-PGE, PROVIDED & INSTALLED BY CUSTOMER
- FAULT INDICATOR
- INSTALL 1 - #2 AL - EPR TX JKT PRIMARY IN 1 - 4" PVC CONDUIT PROVIDED & INSTALLED BY CUSTOMER
- INSTALL 1 - 350 AL - QX UG SECONDARY IN 2 OF ~~4~~ 3 - 3" PVC CONDUITS, PROVIDED & INSTALLED BY CUSTOMER (2 - 3" SPARES)
- EASEMENT REQUIRED
- BARRIER POSTS PROVIDED & INSTALLED BY CUSTOMER

THINK SAFETY FIRST

CONSTRUCTION NOTES: CMDEV

1. CUSTOMER IS RESPONSIBLE FOR ALL TRENCH, CONDUIT, VAULTS, PADS AND ROAD CROSSINGS. ALL CONDUIT TO BE INSTALLED WITH 30 INCHES (MIN) COVER AT TOP OF CONDUIT FROM FINAL GRADE.
2. A PGE STANDBY CREW IS REQUIRED FOR OPENING ALL ENERGIZED PGE VAULTS, JUNCTION BOXES AND EQUIPMENT/FACILITIES, INCLUDING CONNECTION OR INSTALLATION OF CONDUITS AND PULL STRINGS. CALL SERVICE COORDINATION AT (503) 323-6700 TO SCHEDULE A PGE STANDBY CREW.
3. ALL PGE CONDUCTORS TO BE INSTALLED IN GRAY, SCHEDULE 40, ELECTRICAL GRADE, PVC CONDUIT WITH NYLON PULL STRINGS (MIN. 500 LBS. TEST). PGE TO DETERMINE THE SIZE AND NUMBER OF CONDUITS REQUIRED. MAINTAIN 12 VERTICAL INCHES AND 24 HORIZONTAL INCHES CLEARANCE BETWEEN GAS AND OTHER UTILITIES. ALL ELBOWS 4 INCH & SMALLER TO BE 36 INCH RADIUS. ALL BENDS MUST BE FACTORY MADE. ALL ELBOWS LARGER THAN 4 INCH TO BE 60 INCH RADIUS. RIGID STEEL OR PGE APPROVED. FIBERGLASS BENDS ARE REQUIRED FOR RUNS OF 151 FEET OR LONGER, OR FOR ANY LENGTH RUN WITH MORE THAN 180 DEGREES IN BENDS. PVC SCHEDULE 40 BENDS ARE ACCEPTABLE FOR RUNS OF 150 FEET OR LESS. THE MAXIMUM TOTAL BENDS IN ANY CONDUIT RUN IS 270 DEGREES.
4. DIRECTIONAL BORING REQUIREMENTS: BLACK HDPE (HIGH DENSITY POLYETHELENE) DUCT OR SCHEDULE 40 PVC WITH A MECHANICAL CONNECTION (CERTA-LOK OR LIKE MECHANICAL CONNECTION PRODUCT) AS AN ALTERNATIVE TO HDPE DUCT. HDPE SHALL MEET THE REQUIREMENTS OF PGE SPECIFICATION LC20515 (AVAILABLE ON REQUEST FROM PGE PROJECT MANAGER). FOR SAFETY REASONS THE DUCT SHALL BE BLACK WITH 3 EQUALLY SPACED EXTRUDED RED STRIPES (WHICH IS A SPECIFICATION REQUIREMENT). MANDREL TEST OF HDPE PIPE IS REQUIRED AFTER INSTALLATION WITH PGE INSPECTOR PRESENT.
5. ALL PGE TRANSFORMERS TO BE INSTALLED 8 FEET (MIN) FROM ANY COMBUSTIBLE BUILDING, WALL OR OVERHANG AND 4 FEET (MIN) FROM ANY FIRE HYDRANT. PGE TRANSFORMERS MUST BE WITHIN 15 FEET OF A DRIVEABLE AREA. ALWAYS MAINTAIN 10 FEET CLEARANCE IN FRONT OF ALL TRANSFORMERS.
6. TRANSFORMER PADS ARE TO BE SET SO THAT THE TOP IS 2 INCHES ABOVE FINAL GRADE. CONDUIT IS TO BE INSTALLED IN PAD AS INDICATED IN DETAIL AND TO EXTEND 1 INCH ABOVE THE PAD.
7. STEEL BARRIER POSTS ARE REQUIRED AROUND TRANSFORMERS THAT ARE EXPOSED TO VEHICLES.
8. ALL SWITCH VAULTS TO BE SET AT FINAL GRADE WITH 6 INCH GRAVEL BASE AND CONDUITS ALIGNED TO ENTER THE VAULT END LOWER KNOCKOUTS (TERM-A-DUCTS). (SEE DETAIL ON SKETCH)
9. PGE TO BE NOTIFIED AND INSPECT ALL CONDUIT, VAULT AND PAD INSTALLATIONS, BEFORE BACKFILL. ALL NEW VAULT & PAD LOCATIONS TO BE FIELD VERIFIED WITH PGE AND CUSTOMER REPRESENTATIVE.
10. REFER TO PGE ELECTRICAL SERVICE REQUIREMENTS BOOK FOR FURTHER DETAILS & SPECIFIC REQUIREMENTS. LINK TO WWW.PORTLANDGENERAL.COM
11. DESIGN IS BASED ON STANDARD UNDERGROUND EQUIPMENT. NON-STANDARD UNDERGROUND EQUIPMENT MAY BE AN OPTION AT AN ADDITIONAL COST TO THE CUSTOMER.
12. THE POINT OF DELIVERY AND DIVISION OF OWNERSHIP BETWEEN THE CUSTOMER AND PGE WILL BE AT THE LINE SIDE OF THE NEW CUSTOMER PROVIDED SWITCH GEAR.

PRE-CONSTRUCTION MEETING / TRENCH AND CONDUIT INSPECTION
YOUR PROJECT REQUIRES A PRECONSTRUCTION MEETING. CONTACT YOUR SERVICE & DESIGN PROJECT MANAGER 7 TO 10 WORKING DAYS PRIOR TO EXCAVATION TO COORDINATE THE PRE-CON. PGE'S FIELD CONSTRUCTION COORDINATOR (FCC) WILL PROVIDE YOUR TRENCH AND CONDUIT INSPECTIONS.

PGE CONSTRUCTION DRAWING
AS-BUILT VERIFICATION & NESC VIOLATIONS CORRECTED
This document accurately represents FIELD Construction

Foreman: Date:
General Foreman: Date:
(Signature only required for field construction changes.)
SDPM/ENG REVIEW: ASBUILT BY DESIGNER:

DATE:	SCALE:	ACCOUNT:	AWO:	JOB NO.
12/31/2020	1 in : 30 ft	1070001	1000004599	M2852501

TITLE: CITY OF WOODBURN
CIRCUIT: ST LOUIS - EAST | SIZE: 17 x 22
LOCATION: 3998 W HAYES ST. WOODBURN, OR
DESCRIPTION: ~~1000A~~ 3P 277/480V UG PUMP STATION 800A
COUNTY: MARION | SECTIONS: C5212C | WORK WITH:
SHEET: 1 OF 1

WOODBURN LINE CREW CENTER
2079 PROGRESS WAY
WOODBURN, OR 97071

DESIGN BY: DARRIN PERKINS | PHONE (503) 463-4325 | DRAWN BY: MATTHEW MEUSER

SECTION 01 12 16 - WORK SEQUENCE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes general sequencing, project phasing and coordination requirements for the Work.

B. Contract Requirements:

1. The existing I-5 Pump Station continuously receives raw sewage. The functions of the facility shall not be compromised during the course of the Work, except as may be specified herein. Plan and prosecute the Work such that the operation of the pump station is not interrupted, expect as specified herein.

2. Pumping disruptions could potentially result in the spillage or discharge of raw wastewater and sewage. State law allows the Department of Environmental Quality to impose civil penalties for violation of a term, condition, or requirement of Owner's NPDES Permit, including spillage or discharge of raw wastewater and sewage.

3. Spillage or discharge of raw sewage to surface waters or drainage courses is prohibited during construction. Penalties imposed on Owner as a result of any bypass of this type caused by Contractor, its employees or Subcontractors, and legal fees and other expenses to Owner resulting directly or indirectly from the bypass shall be borne in full by Contractor.

4. Control any and all leakage resulting from or integral to making all temporary and permanent piping connections. Provide any and all devices required to control, stop, divert, or dispose of any and all leakage.

5. Owner may determine the order of precedence and the time and season at which any portion or portions of the Work shall be commenced and carried on in order to ensure proper completion of the Contract, proper operation of the sewage pump station or compliance with NPDES Permit conditions.

6. Plan and prosecute the Work such that temporary bypass pumping operations are provided in accordance with Section 01 57 19.11, Temporary Sewage Control and Bypass Pumping.

1.2 RELATED SECTIONS

A. Section 01 57 19.11, Temporary Sewage Control and Bypass Pumping.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Work Sequencing Plan: At a minimum, to include the following:

1. Complete sequence of construction for all activities contained herein.

2. Major work activities to occur.

3. Schedule of temporary shutdowns of pump station and estimated duration of shutdowns. Submit a detailed plan for conveying sewage to the downstream collection system during temporary shutdowns.

4. Listing of equipment to be present on site, including temporary pumping equipment to be used to bypass sewage around pump station during shutdowns.

5. Assistance to be required of Owner's operating personnel during shutdowns.

6. Contingency plan identifying what action will be taken if activities during a shutdown cannot be completed within the allotted times, or if there is a failure of pumping equipment to be used during temporary pumping operations.

7. Name and contact information of individual in charge of activity during shutdown.

1.4 PROJECT SPECIFIC WORK CONSTRAINTS

A. Complete construction and testing and obtain Engineer's acceptance of the following components of the facility prior to a prolonged shutdown of the existing pump station:

1. Install line stop and hot tap on existing DI force main.

a. Use the hot tap connection as a temporary bypass pumping connection port during the Work described in Section 1.4.A.2 below.

b. Provide temporary bypass pumping system per the requirements of Specification 015719.11 Temporary Sewage Control and Bypass Pumping.

2. Cut existing DI force main and install wye fitting, reducers and isolation plug valves for permanent bypass pumping assembly connection.

a. During this installation, Contractor shall manage and dispose of any sewage remaining in the force main pipe.

b. Following the installation, make connections to the existing DI pipe both upstream and downstream of the wye assembly with reducers down to

existing pipe size. Contractor can continue to use the existing pump station until it needs to be taken offline for demolition unless they are ready to go on permanent bypass pumping.

c. Install concrete collar thrust block on existing DI force main as shown in the Plans. Install concrete collar thrust block prior to doing the temporary bypass connection through the hot tap to ensure thrust block has adequate curing time.

3. Install buried and above grade ductile iron pipe bypass assembly as shown in the Plans.

4. Line stop and hot tap can be abandoned by installing mechanical cap and plug once the permanent bypass assembly has been installed and the thrust block has cured.

B. When the bypass assembly is constructed, utilize the bypass assembly and existing force main for all bypass pumping conducted during prolonged temporary shutdowns.

C. The proposed 16” DI force main shall be constructed in its entirety, including pressure testing, prior to connection to the existing 12” DI force main as shown on the Plans. Construction of the proposed force main shall be coordinated with the approved traffic management plan to accommodate the surrounding traffic, which includes, but is not limited to, installation of the proposed force main in discrete segments to avoid blocking multiple intersecting streets at any given time, and the completion of trench pavement every Friday to minimize the open trench length throughout construction.

At each point of connection, the proposed force main shall then be connected to the existing, 12” plug valves (currently in the closed position). Those valves shall then be opened, and the existing 8” plug valves shall be closed. After the completion of the above, the 8” plug valves on the existing force main shall be abandoned in the closed position, and the existing 8” force main shall be severed and abandoned as detailed on the Plans.

1. CONTRACTOR to drain existing 8” DI force main before abandoning the line as shown in the Plans.

1.5 GENERAL WORK CONSTRAINTS

A. Constraints primarily relate to interfacing with and tying into existing pipelines, power supply, equipment, and other aspects of the operating pump station facility.

B. Make every effort to give proper attention to each of these items so as to minimize interruptions of the existing facilities and avoid delays that may result if the constraints are not observed.

C. Constraints listed below involve limits on activities during construction. These limits relate to the critical nature of the existing pump station facility.

1. Coordinate construction schedule and operation with Owner.

2. Coordinate proposed work with Owner, Engineer, and facility operations personnel before implementing unit shutdowns. Under no circumstances cease Work at the end of a normal working day if such actions may inadvertently cause a cessation of any facility operating process; in which case, remain on site until necessary Work and/or repairs are complete.

3. Owner recognizes portions of the facility and facility operations will have to be interrupted or shut down or interfered with in order to accommodate construction activities. Owner will, through its personnel, attempt to accommodate Work, provided that proper notification is given. Owner reserves the right to deny permission for interruption or shutdown on any day.

4. Do not operate any of the existing equipment without written permission from Owner naming the specific piece of equipment, operator(s), and dates equipment may be used. Contractor is liable for any loss or damage caused to property or equipment or any personal injury resulting from or related to this usage.

D. Extended Working Hours: If it is desired to perform any Work outside the specified working hours, obtain written permission from Owner and all necessary permitting agencies, and make all necessary arrangements prior to commencing.

1.6 TEMPORARY SHUTDOWNS

A. Provide 14-day minimum advance notice to request approval of a temporary shutdown of a facility. This shall include shutdowns of the pump station or any utility serving the pump station (force main, gravity sewer, power service, etc).

B. Each Notice of Request for Approval of a Temporary Shutdown submitted to Owner shall include the following:

1. Dates, times, and duration of proposed shutdown.

2. Work activities to be performed during the shutdown.

3. Assistance required of Owner’s personnel before, during, and after shutdown.

4. Personnel to be on Site during shutdown.

5. Contingency plan if work during shutdown is not completed during allotted time or critical equipment fails.

C. Upon receipt of such request, Owner will decide what action(s) is required by Owner and if the requested shutdown is acceptable considering the flows through the pump station at that time. The request from Contractor will be returned to Contractor with the Owner's written decision noted. If Owner deems that the requested shutdown is unacceptable, Owner will state such reasons, and Contractor shall reschedule the shutdown as required.

D. It is hereby agreed between the Contractor and Owner that disapproval by Owner of the Contractor's shutdown request does not entitle Contractor to any time extension unless Contractor can demonstrate to the satisfaction of Owner, through an updated CPM schedule, that the overall Project completion date will not be met as a result of this disapproval.

E. Owner may postpone a planned and approved shutdown at any time for pumping capacity, or safety reasons.

F. Contractor shall provide temporary bypass pumping system during all temporary shutdowns as specified in Section 01 57 19.11, Temporary Sewage Control and Bypass Pumping, unless otherwise approved by the Engineer.

1.7 INTERRUPTION OF UTILITY SERVICE

A. Indicate required shutdowns of existing utilities or interruptions of existing operations on Progress Schedule. Interruptions to utility service will be allowed to the extent that customer service will not be adversely compromised.

B. Submit requests for interruptions to utility service not less than five business days in advance of the date scheduled for the interruption.

C. Following receipt of the request, Engineer will notify Contractor if the requested date will be permitted. Evaluation of the request will be based upon the availability of the utility owner's personnel to assist and monitor utilities during the shutdown period and impact to customer service.

D. Minimize the period of interruption by thorough advance planning. Procure and provide all required materials, equipment and labor on site during the shutdown.

E. Do not begin interruption until written authorization is received from Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 22 20 - MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 Description

Measurement and payment of the work will be on a unit price basis in accordance with the prices set forth in the proposal for individual work items. Where Work is required but does not appear as a separate item in the bid schedule, the cost for that Work shall be included and absorbed in the lump sum price of item 5. CONTRACTOR shall make a careful assessment when preparing the bid.

1. Mobilization, Bonds, Insurance and Demobilization:

Payment for mobilization, bonds, insurance and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least;

B. When all work is completed, amount of mobilization exceeding 5% of the original contract amount

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

2. Temporary Traffic Control, Complete:

Payment for temporary traffic control, complete will be on a lump sum basis. The lump sum price shall include all labor, materials, supervision, and maintenance required for the safe construction of all pump station and force main upgrades.

3. Erosion and Sediment Control:

Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for transfer of the erosion control permit from the applicant to CONTRACTOR, and all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project and after vegetation is fully established, and all other materials and work necessary.

4. Existing Pump Station Demolition:

Payment for Existing Pump Station Demolition will be on a lump sum basis. Existing Pump Station Demolition work shall be defined as all materials and work related to the safe

removal and disposal of the I5 Existing Pump Station in accordance with Section 02 41 00, Demolition and as shown on the Plans.

5. Pump Station, Complete:

   Lump sum payment under this item shall cover all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for work included separately under separate bid items. Payment will be made on a lump sum basis for the completion of all work to the I-5 Pump Station. Pump station work shall be defined as all work not identified under separate bid items. Payment shall be full and complete compensation for all work shown in the drawings and other work required to provide complete and usable facilities including materials, equipment, and labor for construction. Payment shall also include the furnishing of all required record drawings, operation and maintenance manuals, and other documents, certifications and reporting specified herein. The Contractor shall provide a breakdown of contract price as required by Section 01 33 00, Submittal Procedures.

6. Landscaping, Complete:

   Measurement and payment for landscaping will be made on a lump sum basis. Work shall include all material, labor and equipment to construct landscaping improvements including trees, shrubs, plants, ground covers, soil preparations, landscaping maintenance and all other landscaping items shown in the drawings and as specified.

7. Dewatering:

   Payment for all dewatering work shall be made on a lump sum basis. Payment shall include all labor, equipment and materials to design and stamp the dewatering system by a Professional Engineer and prepare a plan and submittal as required by Section 31 23 19-Dewatering, pre-treatment and testing, furnishing and installing onsite detention and treatment tanks and equipment, off-site disposal of settled material in the tanks, trench sump pumping, water treatment, permitting, and all other work necessary to provide dewatering. Payment shall also include all labor, equipment and materials to install, establish, operate, and maintain 1 monitoring well for the wet well excavation, and up to 4 deep dewatering wells necessary for the pump station work, including discharge lines, conveyance piping and valving and all other miscellaneous work necessary to dewater. Payment shall also include decommissioning the wells installed by the Contractor and those previously installed for design support.

8. 4” CARV Assembly and Enclosure on New FM:

   Payment will be made on a per each basis for the 4” CARV Assembly and Enclosure on New FM. 4” CARV Assembly and Enclosure on New FM shall be defined as all valves, piping, appurtenances, connection to force main, excavation and back fill, structure and installation as shown, and surface restoration to match pre-existing conditions, and any other materials

requires as specified in the drawings. Payment shall be full and complete compensation for all work shown in the drawings, as specified in the Special Provisions, and other work required to provide a complete and usable air release valve assembly including materials, equipment, and labor for construction.

9. 4" CARV Assembly and Enclosure on Existing FM:

   Payment will be made on a lump sum basis for the 4" CARV Assembly on Existing FM. 4" CARV Assembly on Existing FM shall be defined as all valves, piping, appurtenances, connection to force main, excavation and back fill, structure and installation as shown, and surface restoration to match pre-existing conditions, all traffic control, and any other materials requires as specified in the drawings. Payment shall be full and complete compensation for all work shown in the drawings, as specified in the Special Provisions, and other work required to provide a complete and usable air release valve assembly including materials, equipment, and labor for construction.

10. 16-Inch Ductile Iron Pipe with Class 3 Backfill:

    Payment for furnishing and installing 16-inch diameter DI sewage force main at the depth shown on the plans, including all work and materials, testing, inspection and acceptance, will be made on a linear foot basis. Payment will include but is not limited to excavation, loading, hauling, disposal, excavation support systems, Class 3 pipe bedding and pipe zone material, pipe installation, tracer wire and tape, trench dams, and the placement, compaction, and testing of the Class of trench backfill shown and specified. Measurement will be based on the total horizontal length of piping constructed without deduction for fittings and valves. Polyethylene encasement of force main piping is considered incidental to the installation of the piping and no separate measurement or payment will be made. Measurement and payment for surface restoration will be paid under separate bid items.

11. 16-Inch Diameter Force Main Fittings:

    Payment for furnishing and installing force main pipe fittings will be made on a per pound basis. The weights used for measurement will be the nominal weights listed in the fitting manufacturer's catalog for DI fittings of the actual class and type installed. Fitting accessories, including glands, bolts and gaskets, are considered incidental and shall not be included in the fitting weights used for payment. Encasement of fittings and thrust blocks are considered incidental to the installation of the fittings and no separate measurement or payment will be made.

12. 16-Inch Diameter Buried Plug Valves:

    Payment for furnishing and installing buried plug valves will be made on a per each basis. Payment will include all labor, materials, and appurtenances to create a useable facility as shown in the Plans including the Plug Valve, pier block foundation, valve can, and valve

operator. Polyethylene encasement of valves are considered incidental to the installation of the fittings and no separate measurement or payment will be made.

13. Existing 8" FM Abandonment:

    Payment for the Existing 8" FM Abandonment shall be on a lump sum basis. Payment shall include all caps, plugs, and blind flanges as shown on the Plans. Pipe shall be abandoned in place. Dewatering of the pipe is considered incidental to the abandonment.

14. Existing 12" FM Abandonment:

    Payment for the Existing 12" FM Abandonment shall be on a lump sum basis. Payment shall include all caps, plugs, and blind flanges as shown on the Plans. Payment shall also include filling the existing 12" FM with CLSM as shown on the Plans.

15. Discharge Manhole Coating:

    Measurement and payment for discharge manhole coating shall be on a lump sum basis. Payment shall include all labor, material, and equipment necessary to coat the existing discharge manhole. Payment shall also include any traffic control and temporary bypassing necessary to complete the work required to provide a complete and useable facility.

16. HMAC Pavement Restoration: 6-Inch Depth:

    Measurement and payment for permanent AC pavement restoration at 6-inch depth shall be on a per square yard basis and shall include furnishing and installing of the crushed rock bedding material, permanent asphaltic concrete, compaction, process control, acceptance testing, and other incidental work required to provide permanent AC pavement, in place, as required by the Contract Documents. Temporary paving is considered incidental and no separate measurement and payment item will be included.

17. Sawcutting: Measurement and payment for saw cutting shall include the total sawed length of the roadway, as shown on the drawings. Payment for saw cutting existing surfacing, which includes AC and concrete surfaces, for cuts up to 6-inches in depth will be on a linear foot basis. Payment for each 1-inch depth beyond 6-inch thickness will be on a per linear foot basis.

18. Trench Foundation Stabilization for Unsuitable Foundation Conditions: Payment for extra excavation and trench foundation stabilization by installing select foundation material will only be considered as approved and directed by ENGINEER. Select foundation material shall be Coarse Aggregate Type A2, Granular Drain Backfill Material in 1-1/2"-3/4" size, as defined in section 31 05 16. When such pre-approval is obtained, payment will be made on a cubic yard basis, including but not limited to excavation, loading, hauling, disposal, excavation support systems and dewatering that may be required for unsuitable foundation conditions and the placement, compaction, and testing of select foundation material. Measurement for trench foundation stabilization shall be for the approved length, from 6-inches below the

pipe invert to the approved excavated depth at the pay width of the nominal pipe diameter plus 12-inches on each side of the pipe. Pay limits for vaults and other structures shall be from 6-inches below the vault or other structure to the approved excavated depth and to a maximum of 12-inches beyond the outside walls of the vault or structure.

19. Rock Excavation: Payment for rock excavation, as defined in Section 31 23 18, Rock Removal, will be made at the unit price per cubic yard of rock excavated and rock excavation will be paid for in addition to the linear foot price for pipe, trench excavation and backfill. Measurement for rock excavation in pipe trench shall be for the length and depth of rock encountered to 6-inches below the pipe invert and the pay width shall be the nominal pipe diameter plus 12-inches on each side of the pipe for all pipe sizes. Measurement for rock excavation for vaults and other structures shall be for the depth of rock encountered to the depth necessary to install the structure and to a maximum of 18-inches beyond the outside walls of the vault or structure. No payment will be made for rock excavation beyond these limits.

20. Connection to Exist 12" FM at STA 1+00 on the Corner of W Hayes & Harvard:

    Measurement and payment for the connection to exist 12" FM at STA 1+00 on the corner of W Hayes & Harvard shall be made as a lump sum basis. Payment shall be full and complete compensation to develop connection plan submittals, all piping, fittings, valves, exposing and connecting to existing force main, testing of the connection, and complete reconfiguration of the force main system as shown on the Plans.

21. Connection to Exist 12" FM at STA 33+60 on W Lincoln St:

    Measurement and payment for the connection to exist 12" FM at STA 33+60 on W Lincoln St shall be made as a lump sum basis. Payment shall be full and complete compensation to develop connection plan submittals, all piping, fittings, valves, exposing and connecting to existing force main, testing of the connection, and complete reconfiguration of the force main system as shown on the Plans.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section contains administrative and procedural requirements for submittals for review, information, and for Project closeout.

B. Section includes:

1. Schedule of Submittals.
2. Submittal requirements.
3. Submittal procedures.
4. Engineer review.
5. Resubmittal procedures.
6. Product data.
7. Shop Drawings.
8. Samples.
9. Design data.
10. Test reports.
11. Certificates.
12. Manufacturer's instructions.
13. Manufacturer's field reports.
14. Erection Drawings.
15. Construction progress schedules.
16. Breakdown of contract price.
17. Operation and maintenance (O&M) instructions.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SCHEDULE OF SUBMITTALS

A. Within 10 days after the Effective Date of the Contract, Contractor shall submit to Engineer a preliminary Schedule of Submittals, including proposed list of major products proposed for use, with specification section reference, name of manufacturer, supplier, trade name, subcontractor and model number of each

product. Provide a schedule of specific target dates for the submission and return of submittals and shop drawings required by the Contract Documents.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

C. The list and schedule shall be updated and resubmitted when requested by the Engineer.

D. Contractor's Schedule of Submittals will be acceptable to the Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

1.4 SHOP DRAWING AND SAMPLE SUBMITTAL REQUIREMENTS

A. Before submitting a Shop Drawing or Sample, Contractor shall have:

1. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

B. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

C. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review of each such variation.

1.5 SUBMITTAL PROCEDURES

A. Contractor shall submit Shop Drawings and Samples to Engineer for review in accordance with the accepted Schedule of Submittals.

B. Transmit each submittal with Engineer-accepted transmittal form certifying compliance with requirements of Contract Documents.

C. Sequentially number transmittal forms. Mark transmittal forms for resubmittals with original number and sequential alphabetic suffix.

D. Show each Submittal with the following numbering and tracking system:

1. Submittals shall be numbered according to specification section. For example, the first product submittal for Section 05 50 00 would be “05 50 00-1”. Resubmittals of that submittal would be “05 50 00-1.1”, followed by “05 50 00-1.2”, and so on. The second product submittal for that Section would be “05 50 00-2”.

2. Submittals containing product information from multiple sections of the specifications will not be reviewed. Contractor and/or their supplier shall divide submittals in a manner that meets the numbering and tracking system requirements stated herein.

3. Alternative method of numbering may be used if acceptable to Engineer.

E. Identify: Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

F. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

G. Coordinate submission of related items.

1. All shop drawings for interrelated items shall be scheduled for submission at the same time.

2. The Engineer may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the Engineer will advise the Contractor in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

H. When hard copies of submittals are provided by the Contractor, six copies of all materials shall be provided to the Engineer. Two copies of reviewed submittals will be kept by the Engineer, two copies of reviewed submittals will be transmitted to the Owner, and two copies of reviewed submittals will be returned to the Contractor. If the Contractor requests that more than two copies of the reviewed submittal be returned, then the Contractor shall submit the appropriate quantity of submittals.

I. When electronic transmittals of submittals are provided by the Contractor under established protocols described elsewhere in the Contract Documents or as jointly developed by the Owner, Engineer and Contractor, provide electronic submittals in portable document format (PDF) in addition to the source document format (Word, Excel, AutoCAD, etc.). Reviewed submittals will be returned to the Contractor as PDF electronic files.

J. For each submittal for review, allow not less than 14 days for Engineer review, excluding delivery time to and from Contractor.

K. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

L. Allow space on submittals for Contractor and Engineer review stamps or comments.

M. When revised for resubmission, the Contractor shall identify changes made since previous submission. A narrative of changes shall be provided, and shop drawings or calculations shall indicate that a revision was made.

N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with review comments.

O. Submittals not requested will not be recognized nor processed.

P. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.6 ENGINEER REVIEW

A. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

B. The Engineer’s review of submittals and shop drawings is not a check of any dimension or quantity and will not relieve the Contractor from responsibility for errors of any sort in the submittals and shop drawings.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. The Engineer will review the submitted data and shop drawings and return to the Contractor with notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item".

E. If more than two submissions of an item are required to meet the Project specifications, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

F. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

G. Engineer's review will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

H. Engineer's review of a separate item as such will not indicate approval of the assembly in which the item functions.

I. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 1.4.C and Engineer has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such accepted variation from the requirements of the Contract Documents in a Field Order.

J. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 1.4 A. and B.

K. Engineer's review of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

L. Neither Engineer's receipt, review, return of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

M. Contractor shall perform the Work in compliance with the requirements and commitments set forth in returned Shop Drawings and Samples, subject to the provisions of Paragraph 1.6.I.

1.7 RESUBMITTAL PROCEDURES

A. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples

for review. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

B. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required review of an item with no more than two submittals. Engineer will record Engineer's time for reviewing a third or subsequent submittal of a Shop Drawings, sample, or other item requiring review, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

C. If Contractor requests a change of a previously reviewed submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

A. Within 10 days after the Effective Date of the Contract, prepare and submit to the Engineer a practicable schedule showing the order in which the Contractor proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. In addition to a time-scaled bar chart schedule depicting the project critical path, the Contractor shall submit a detailed CPM logic diagram. The CPM diagram and time-scaled bar chart shall include the following:

- Construction activities
- Submittal and review of material samples and shop drawings
- Procurement and delivery of critical materials
- Fabrication, installation, and testing of special material and equipment
- Duration of work, including completion times of all stages and their sub-phases

The activities shall be separately identifiable by coding or use of sub-networks or both. The duration of each activity shall be verifiable by manpower and equipment allocation, in common units of measure, or by delivery dates and shall be justifiable by the Contractor upon the request of the Engineer.

Detailed subnetworks will include all necessary activities and logic connectors to describe the work and all restrictions to it. In the restraints, include those activities from the project schedule which initiated the subnetwork as well as those restrained by it.

Include a tabulation of each activity in the computer mathematical analysis of the network diagram. Furnish the following information as a minimum for each activity:

- Event (node) number(s) for each activity
- Activity description
- Original duration of activities (in normal workdays)
- Estimated remaining duration of activities (in normal workdays)
- Earliest start date or actual start date (by calendar date)
- Earliest finish date or actual finish date (by calendar date)
- Latest start date (by calendar date)
- Latest finish date (by calendar date)
- Slack or float time (in workdays)

Computer printouts shall consist of at least a node sort and an "early start/total-float" sort.

A. Within 10 days after the Effective Date of the Contract, prepare and submit to the Engineer a practicable schedule showing the order in which the Contractor proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. A time-scaled bar chart schedule shall include the following:

- Construction activities
- Submittal and review of critical material samples and shop drawings
- Procurement and delivery of critical materials
- Duration of work, including completion times of all stages and their sub-phases

B. Attention is drawn to typical local climatic weather patterns and Work shall be coordinated accordingly.

C. Complete project schedule shall be revised and resubmitted to the Engineer at a minimum occurrence of every 3 weeks for review.

D. Three Week Lookahead Schedules: Provide each week at the weekly construction meeting. The previous week's completed work shall be shown on the schedule for a total of 4 weeks shown.

2.2 BREAKDOWN OF CONTRACT PRICE

A. Within 10 days after the Effective Date of the Contract, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the work, including an allowance for profit and overhead adding up to the total lump sum contract price.

B. Breakdown of lump sum bids shall be coordinated with the items in the schedule and shall be in sufficient detail to serve as the basis for progress payments during construction.

C. Engineer will review the contract price breakdown and may request items to be further broken down or for more items be added in order to facilitate tracking of work progress for payment.

D. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5 percent of the total base bid.

E. Upon acceptance of the breakdown of the contract price by the Engineer, it shall be used as the basis for all requests for payment.

2.3 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents. Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

1. Note submittal will be returned to Contractor without review of submittal if products, models, options, and other data are not clearly marked or identified.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.4 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer licensed in the state of Project responsible for designing components shown on Shop Drawings.

1. Include signed and sealed calculations to support design.

2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.

3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. All dimensioned shop drawings shall be scalable and provided as full-sized (22-inch x 34-inch) sheets. PDF electronic files shall print as scalable full-sized sheets.

E. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.5 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:

1. Submit to Engineer for aesthetic, color, and finish selection.

2. Submit Samples of finishes, textures, and patterns for Owner selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

H. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.6 DESIGN DATA

A. Informational Submittal: Submit data for Engineer's knowledge as Contract administrator or for Owner.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

2.7 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.8 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

2.9 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

2.10 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit report within 48 hours of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.11 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

2.12 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Submit preliminary O&M materials for review by Engineer. The equipment manufacturer may furnish instruction manuals prepared specifically for the equipment furnished or standard manuals may be used if statements like "if your equipment has this accessory..." or listings of equipment not furnished are eliminated. O&M materials will be returned to the Contractor for resubmittal if the O&M materials do not clearly indicate what specific equipment was furnished and all items not provided being clearly crossed out. Poorly reproduced copies are not acceptable. Operation and maintenance instructions shall contain the following as a minimum:

1. Reviewed shop drawings and submittal data;

2. Model, type, size, and serial numbers of equipment furnished;

3. Equipment and driver nameplate data;

4. List of parts showing replacement numbers;

5. Recommended list of spare parts;

6. Complete operating instructions including start-up, shutdown, adjustments, cleaning, etc.;

7. Maintenance and repair requirements including frequency and detailed instructions; and

8. Name, address and phone numbers of local representative and authorized repair service.

B. Following review of the preliminary O&M materials by the Engineer and before acceptance of the Work, submit four copies of complete final operation and maintenance instructions for all equipment supplied. Submit items in 8-1/2 x 11-inch heavy-duty three-ring binders when appropriate, or in 8-1/2 x 11-inch file folders. All binders and folders shall have clear plastic pockets on the front of the cover and the spine to allow for insertion of identifying information.

2.13 OTHER REQUIRED SUBMITTALS

A. Other required submittals include the items listed below. This list is provided for Contractor's convenience only and may not be complete in all respects. Contractor shall provide all submittals specified or required, whether or not listed here.

1. Contractor Emergency Contact List.
2. Erosion and Sediment Control Plan.
3. Traffic Control and Protection Plan.

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 45 00 - QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers quality control requirements supplementary to those of the General Conditions and Technical Specifications.

1.2 PROVISIONS

A. Contractor's Responsibility for Testing

The CONTRACTOR shall be responsible for the cost of all testing as specified in this section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

B. OWNER's Right to Perform Additional Tests

The OWNER or ENGINEER reserves the right to complete additional testing. In such cases, the CONTRACTOR shall provide safe access for the OWNER or ENGINEER and their inspectors to adequately inspect the quality of work and the conformance with project specifications.

1.3 QUALITY ASSURANCE

A. Testing Requirements

An independently owned and operated laboratory approved by the ENGINEER shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of work and/or materials shall be conducted in the presence of the ENGINEER. The CONTRACTOR shall provide 48-hour notification to the OWNER and OWNER's REPRESENTATIVE prior to conducting any and all quality assurance testing. Where applicable, work and materials shall only be buried with the consent of the ENGINEER.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of material to be tested shall be selected by such laboratory or agency or by the ENGINEER. The CONTRACTOR shall furnish such samples of all materials without charge to OWNER.

c. The results from any and all tests are made for the information of the OWNER. Regardless of any test results, the CONTRACTOR is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the Drawings and Specifications.

2. Costs of Testing

a. The CONTRACTOR shall be responsible for and shall pay for all tests as specified in Part 3 of this Section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

b. With regards to all materials to be tested, where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

1.4 SPECIAL INSPECTIONS

Special inspections and testing as required by Chapter 17 of the IBC shall be conducted by OWNER-retained Special Inspectors and Testing Agencies as required and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the Work.

2. Promptly notify OWNER and CONTRACTOR of irregularities and deficiencies observed in the Work during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to OWNER, CONTRACTOR and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected work.

B. CONTRACTOR'S Responsibilities

1. Provide quality requirements to all subcontractors and enforce all requirements.

2. Notify OWNER, ENGINEER, Special Inspectors and Testing Agencies at least 48 hours in advance of time when Work that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

3. Pay for any CONTRACTOR requested testing and inspecting not required by the Contract Documents.

4. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement work resulting from work that failed to comply with the Contract Documents. OWNER will deduct such costs from the Contract Price.

5. Submit copies of licenses, certifications, correspondence, records and similar documents used to establish compliance with standards and regulations that pertain to performance of the Work to the OWNER, ENGINEER and Special Inspectors.

6. Where Special Inspection requires pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:

    a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

    b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

7. Cooperate with Agencies performing required tests, special inspections, and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the Work.

    b. Incidental labor, equipment, and materials necessary to facilitate tests and special inspections.

    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Agencies in obtaining samples.

    d. Provide facilities for storage and field curing of test samples.

    e. Deliver samples to Testing Agencies.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

9. Schedule times for tests, special inspections, obtaining samples, and similar activities. Distribute schedule to OWNER, ENGINEER, Special Inspectors, Testing Agencies, and each party involved in portions of the work where tests and special inspections are required.

1.5 SUBMITTALS

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three copies of each report to the OWNER or OWNER's REPRESENTATIVE.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 FIELD TESTING SCHEDULE

A. The CONTRACTOR shall complete field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of work completed by the CONTRACTOR. Testing locations to be determined by the ENGINEER.

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Structural Backfill	OWNER	See Article 3.5, Field Quality Control of Section 31 23 23, Fill for further details on testing requirements.
Trench Backfill	CONTRACTOR	See Article 3.16, Field Quality Control of Section 31 23 17, Trenching for further details.
Asphalt Concrete	CONTRACTOR	As required when placed. See detailed requirements in Article 3.3, Field Quality Control of Section 32 12 16, Asphalt Paving.
Concrete	OWNER	As required when placed. See detailed requirements in Article 3.15, Quality Control Testing During Construction of Section 03 30 00, Cast-In-Place Concrete.
Grout	OWNER	Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with Specifications. See detailed requirements in Article 1.6, Quality Assurance of Section 03 60 00, Grouting.
Masonry Mortar and Grout	OWNER	As required when placed. See detailed requirements in Section 04 05 17-1.4.
Waterline – Hydrostatic testing and disinfection	CONTRACTOR	As required. See Section 33 13 00, Testing & Disinfection of Utility Piping.

END OF SECTION

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes provisions for temporary protection of trees and other plant life in preparation for site or building excavation Work.

B. Related Sections:

1. Section 31 10 00 - Site Clearing
2. Section 31 22 13 - Rough Grading
3. Section 31 23 16 - Excavation
4. Section 31 23 17 - Trenching

C. This specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

PART 2 MATERIALS - NOT USED

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect all trees specified on the Drawings for protection prior to construction.

1. Document with written memorandum and photographs any unusual conditions.

2. Submit copies of documentation to ENGINEER prior to beginning work.

B. Verify all conditions on the Drawings with actual conditions at Site regarding tree protection prior to any site disturbance.

C. The ENGINEER must be present during demolition of existing conditions occurring within the drip line of trees designated to remain.

D. Notify ENGINEER 24 hours prior to inspections and/or tagging of protected trees.

3.2 PROTECTION

A. Install barricades specified in the Drawings at drip lines of trees designated to remain prior to the commencement of construction.

B. Clearly designate protected trees and clear of any material storage, personnel, or vehicular movement.

C. Provide temporary fencing, barricades, and guards as necessary or required to protect trees designated on the Drawings to remain, from damage above and below grade.

D. Protect root systems of trees and plant life to remain.

1. Protect from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.

2. Protect from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.

3. Protect against unauthorized cutting, breaking, skinning roots and branches, or bruising bark.

4. Protect from smothering and compaction.

a. Do not store construction materials or permit vehicles to drive or park within the drip line area of any tree to remain.

5. Protect from dumping of refuse in close proximity.

E. Where cutting is necessary, review conditions with the ENGINEER before proceeding, and comply with directives of ENGINEER.

3.3 EXCAVATION AROUND TREES

A. Excavate within drip lines of trees only where indicated on the Drawings or as directed by ENGINEER.

B. Where trenching for utilities is required within drip lines, tunnel under or around roots by hand excavating.

1. Where possible trench toward trunk of tree and tunnel under central root mass to avoid severing all lateral roots on side of trench.

2. Do not cut main lateral roots or tap roots over 1-inch in diameter.

3. Temporarily support and protect trees from damage until permanently covered with approved backfill.

C. Do not allow exposed roots to dry out before backfill is placed.

1. Provide temporary earth or burlap cover.

2. Water roots daily when exposed and maintain in a moist condition.

D. Backfill roots only upon inspection approval from the ENGINEER.

1. Backfill around root excavations only with clean imported topsoil free from materials deleterious to root growth.

2. Backfill to eliminate voids and compact only by means of manual tamping at root areas.

3. Water sufficiently to settle topsoil and eliminate voids or air pockets around roots.

4. Allow for natural settlement of soil surface and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.

E. If during excavation, any condition arises that threatens the survivability of the protected tree, or an unknown condition arises that affects the stability or integrity of the root system, notify the ENGINEER immediately.

3.4 REPAIR AND REPLACEMENT OF DAMAGED TREES

A. In the event of damage to existing trees:

1. Immediately prune limbs smaller than 3-inch caliper or roots smaller than 2-inch caliper to repair trees damaged by construction operations.

2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.

3. Any such pruning and/or repairs shall be approved in advance and at completion by ENGINEER.

4. The ENGINEER shall reserve the right, at cost to the CONTRACTOR, to obtain the services of a Certified Consulting Arborist with current membership in the American Society of Consulting Arborists to determine the severity of damage.

5. The CONTRACTOR is responsible for the cost of repairs caused by their actions or by the actions of subcontractors engaged by the CONTRACTOR.

B. Remove and replace dead or damaged trees which are determined by the ENGINEER to be incapable of restoration to normal growth patterns at no additional cost to OWNER.

1. Provide new trees of the same species as those removed or damaged, with size and/or quantity to be determined by ENGINEER.

2. Furnish replacement trees and plant life to the Site and plant, maintain, and warranty as directed by the ENGINEER.

3. If trees are not replaceable with the same species, and size, compensate the OWNER for the replacement cost of the trees based on the evaluation of a Certified Consulting Arborist.

4. The CONTRACTOR is responsible for additional costs of removing damaged trees and labor for planting new specimens.

3.5 DESIGNATED TREE REMOVAL PROCEDURES

A. If designated tree removal is specified by ENGINEER, furnish labor, material, and equipment necessary for removing and/or salvaging existing trees, if necessary, as designated on the Drawings for removal.

1. Verify location and species with ENGINEER prior to removal.

B. Salable logs or timber may be sold to CONTRACTOR's benefit upon notification and prior approval of OWNER. Upon approval, remove salable logs or timber promptly from site.

3.6 GRADING AND FILLING AROUND TREES

A. Maintain existing grade within drip line of trees unless otherwise indicated on the Drawings or directed by the ENGINEER.

3.7 MAINTENANCE OF PROTECTIVE MEASURES

A. Maintain protective measures throughout the construction process. Immediately repair any alteration to protection measures throughout construction process. Repair or reinstall protective measures immediately upon alteration. Monitor protective measures daily.

B. Remove and clear area of debris and fencing, barricades, etc., upon final written approval of ENGINEER.

END OF SECTION

SECTION 01 57 19.11 - TEMPORARY SEWAGE CONTROL AND BYPASS PUMPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for providing temporary bypass pumping and piping equipment to provide continuous conveyance of wastewater from a sewage pump station to a collection system during construction activities.

B. Contract Requirements:

1. The existing facility continuously pumps wastewater to the City's Wastewater Treatment Facility. The functions of the facility shall not be compromised or diminished during the course of the Work, except as specified herein. Plan and prosecute the Work such that operation of the pump station and plant is not interrupted.

2. Inadequate conveyance of sewage or temporary bypass pump system malfunctions could potentially result in the spillage or discharge of raw wastewater and sewage. State law allows the Department of Environmental Quality to impose civil penalties for violation of a term, condition, or requirement of Owner's NPDES Permit, including spillage or discharge of raw wastewater and sewage.

3. Spillage or discharge of raw sewage to surface waters or drainage courses is prohibited during construction. Penalties imposed on Owner as a result of any bypass of this type caused by Contractor, its employees or Subcontractors, and legal fees and other expenses to Owner resulting directly or indirectly from the bypass shall be borne in full by Contractor.

4. CONTRACTOR shall be responsible for controlling any and all leakage resulting from or integral to making all temporary and permanent piping connections, and shall provide any and all devices and materials required to control, stop, divert, or dispose of any and all leakage.

5. Temporary force mains shall be pressure tested as specified herein and shall not leak any sewage during the timeframe it is used. Visually inspect the entire length of the force main alignment daily to verify there are no leaks.

6. Contractor is responsible for planning, scheduling, and sequencing its construction activities to ensure that pumping of wastewater at all times is uninterrupted.

6. Contractor is responsible for planning, scheduling, and sequencing its construction activities to ensure that pumping of wastewater can begin in accordance with the schedule outlined in Section 01 12 16, Work Sequence and remains in effect, at all

times thereafter uninterrupted, until the complete facility has been accepted by Owner.

7. Plan and prosecute the Work such that temporary bypass pumping operations can be initiated in accordance with the schedule outlined in Section 01 12 16, Work Sequence.

1.2 RELATED SECTIONS

A. Section 01 12 16, Work Sequence.
B. Section 43 21 39, Submersible Liquid Pumps.

1.3 SUBMITTALS

A. Individual Temporary Sewage Control and Bypass Pumping Plan for each planned bypass. Submit each plan a minimum of four weeks prior to the proposed date of temporary pumping and piping activity.

B. Do not construct, install, or place in operation temporary process pumping and piping facilities until Engineer has reviewed and approved each planned bypass.

C. Temporary Sewage Control and Bypass Pumping Plan: At a minimum, to include the following:

1. Name, qualifications, and references of the Supplier providing the pumping facilities, including a minimum of three jobs of similar scope and complexity.

2. Description of the pumps to be used, including pump curves and calculation of pumping capacity required.

3. Description of the temporary primary and backup power supply, and estimated fuel consumption for engine-driven pumps and generators.

4. Description of the control equipment, the temporary control panel(s), and the method to be used to operate the pumps.

5. Drawing showing the layout and routing of bypass pumping equipment, piping, and valves with associated sizes and dimensions.

6. Drawing showing the layout and routing of proposed electrical service connections, including conductor types and sizes, conduits, and routing, with associated sizes and dimensions.

7. Drawing showing the layout of the force main. The drawing shall show details of any portions of the force main routing that is installed below grade.

8. Pump maintenance plan describing regular maintenance to be performed while the pumps are in service and the length of the maintenance period when a pump will be out of service.

9. Contingency plan describing steps to be taken if a pump fails and emergency contact phone numbers. Alarms shall be sent to Contractor and notify City personnel of any and all alarms.

10. Noise levels at minimum and maximum operating speed.

D. Results of field pressure test of temporary piping shall be submitted prior to startup of temporary pumping operation.

1.4 CONTINUITY OF PUMP STATION OPERATION

A. Once initiated, temporary pumping must be kept in operation, except as specified herein, until the new facilities are accepted by Owner and capable of accepting the raw sewage.

B. Execute Work in such a way to allow reasonable access to the facilities by Owner.

C. Coordinate the switch-over from the temporary pumping system to the new facilities with Owner.

D. Through the use of permanent or temporary pumps, maintain the following minimum pumping ability at all times during construction:

1. Minimum Capacity: 2800 gallons per minute (gpm) at 131 feet total dynamic head (TDH) with one pump running.

2. Redundancy: Provide onsite, and installed ready for operation, a complete redundant backup pump equal to or larger than the largest pump in the system used to provide the specified minimum pumping capacity.

3. Primary Pump: The primary pump in the temporary pumping system shall be an electric pump.

a. Provide and install a metered temporary electric service connection, approved by the power utility, for powering the temporary primary pumping system.

b. Alternatively, if a temporary electric connection is not available, provide a diesel engine-driven generator to provide power for the primary electric pump. If this option is utilized, the backup pump must by powered by a separate power source and shall be as specified herein.

4. Backup Pump: A standby pump shall be provided and installed ready for operation in the event of a power failure. The standby backup pump shall provide the minimum capacity as listed above.

5. Noise Standard: The temporary pumping system shall meet all local, State, and Owner's noise standards for operating in a residential environment.

1.5 DISCHARGING OF WASTEWATER TO SURFACE WATERS

A. Any discharge of wastewater to surface waters is prohibited.

PART 2 PRODUCTS

2.1 TEMPORARY BYPASS PUMPING EQUIPMENT

A. Provide all temporary bypass pumping equipment necessary to ensure continuous pumping operations during pump station shutdowns.

B. Temporary bypass pumps shall meet the flow and head requirements as specified above. Temporary bypass pumps shall be non-clog raw sewage pumps.

C. Primary pump shall be and electrically powered dry-prime non-clog raw sewage pump.

D. Backup Pump shall be one of the two following options:

1. Diesel fueled engine-driven non-clog dry-prime sewage pump.

2. Electrical pump meeting the requirements of the primary pump and powered by a diesel engine-driven generator.

E. Temporary pumping equipment shall include a pump control panel to allow the pump station to be automatically operated, unless manually operated by the Contractor's staff 24 hours per day.

F. Provide all lifting mechanisms required to install, maintain, and remove temporary pumping equipment.

G. Provide auto dialer to automatically notify Contractor and Owner upon all alarms. Coordinate alarm programming with Owner. Provide high level and overflow level floats for the temporary pumping system:

1. High level alarm float shall be set above the primary pump normal level control elevation and shall trigger the backup pump to run and shall also send an alarm via the auto dialer.

2. Overflow float shall be set above the high-level alarm float and shall send an overflow alarm via the auto dialer.

3. Coordinate primary level control and alarm float elevations with the ENGINEER.

2.2 TEMPORARY PIPING

A. Provide temporary piping, valves, and fittings for temporary pumping equipment, using sizes and types shown in the Drawings.

B. Provide pipe and couplings rated for a minimum pressure of 150 pounds per square inch (psi).

2.3 DIESEL EQUIPMENT SPILL CONTAINMENT

A. Secondary spill containment berms shall be provided for all diesel fueled equipment. Spill containment berm shall be made of 40-mil Linear Low-Density Polyethylene material with minimum 12-inch tall aluminum L-Bracket wall supports.

PART 3 EXECUTION

3.1 OPERATION

A. Contractor shall be responsible for all costs associated with temporary pumping, including temporary electric service, temporary standby power, all electricity usage, and fuel to operate the temporary pumps and controls.

B. Respond to and resolve all alarms from temporary pumping operations. Have personnel available to respond to an alarm within 30 minutes.

C. Ensure temporary bypass pumps are maintained and remain operational 24 hours per day, 7 days per week for the duration of any planned bypass.

D. Notify Owner immediately in the event of a high level or overflow alarm. Owner will provide names and telephone numbers of personnel to be contacted in the case of an alarm or other emergency.

E. The temporary electrical pump shall not be operated at the same time as the proposed permanent pumps. The switchover from temporary pumping systems to permanent pumping system shall be coordinated with the Engineer and Owner. During the switchover, the standby pump system shall be utilized to ensure that the electrical service is not overloaded.

3.2 STAFFING

A. Provide a minimum of one operator for temporary pumping at all times that the pumps are in operation, unless pumps are automatically controlled in accordance with this Section.

3.3 TEMPORARY PIPING

A. Route temporary piping to avoid blocking construction and maintenance equipment access.

B. Provide protection for piping and couplings where crossing access points in unavoidable.

3.4 TESTING

A. Prior to operation, pressure test temporary piping to a pressure no less than 150 psi. Submit test results to Engineer.

B. Prior to operation, provide a functional test for the complete temporary pumping system including pumps, valves, alarms, telemetry, and redundancy.

END OF SECTION

SECTION 01 75 16 - TESTING, TRAINING AND SYSTEM START-UP

PART 1 GENERAL

1.1 SCOPE

This section specifies equipment and system testing and start-up, services of manufacturer's representatives, training of OWNER's personnel and final testing requirements for the complete facility.

1.2 CONTRACT REQUIREMENTS

A. Testing, training and facility startup acceptance are requisite to the satisfactory completion of the Contract.

B. Complete all startup procedures, testing and training, as specified herein, within the Contract Time(s).

C. Furnish all necessary labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

D. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation, testing, and operator training.

1.3 SUBMITTALS

A. Provide detailed Start-up Progress Schedule with the following activities identified:

1. Manufacturer’s services
2. Installation certifications
3. Operator training
4. Submission of operation and maintenance manual
5. Field testing
6. Functional testing
7. Operational testing

B. Testing and Startup Plan:

1. Not less than 30 Days prior to performing field testing, the Contractor shall submit for review a detailed Testing Plan. The Plan shall include schedules for equipment certifications, schedules for submitting final Operations and Maintenance Manuals, schedule for training the Owner’s personnel, list of Owner furnished supplies or equipment, electrical testing schedule, and detailed schedule of operations to

achieve successful field testing, functional acceptance testing and activities to implement the operational test.

2. The Plan shall include test checklists and data forms for each item of equipment and shall address coordination with the Owner's staff.

3. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

C. The Contractor shall maintain the following records during installation, field testing, functional acceptance testing and operational readiness testing and submit these said records as requested by Owner's Representative and shall be provided prior to startup acceptance:

1. Lubrication and service records for each item of mechanical/electrical equipment including logs of time spent by manufacturer's representatives performing services on the job site.

2. Hours of daily operation for each item of mechanical/electrical equipment.

3. Daily logs of equipment testing identifying all tests conducted and outcome.

4. Instrumentation calibration and testing and check lists.

5. Manufacturer's certification of proper equipment installation.

6. Testing and validation of all control inputs, outputs, logic functions, status indication, and alarms.

7. Factory and field equipment settings.

8. Equipment lubrication records, as may be needed.

9. Electrical phase, voltage, and amperage measurements.

10. Insulation resistance measurements.

11. Data sheets of control loop testing including testing and calibration of instrumentation devices and set-points.

12. Field test reports.

13. Functional acceptance test report.

14. Other records, logs, and check lists as required by the Contract Documents.

D. Provide summary of shutdown requirements for existing systems if required, which are necessary to complete start-up of new equipment and systems.

1.4 EQUIPMENT INSTALLATION

A. Inspect all equipment and systems following installation and prior to testing.

B. Provide written certification that mechanical, electrical and instrumentation systems furnished are installed to manufacturer requirements prior to testing.

1.5 FIELD TESTING PROCEDURES

A. Mechanical Systems:

1. Remove rust preventatives and oils applied to protect equipment during construction.

2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.

3. Flush fuel system and provide fuel for testing and start-up.

4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.

6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.

7. Perform cold alignment and hot alignment to manufacturer's tolerances.

8. Adjust V-belt tension and variable pitch sheaves.

9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to ensure no leakage but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.

11. Install gratings, safety chains, handrails, shaft guards and sidewalks prior to operational testing.

12. Pressure test lift station piping per the specification requirements.

B. Electrical Systems

1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.

2. Perform continuity tests on grounding systems.

3. Test and set switchgear and circuit breaker relays for proper operation.

4. Check motors for actual full load amperage draw. Compare to nameplate value.

5. Perform additional testing procedures as required by NEC, other codes, and Division 26 of these specifications.

6. Document and provide any adjusted equipment settings in the O&M manuals. This shall include all VFD parameter settings.

C. Instrumentation Systems

1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

3. Perform additional testing procedures as required by Division 26 and 40 of these Specifications.

4. Document and provide any adjusted equipment settings in the O&M manuals.

D. HVAC SYSTEMS

1. Leak test piping and ducting.

2. Test all electrical and mechanical components for proper operation.

3. Document and provide any adjusted equipment settings in the O&M manuals.

1.6 FUNCTIONAL TESTING

A. Functionally test mechanical and electrical equipment for proper operation after field testing tasks have been completed.

B. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

1.7 FUNCTIONAL ACCEPTANCE TEST REPORT

A. At completion of functional testing, the Contractor shall furnish a written report prepared and signed by manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, aligned, adjusted and lubricated.

2. Is free of any stresses imposed by connecting piping or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Operates within the allowable limits for vibration.

5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:

1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.

2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.

C. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.8 TRAINING OF OWNER’S PERSONNEL

A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.

B. Coordinate training schedule with City staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two (2) sessions per week.

C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems two (2) weeks prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

E. The OWNER may videotape the training for later use with the OWNER's personnel.

1.9 MINIMUM SERVICE SCHEDULE

Minimum services shall be provided by the manufacturers' representatives for certain Contractor-provided equipment in accordance with the following schedule:

Specification Section	Equipment	1 Equipment Installation Instruction	2 Equipment Testing Assistance	3 Operator Training
43 21 39	Submersible Pumps	1 CWD	1 CWD	1 CWD
26 29 23	Variable Frequency Drive	1 CWD	1 CWD	1 CWD
40 60 00	Programmable Logic Computer	0.5 CWD	1 CWD	0.5 CWD
26 32 13	Generator and ATS	0.5 CWD	1 CWD	0.5 CWD
26 95 00	Level Sensors	0.5 CWD	0.25 CWD	0.25 CWD
40 09 23.33	Flow Process Measurement	0.5 CWD	0.5 CWD	0.25 CWD
23 70 00	HVAC	0.25 CWS	0.25 CWD	0.25 CWD

NOTE: CWD is defined as a consecutive working day consisting of 8 hours each from 8:00 a.m. to 5:00 p.m.

1.10 OPERATIONAL TESTING

A. Following operator training and functional testing, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. The operational readiness test shall not be commenced until all required equipment tests have been completed to the satisfaction of the Engineer

C. Operational Test

1. The Contractor shall conduct entire facility operational test for continuous 7-day period without malfunctions or deficiencies causing shutdown or partial operation of the facility or results in performance that is less than specified.

2. Operational test shall use clean potable water to test the functionality of the facility for the first 4-days. Contractor shall provide a storage tank to pump into for testing that has an outlet to recirculate flow back to the wet well. The unused connection to the header for the future pump can be used to connect temporary piping to

route to the storage tank. Contractor is responsible for restraining all temporary pipe.

a. The purpose of this testing is to completely test the pumps and controls in manual and automatic operational modes, prior to introducing sewage to the new facility.

3. After successful completion of the first 4-days of the 7-day operational test, raw sewage can be conveyed to the wet well to continue the operational test of the facility. See section 01 12 16-Work Sequence for more information.

4. The existing pump station shall remain in operation during the first 4-days of the operational test, and as a standby during the last 3-days of the operational test.

5. All equipment must properly run continuously 24 hours per day for the test period and within the design criteria range. If any item malfunctions during the test, the item shall be repaired, and the test restarted at day zero with no credit given for the operating time before the aforementioned malfunction.

6. The Contractor shall provide the services of authorized representatives to correct faulty equipment.

7. Contractor shall facilitate hydraulic pump testing by the Engineer during the operational test.

D. The Contractor shall provide operating personnel for the duration of the operational test.

E. Contractor shall provide power, fuel, and other consumables for duration of the operational test.

F. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

1.11 PUMP STATION STARTUP ACCEPTANCE

A. Pump station startup acceptance will be provided to the Contractor by the Engineer when the following activities are approved by the Engineer:

1. Successful completion of the 7-day operational test.

2. All records specified in section 1.3.C of this Specification are provided to the Engineer.

3. All manufacturer training of Owner personnel is complete.

B. Pump station startup acceptance does not relieve the contractor of the requirements for final acceptance as specified in the General Requirements.

END OF SECTION

SECTION 02 30 00 - SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.1 DESCRIPTION

Subsurface investigations and reporting have been performed for the purpose of obtaining data for the planning and design of this project. Copies of such reporting are included with the Contract Documents as Supplementary Information.

1.2 LIMITATIONS

The subsurface investigations and reporting are being made available solely for the convenience of the Bidder and shall not relieve the Bidder or the CONTRACTOR of any risk, duty to make examinations and investigations as required by section 00120.15 of the Standard Specification.

It is mutually agreed to by all parties that the written reports are reference documents and are not part of the Contract Documents, that the subsurface investigations are for the purpose of obtaining data for planning and design of the project, and that the data concerning borings is intended to represent with reasonable accuracy conditions and material found in specific borings at the time the borings were made.

It is expressly understood and agreed that the OWNER and ENGINEER assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigation thus made, the records thereof, or of the interpretations set forth therein, or made by the OWNER in his use thereof; and there is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations, or records thereof, are representative of those existing throughout such areas, or any part, or that unforeseen developments may not occur.

The OWNER's subsurface investigations and reporting are made available to Bidder or CONTRACTOR only on the basis of the understandings and agreement herein stated.

END OF SECTION

SECTION 02 35 00

CAISSON CONSTRUCTION

PART 1 GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall provide all design, labor, materials, and equipment necessary to design and construct the below grade portion of the wet well using the caisson method of construction. It is the CONTRACTOR'S responsibility to determine the method of construction of the below grade portions of the wet well given the site conditions and contractor's experience and equipment.

1.2 RELATED SECTIONS

A. Section 03 21 00 – Reinforcing Steel.

B. Section 03 30 00 – Cast-In-Place Concrete Work.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit drawings and design calculations prepared by CONTRACTOR'S Engineer, licensed as a Structural Engineer in the State of Oregon. See structural drawings for required design and loading criteria.

1. Caisson construction shall meet all requirements outlined in the Geotechnical report, including a buoyancy factor of safety of 1.5 at all times during and after construction. Groundwater shall be assumed at a depth of 7-feet below existing grade.

2. Show modifications to proposed wet well design required for caisson construction.

3. Submit wall design including water jet, bentonite, and grout pipes, and injection ports, and dimensions of annular space for bentonite lubrication. Show increased wall thickness for dead weight when required to sink caisson.

4. Show height of each concrete placement lift and construction joint locations.

5. Show plan for accurately placing penetrations.

6. Caisson design shall include waterstop between structural slab and caisson walls.

7. Contractor to confirm the assumed 7-foot deep groundwater level prior to construction using the existing piezometer. The groundwater criteria for design shall be adjusted if groundwater is found at a shallower depth than 7-feet. If groundwater is found below a depth of 7-feet, the assumed groundwater depth shall remain at 7-feet.

C. The CONTRACTOR shall submit a caisson construction plan to be reviewed by the ENGINEER prior to the beginning of construction activities. The plan shall identify all elements of the caisson construction, including but not limited to: forming, concrete pours, curing times, excavation, etc. A detailed schedule shall be provided with the plan defining a timeline for all activities identified.

D. Submit safety plan to meet OSHA requirements. These procedures will not be subject to approval by CITY ENGINEER and are for record purposes only. Address in plan, as minimum but not limited to the following:

1. Protection against caisson instability, ground heave at the base of the caisson or internal piping of external soil into the caisson, and ground water inflow.

2. Safety for caisson access and exit, including ladders, stairs, walkways, and hoists.

3. Protection against equipment operations, and for lifting and hoisting equipment and material.

4. Support of surcharge weights.

5. Ventilation system.

6. Monitoring for hazardous gases.

7. Protection against flooding of caisson and inflow into sewers when connected to caisson structure.

8. Protection of workers and public, including traffic barriers, accidental or unauthorized entry, and falling objects.

9. Safety supervising responsibilities.

E. Building and Structures Assessment. Submit for review prior to construction, Building and Structures Assessment Plan. Provide preconstruction and post-construction assessment reports for buildings and structures located within distance equal to the depth of the caisson but at least 50 feet in plan from proposed caisson perimeter. Include photographs or video of existing damage to structures in vicinity of caisson in assessment reports.

F. Caisson Survey. Submit Caisson Survey identifying required modifications to complete lift station and to comply with specified tolerances.

1.4 SITE CONDITIONS

A. The CONTRACTOR shall become aware of site conditions and subsurface investigations, as defined in Section 02 30 00.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Sections 03 21 00 Reinforcing Steel and 03 30 00 Cast in Place Concrete, and other applicable sections herein.

PART 3 EXECUTION

3.1 CONCRETE WORK

A. Refer to Section 03 30 00 Cast in Place Concrete.

3.2 SINKING OF CAISSON

A. Caisson shall be placed to the grades shown on the drawings. The caisson shall be sunk by the excavation of material within the walls in a manner that shall cause the caisson to sink evenly and squarely. The water elevation within the caisson shall not be lowered by pumping without the approval/concurrence of the ENGINEER.

B. The caisson shall be installed plumb, with a maximum allowable deviation of 1/8” per foot. Vertical and horizontal control and maximum allowable deviations including rotational orientation shall be dictated by the need to align the 24” gravity sewer within a 36” diameter caisson wall penetration. The CONTRACTOR shall cast into the caisson wall a penetration centerline marker (suggested option would be a 3” diameter by 2’-0” long PVC pipe securely fastened to forms) so that upon dewatering, the penetration location and elevation may be verified prior to core drilling the wall. Notify the ENGINEER prior to proceeding with core drilling operations.

C. Surface water shall be directed away from, and not allowed to pond next to, the outside wall during construction of the caisson.

3.3 CAISSON CONSTRUCTION TOLERANCES

A. Maximum acceptable deviation of caisson from vertical is 1/8 inch in 1 foot.

B. Maximum acceptable horizontal deviation from design location of center of caisson at ground surface level is 12 inches.

C. Install elevation of base of caisson structure equal to or lower than elevation shown in Drawings. Show top of caisson structure elevation on Drawings.

D. Provide block-outs with allowance for pipe entry deviations of plus or minus 1.5 inches vertically and plus or minus 6 inches horizontally, plus caisson construction tolerances.

E. Tolerances defined above are only acceptable provided that CONTRACTOR can adjust sewer connections, structural, mechanical, and electrical components to resolve deviation from plumbness and horizontal or vertical location as approved by CITY ENGINEER. Adjustments must be made without adversely affecting operation or maintenance of wet well.

F. Monitor caisson installation to verify that no settlement or heave is observed for 10 consecutive days starting not later than 50 days after structural completion.

3.4 CAISSON SECTIONS

A. The number and size of caisson wall sections shall be determined by the CONTRACTOR. The minimum size shall be 10’ in height. Joints between sections shall include a waterstop.

B. Wall sections must be allowed to cure at least 7 days and achieve 90% design strength prior to sections being sunk.

C. Reinforcement protruding above concrete level shall be protected by cement wash.

3.5 MONITORING

A. Settlement.

1. Install series of settlement monitoring points on ground and structures within area of potential influence due to soil movements at caisson, before start of caisson or starter pit construction.

2. As minimum, equally space 4 monitoring points around caisson at distance of 15 feet and 4 more at distance 30 feet from caisson for total of 8 monitoring points.

3. Survey monitoring point elevations before start of caisson excavation and weekly thereafter until structure has been completed and dewatering terminated.

B. Caisson.

1. Determine plumbness of caisson at least once each shift at two locations, 90 degrees apart, during caisson sinking operations until caisson is secured by grout and base slab hardened.

2. Submit Daily and Weekly Logs of caisson progress to ENGINEER.

    a. Daily and Weekly Log information to be recorded:

        1) Date.

        2) Weather.

        3) Caisson number.

        4) Type of work carried out and equipment in use.

        5) Level of adjacent ground referred to Principal Datum.

        6) Level of survey markers on upper section of concrete lining referred to Principal Datum.

        7) Depth of caisson at end of day below adjacent ground level.

        8) Details and depth of each type of ground encountered.

        9) Type and volume of concrete placed.

        10) Depth of caisson concreted.

        11) Level in the piezometer to define the actual groundwater depth.

        12) Number and position of pumps in operation.

        13) Accurate record of bedrock proving test.

        14) Preliminary record of caisson base.

        15) All tests made on materials.

3. As soon as caisson has been secured and top slab has been finished, install 3 benchmarks, 120 degrees apart, on top concrete placement for settlement monitoring of installed caisson. Continue weekly monitoring of settlement points until 60 days after completed construction of structure.

4. Provide for control of ground water and surface water according to Section 31 23 19 Dewatering.

a. For dry construction, maintain the piezometric groundwater level and hydrostatic head below the excavation bottom in the caisson, as necessary to maintain stability, and to prevent heave of the soil layers underlying the final excavation elevation. The piezometric level shall be a minimum of 3 feet below the final excavation bottom when that elevation is reached.

b. For wet construction, maintain the groundwater level in the piezometer.

C. Submit monitoring results to ENGINEER weekly.

3.6 BOTTOM PREPARATION

A. The bottom profile of the excavation shall conform to the depth shown on the drawings. Over-excavation in the middle portion of the excavation is acceptable but the cutting edge of the caisson shall not be undermined by over-excavation at the finished grade. Formed keys shall be inspected and cleaned prior to placement of tremie slab.

3.7 PLACEMENT OF TREMIE SEAL

A. Refer to Section 03 30 00 Cast in Place Concrete, herein.

3.8 DEWATERING

A. Dewatering of caisson structure shall not proceed until the tremie seal has cured at least 7 days and achieved 90% design strength. Dewatering activities shall conform to Section 31 23 19.

B. The CONTRACTOR shall install the buoyancy collar, or sufficiently thick treme seal, and take other actions as necessary to prevent a caisson buoyant condition prior to, during, and after dewatering activities, refer to structural plans and plan notes.

C. CONTRACTOR shall not pump from inside the caisson that will create a critical gradient that will heave the soil material.

3.9 STRUCTURAL SLAB PREPARATION

A. The structural concrete floor shall be installed as soon as practical after the structure has been dewatered. The surface of the tremie seal shall be chipped so that no concrete shall project more than 1.5 inches into the underside of the structural slab. All laitance and other materials shall be removed.

3.10 TESTING

A. The wet well portion of the caisson structure shall be hydrostatically tested and conform to the requirements for testing sanitary manholes. Wet well shall be tested at an elevation equal to the overflow float elevation, 170 feet.

B. Dry pit portion of the caisson structure shall be visibly inspected for leaks and seeps. Repair of all surface abnormalities shall conform to the requirements set forth in Section 03 30 00 Cast in Place Concrete. All leaks and seeps shall be repaired.

3.11 REPAIRS

A. Leak repairs shall be by pressure injected epoxy only.

3.12 CAISSON SURVEY

A. When caisson has been secured, seal slab poured, and fluid has been pumped out, survey installed caisson for compliance with tolerances as defined in Part 3.3, CAISSON CONSTRUCTION TOLERANCES. Include in Survey:

1. Location of center of caisson at ground level.

2. Elevation of top and bottom of caisson and structural slab connection.

3. Elevation and locations of penetrations and embedded items and other support points for set well connection completion.

4. Deviation from plumb from caisson top to structural slab at two locations 90 degrees apart.

END OF SECTION

SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of existing facilities.
2. Abandoning and removing utilities.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork
2. Section 31 10 00 - Site Clearing
3. Section 31 22 13 - Rough Grading
4. Section 31 23 16 - Excavation
5. Section 33 11 50 - Existing Pipe Abandonment

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit to Engineer a copy of written permission of private property owners, with copy of fill permit for said private property, as may be required for disposal of materials.

1.3 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of work required and limitations before proceeding with Work.

B. Conform to applicable local, state, and federal codes for environmental requirements in relation to disposal of debris.

1. Burning at the Site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

C. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

D. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the Work and requirements of the General Provisions.

E. If the existing material to be demolished and removed contains any hazardous materials which will require special handling upon removal, such as asbestos or lead,

it is the responsibility of the Contractor to remove and dispose of the material in accordance with all applicable federal, state and local regulations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring, or resulting from demolition, clearing, and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated in the Drawings or Specifications.

B. Crushed Rock: As specified in Section 31 05 16-2.1, Aggregates for Earthwork. Of the size shown in the Drawings or specified herein.

C. Sand: As specified in Section 31 05 16-2.2, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. The Owner assumes no responsibility for the actual condition of the facilities to be demolished. The Contractor shall visit the site, inspect all facilities and be familiar with all existing conditions and utilities.

B. Demolition drawings identify major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown shall be considered incidental to all demolition work.

C. Identify waste and salvage areas for placing removed materials.

3.2 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

B. Call Local Utility Line Information service at 811, not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

3. Keep all active utilities intact and in continuous operations.

3.3 PROTECTION

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated in the Drawings to remain from damage.

B. Survey control: Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Preservation and Trimming of Trees, Shrubs and Other Vegetation: As specified in Section 31 10 00-3.4.C, Site Clearing.

D. Landscaped Areas: Protect existing landscaped areas as specified in Section 31 10 00-3.4.D, Site Clearing.

E. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, guy wires, utility poles, and curbs.

F. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of Work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.4 DEMOLITION

A. Areas which are to be excavated for the purpose of demolition shall be cleared and stripped in accordance with Section 31 10 00-3.6, Site Clearing.

B. Carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, consult with Engineer prior to the placement of such equipment or material.

C. Demolition of Existing Structures:

1. Excavate around existing structures as required to perform demolition operations and to plug associated existing pipelines where shown in the Drawing.

2. Provide shoring, bracing, and supports, as required, to ensure adjacent structures are not damaged and structural elements of existing structure are not overloaded during demolition activities.

    a. Increase structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

    b. Remove all temporary protection when the Work is complete or when so authorized by the Engineer.

3. Any floors that are to remain in place shall be completely cracked through to allow for drainage. Cracking shall be accomplished by dropping a demolition ball or by other methods approved by the Engineer.

4. Remove and dispose of all exposed and/or protruding metalwork, piping, plumbing, and conduits resulting from demolition activities, and all woodwork, roofing, and electrical and mechanical equipment removed from demolished structures.

    a. Reinforcing bars shall be cut flush with final wall elevations as shown in the Drawings.

    b. No detached metalwork, excluding concrete reinforcing bars, shall be buried with the concrete and masonry rubble.

D. Backfill at Demolished Structures:

1. For structures designated to be abandoned and/or demolished in place, concrete and/or masonry rubble and excavated soils resulting from demolition activities shall be used for backfill or placed in the bottoms of said structures only as directed by the Engineer.

2. Concrete and masonry rubble used for backfilling shall be broken into pieces no larger than 12 inches on any one side.

3. Materials resulting from abandonment/demolition activities approved for backfill shall be combined with imported filler sand to create a dense, compacted backfill.

4. Backfilling or placement of the excavated material in the structures shall meet the following requirements.

    a. Furnish, place and compact filler sand along with the concrete and masonry rubble so that all voids are filled and a dense, compacted backfill is obtained.

    b. Filler sand shall be placed in horizontal layers completely filling all voids between pieces of rubble and not exceeding 12 inches in thickness.

c. Each layer of filler sand shall be compacted to obtain at least 90 percent of maximum density as determined by ASTM Method D-698-78 (AASHTO T-99).

d. Water shall be furnished by the Contractor and added to each layer as required to maintain optimum moisture content.

e. The amount of filler sand used shall only be the amount needed to fill all voids created by placement of the concrete and asphalt rubble, as directed by the Engineer.

f. At locations where concrete and masonry rubble are used for backfill, they shall be placed such that a minimum of 3 feet of compacted non-rubble backfill material (crushed rock) exists between any rubble and finished grade. Protruding reinforcing bars shall be cut to lengths that allow granular backfill to be placed and compacted to required levels in and above the rubble.

5. Disposal of all materials not used for backfill shall be performed off-site and in compliance with applicable local, state, and federal codes and requirements.

6. In areas where new construction will take place, no trace of these structures shall remain prior to placing of backfill.

E. Backfilling within the footprint of new structures with rubble material resulting from demolition activities will not be allowed.

F. All existing improvements designated in the Drawings or specified to be removed, including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing, and similar structures occurring above, at, or below existing ground surface shall be included in the demolition work.

G. Unless otherwise specified, any resulting voids shall be backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.5 EXISTING UTILITY PIPING ABANDONMENT

A. As specified in Section 33 11 50, Existing Pipe Abandonment.

3.6 ELECTRICAL AND CONTROL SYSTEM DEMOLITION

A. All electrical and control system demolition work shall at all times be conducted in a safe and proper manner to avoid injury from electrical shock to all personnel.

1. Electrical equipment to be shut off for a period of time shall be tagged, locked out, and sealed with a crimped wire and lead seal and made inoperable.

2. At no time shall live electrical wiring or connections or those which can become energized be accessible to any persons without suitable protection or warning signs.

3.7 PERMANENT ABANDONMENT OF WELLS

A. The Contractor shall be responsible for securing and paying any local, state, or federal fees for abandonment of the well.

B. Abandonment of the well shall be performed by a licensed well constructor in the state in which the work is accomplished.

C. All work shall be performed according to federal, state, and local standards for permanent well abandonment.

3.8 ASPHALTIC CONCRETE DEMOLITION

A. Asphalt pavement shall be removed to the limits shown in the Drawings.

B. The limits of the removal shall be saw cut.

C. Asphalt pavement may not be used as rubble fill.

3.9 REMOVAL

A. Remove debris, rock, excavated materials, rubble, abandoned piping, and extracted plant life resulting from abandonment and/or demolition activities from site.

B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

C. Removal: All material resulting from demolition, clearing, and grubbing, and trimming operations shall be removed from the project site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

3.10 GRADING

A. All grading work shall be completed in accordance with Section 31 22 13, Rough Grading.

3.11 CLEANUP:

A. During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the work in a clean, condition, as may be subject to Engineer approval.

B. Adjacent structures shall be cleaned of dust, dirt, and debris resulting from demolition.

C. Adjacent areas shall be returned to their existing condition prior to the start of work.

3.12 SCHEDULES

A. The following materials and structures are to be demolished for the project site:

1. Work shed and foundation.
2. Existing 11’ diameter wet well lid and base section.
3. Existing bypass manhole.
4. Existing valve vault and associated piping and appurtenances.
5. Existing above grade hot box and rpba.
6. Existing 5’x10’ vault top.
7. Existing power vault and associated conduit and appurtenances.

B. Protect the following structures:

1. Existing 5’x10’ vault base and walls.

END OF SECTION

SECTION 03 21 00 - REINFORCING STEEL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all the work necessary to furnish all labor, materials, equipment, and services necessary to furnish reinforcing steel, accessories, welding, equipment and services, and place concrete reinforcement.

B. Section includes:

1. Reinforcing steel.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete Work.

B. Section 04 22 00 Concrete Masonry Units.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Submit shop drawings of detailed placing and bending lists for the ENGINEER's approval before the reinforcement is fabricated.

C. Mill Certificates: Mill test certificates shall be submitted to the ENGINEER to certify that the reinforcing steel meets the specified requirements. Mill test certificates shall be furnished and paid for by the CONTRACTOR.

D. In addition, the ENGINEER may require that test samples be taken and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

1.4 QUALITY CONTROL

A. The ENGINEER may require that test samples be taken and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

PART 2 PRODUCTS

2.1 DEFORMED REINFORCING BARS

A. Unless otherwise specified, reinforcing steel shall be Grade 60 billet steel conforming to ASTM Specification A615 or ASTM 706.

1. All such reinforcing shall be deformed steel bars with *deformations* conforming to the requirements set forth in ASTM Specification A615 or ASTM 706

2. Stirrups and Ties shall be Grade 60 but Grade 40 may be used for #3 and smaller.

B. Spiral reinforcement and steel wire shall be cold-drawn steel wire conforming to the requirements of ASTM Specification A82 unless shown otherwise on the Drawings.

C. Welded Wire Fabric (WWF) shall conform to ASTM Specification A185.

D. Bar and rod mats for concrete reinforcement conforming to ASTM A184

E. Tie wire, 16 gauge or heavier black annealed wire.

F. Varying grades shall not be used interchangeably in structures.

G. Steel bending processes shall conform to the requirements of ACI 318.

H. Bending or straightening shall be accomplished so that the steel will not be damaged.

I. Kinked bars shall not be used.

2.2 PLAIN REINFORCING BARS

Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A82 unless shown otherwise on the Drawings.

Plain smooth dowels and ¼-inch diameter smooth bars conforming to ASTM A615 Grade 60.

2.3 SUPPORTS

A. Bar supports shall conform to ACI 315 and CRSI Manual of Standard Practice, Chapter 3, Bar Supports.

B. Bar supports shall consist of approved high density "adobes", stainless steel chairs, plastic spacers or plastic shim plates.

1. Brick, broken concrete masonry units, spalls, rocks or similar materials shall not be used for support of reinforcing steel.

2. Steel chairs shall be furnished with plastic tips when incorporated into concrete exposed to view, such as in the roof slab.

3. Plastic spacers shall be PRECO BARSPAN WHEELS, as manufactured by the PRECO CORPORATION or equal.

4. Plastic shim plates may be used to support the plastic spacers and shall be used to support the vertical reinforcing in the corewall, unless shown otherwise on the Drawings.

C. Hot-dipped Galvanized Reinforcing Bars

When reinforcing bars are indicated on the Drawings to be hot-dipped galvanized, they shall be galvanized in accordance with ASTM A767 and ASTM A143. The grade of reinforcing bars shall be as specified under Section 2.1. The bars shall be galvanized in conformance with a Class 1 coating and shall be galvanized after fabrication and shearing.

D. Steel Tie Wire: Annealed steel tie wire shall be used to fasten the reinforcing steel in place.

PART 3 EXECUTION

3.1 REINFORCING BARS

Comply with the specified codes and standards and Concrete Reinforcing Steel Institutes recommended practice for "placing reinforcing bars," for details and methods of reinforcement placement and supports, and as herein specified.

A. General

1. Mild steel reinforcing bars shall be furnished, cut, bent and placed as indicated on the Drawings.

2. At the time of placing concrete, all reinforcement shall be free from loose mill scale, rust, grease, oil, or other coating which might destroy or reduce its bond with concrete.

    a. Reinforcing bars with rust, mill scale or a combination of both will not be acceptable without cleaning or brushing provided that upon wire brushing a sample, the dimensions including height of deformations and weights shall not be less than the applicable ASTM requirements. Steel reinforcement which is to be placed in the work shall be stored under cover to prevent rusting and shall be placed on blocking such that no steel touches any ground surface.

3. All reinforcing steel placed in the work shall be tied together and supported in such a manner that displacement during placing of concrete and shotcrete will not occur.

4. When there is a delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.

B. Cutting and Bending

1. Steel reinforcement shall be cut and bent in accordance with ACI 318 and with approved practices and machine methods, either at the shop or in the field.

2. Reinforcement shall be accurately formed to the dimensions indicated on the Drawings and on the bending schedule.

3. Bends for hooks on bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar.

4. All bars shall be bent cold.

C. Minimum Bar Spacing

The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars and, unless specifically authorized, shall in no case be less than 1-inch, nor less than the maximum size of coarse aggregate specified.

D. Concrete Cover (Minimum)

1. On all formed surfaces which will be exposed to water, ground or the elements, there shall be a nominal cover over the steel of 2.0-inches for bars number 6 through number 18 and 1-1/2 inches for bars number 5 and smaller, with an installation tolerance of + 1/4 inch. When crossing bars of different diameter are encountered in one face, one shall consider the bar size and location that will provide the largest cover over the nearest steel to the outside surface.

2. Unless otherwise specified in these specifications or shown on the Drawings, all reinforcing steel facing subgrades for concrete construction of the foundation or below-grade elements shall be given a nominal protective cover of 3.0-inch minimum. The largest cover shall be used when different size bars are encountered in one face.

3. The minimum cover over reinforcing steel for concrete construction of other facilities shall be as shown on the Drawings.

4. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

E. Splicing

1. Except as shown or specified on the Drawings, reinforcing steel shall not be spliced at any location without specific approval by the ENGINEER. Splices in adjacent bars shall be staggered.

2. Where permitted or required, splices in reinforcing steel shall have sufficient lap to transfer full strength of the bar by bond and shear. Unless specified or shown otherwise on the Drawings, the bars at a lap splice shall be in contact with each other. In no event shall the lap be less than 40 diameters of the spliced bars.

3. Unless specified or shown otherwise on the Drawings, bars shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel tie wire.

4. Unless shown otherwise on the Drawings, where bars are to be lapped spliced at joints in the concrete, all bars shall project from the concrete first placed, a minimum length equal to the lap splice length indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sandblasting before the bars are embedded in a subsequent concrete placement.

F. Supports

1. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved bar supports. The CONTRACTOR shall submit for ENGINEER's approval, samples of all bar supports he proposes to use along with a written description of where each bar support will be used.

2. The supports shall be of sufficient quantity, strength and stability to maintain the reinforcement in place throughout the concreting operations. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete. The CONTRACTOR shall be held responsible for providing the appropriate quantity and type of bar supports.

3. Do not place reinforcing bars more than two inches beyond the last leg on continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

G. Bar Tying

1. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (this shall not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity).

2. Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

	Slab Bars (in)	Wall Bars (in)
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 through No. 11	120	96

H. Reinforcement Around Openings -- Where reinforcing steel has to be cut to permit passage of pipe or to create openings, and should no detail be shown for extra reinforcing in such areas, the area of steel removed by the creation of the opening must be replaced by placing at least double the area of steel removed by the opening equally around the openings. The steel shall be placed such that it extends 5 feet beyond the opening on each side to provide for sufficient bond.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the Drawings.

B. Work includes providing formwork and shoring for cast-in-place concrete and installation of related items including reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

C. Definitions

1. Batch: Used in this specification to define an overall class of concrete as delivered from a concrete batching plant or on-site batching operation. Batching operations can continue for hours or days and as long as the class of concrete is similar, the batch would be considered the same. Multiple mixer truck loads could be used to deliver a “batch” of concrete over the course of multiple hours or days.

2. Batched/Batching: The loading of concrete, as combined and mixed at a batching/ready-mix plant, into a concrete mixer truck for delivery to the job site.

3. Truckload: A standard concrete mixer truck size is assumed to have a concrete capacity of 8 cubic yards. A truckload is used to help define the frequency of testing which of occurs per concrete mixer truck.

4. Ready-Mix Concrete: Concrete that is manufactured in a batch plant, according to a set engineered mix design. This specification assumes ready-mix concrete will be delivered by mixer truck to the job site.

1.2 RELATED SECTIONS:

A. Section 03 21 00 - Reinforcing Steel.

1.3 QUALITY ASSURANCE

A. Codes and Standards

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified here:

ACI 301 “Specifications for Structural Concrete for Buildings”

ACI 311 “Recommended Practice for Concrete Inspection”

ACI 318 "Building Code Requirements for Reinforced Concrete"

ACI 347 "Recommended Practice for Concrete Formwork"

ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

Comply with building code requirements which are more stringent than the above and all OSHA requirements.

B. American Society for Testing and Materials (ASTM)

1. C31, Making and Curing Concrete Test Specimens in the Field.
2. C33, Specification for Concrete Aggregate.
3. C39, Compressive Strength of Cylindrical Concrete Specimens.
4. C40, Organic Impurities in Fine Aggregate for Concrete.
5. C85, Cement Content of Hardened Portland Cement Concrete.
6. C88, Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.
7. C94, Standard Specifications for Ready-Mixed Concrete.
8. C131, Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
9. C136, Method for Sieve Analysis to Fine and Coarse Aggregate.
10. C143, Slump of Portland Cement Concrete.
11. C150, Standard Specification for Portland Cement.
12. C156, Water Retention by Concrete Curing Materials.
13. C173, Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. C231, Air Content of Freshly Mixed Concrete by the Pressure Method.
15. C233, Standard Method of Testing Air-Entraining Admixtures for Concrete.
16. C260, Standard Specifications for Air-Entraining Admixtures for Concrete.

17. C289, Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

18. C441, Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction.

19. C457, Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete.

20. C494, Standard Specifications for Chemical Admixtures for Concrete.

21. C670, Preparing Precision Statements for Test Methods for Construction Materials.

22. C803, Penetration Resistance of Hardened Concrete.

C. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the OWNER or ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

D. Concrete Testing Service

The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.15 “Quality Control Testing during Construction”. Per the OWNER or ENGINEER’s requirements the CONTRACTOR shall notify the designated representative to schedule the special inspections and materials testing required by the project documents.

E. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times.

The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

F. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the OWNER and ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

G. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

   a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

   b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

   c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

   d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

   e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

   f. Variations in footing plan dimensions, minus 1/2-inch and plus two (2) inches; misplacement or eccentricity, two (2) percent of the footing width in direction

of misplacement but not more than two (2) inches; thickness reduction, minus five (5) percent.

g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

H. Quality Control Testing During Construction

See Section 3 - Execution.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. For information only, submit an electronic copy of manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

C. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures and indicate spacer or burner bars.

D. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

E. Submit electronic copy of laboratory test reports for concrete materials and mix design tests as specified.

F. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.5 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7, 14 and 28 day strengths versus slump values of two (2), four (4), and six (6) inches, all conforming to these Specifications, shall be established by an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders.

The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.6 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.7 SAMPLE

Upon request by the OWNER or ENGINEER the CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER's approval prior to construction if exposed aggregate is included on job.

1.8 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 WALL FORMS

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a 1.5 inch minimum breakback or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Provide A-58 SURE PLUG as manufactured by DAYTON SUPERIOR or approved equal.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles or tubing of adequate size to retain the concrete without deflecting.

2. As required the walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the Drawings and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be used at a minimum horizontal spacing of 74 inches and shall have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the ENGINEER that it will be equally effective.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.4 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type 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. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel - 16 gauge minimum, free of dents, irregularities, sag and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts & Embeds

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide “Parabolt” by the Molly Company, “Phillips Red-Head”, “Burke” or approved equal products. The CONTRACTOR is responsible for insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.5 REINFORCING MATERIALS

A. See Section 03 21 00 – Reinforcing Steel for additional information

B. Reinforcing Bar (rebar): ASTM A615 or ASTM 706 and as follows below

Stirrups and Ties	Grade 60 (Grade 40 may be used for #3 and smaller)
All other Uses	Grade 60

C. Steel Wire: ASTM A82, plain, cold-drawn, steel.

D. Welded Wire Fabric (WWF): ASTM A185, welded steel wire fabric.

E. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

F. Fiber Reinforcement – Collated polypropylene fiber, ¾”-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116. Fiber reinforcement shall be ProconF fibrillated polypropylene by Nycon or approved equal. Minimum dosage rate shall be 1.5 pounds per cubic yard.

2.6 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type II, unless otherwise acceptable to ENGINEER. Use only one (1) brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used

when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:

    a. Crushed stone processed from natural rock or stone.

    b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

    c. Maximum Aggregate Size - Not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms, one-third (1/3) of the depth of slabs, nor three-fourths (3/4) of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water: Clean, fresh, potable.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A or F

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding.
2. Type C, Accelerating.
3. Type D, Water-reducing and Retarding.
4. Type E, Water-reducing and Accelerating.

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.7 RELATED MATERIALS

A. Waterstops

Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of Engineer's CRD-C 572. Waterstops provided to be Greenstreak 701 or approved equal. Split face waterstops will not be acceptable under any circumstances.

B. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

C. Joint Sealing Compound: See Section 07 92 00, Joint Sealants.

D. Moisture Barrier

Provide moisture barrier cover over all prepared base material. Use only materials that are resistant to decay when tested in accordance with ASTM E154. The moisture barrier consists of heavy Kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. Provide Moistop, St. Regis, or equal.

E. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

F. Concrete Curing Materials

Acrylic curing and sealing compound - Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water-based carrier. W.R. Meadows, Inc. VOCOMP-20 or approved equal.

G. Epoxy Adhesive

Provide Sikadur 32 Hi-Mod or Sikadur 31 Hi-Mod Gel for application to wire-brushed and prepared existing concrete to be mated to new concrete. Apply per manufacturer's recommendations.

H. Chemical-Hardener Finish: Provide Hornolith from Tamms Industries, or approved equal.

I. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

J. Non-shrink Grout: See Section 03 60 00, Grouting.

2.8 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will either be by the same supplier to insure compatibility. If different suppliers are used a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Not withstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,500 psi 28-day compressive strength and a maximum water/cement ratio of 0.40. Up to a maximum of 15% of cementitious material may be fly ash in accordance with ASTM C618. The use of ground granulated blast furnace slag is not allowed for any surfaces in contact with potable water.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride, and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The total volumetric air content of the concrete before placement shall be six (6) percent +/- 1.5 percent as determined by ASTM C 173 or ASTM 231 for mixes using a 3/4"nominal aggregate size.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX “AES,” GRACE “DAREX AEA,” MASTER BUILDERS “MB-AE10,” or SIKA CHEMICAL “AER.”

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

G. Fiber reinforcement admixture shall be included in the ready-mix concrete design used for filling and channeling the wet well chambers. Fibers shall be used in strict accordance with the manufacturer's directions.

2.9 CONCRETE MIXING

A. Ready-Mix Concrete

1. Comply with the 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 specified in ASTM C94 may be required. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

2. Minimum Mix Time: Once all materials are in the drum, the minimum mixing time shall be for 10 minutes before concrete is placed.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, 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 work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast

concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. 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 of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints. A ½ inch chamfer at exposed edges is typical unless noted otherwise.

I. 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 ties. Accurately place and securely support items built into forms.

J. 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 after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, 2.0-inches for No. 6 and larger bars or for any bars exposed to exterior or wet environments, and 3.0-inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of two (2) feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. 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. Do not place reinforcing bars more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two (2) inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER. Install and locate other construction joints as specified.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints

in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth (1/5) to one-fourth (1/4) of the slab depth, unless otherwise shown.

1. Form control joints by the following methods

a. Inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

b. Saw cutting a control joint in the required location. Plan for saw cutting so work does not damage reinforcing or violate edge distance minimums.

2. Joint sealant material shall be as specified above.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and

under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with 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.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Remove all garbage and debris from the base of formwork. Items such as aluminum cans, food containers, plywood, and their like are to be cleaned-up and disposed.

3. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

4. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

5. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. 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.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least six (6) inches into the preceding layer. Do not insert vibrators into

lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

   a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than six (6) gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for three (3) days or 50°F for five (5) days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the

concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are 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 shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a one (1) part muriatic acid to10 part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface. After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 SCHEDULE OF CONCRETE SURFACE FINISHES

Also see Section 09 90 00, Painting and Coating for protective coating requirements.

	Surface Description	Type	Finish Requirement
A.	Interior Horizontal Slabs	Slab	Trowel Finish
B.	Exterior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
C.	Interior Vertical Surfaces (including Wet Well)	Formed	Smooth Form
D.	Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.10 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least seven (7) days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing or moisture cover curing. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

4. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.

    b. Continuous water-fog spray.

    c. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

5. Provide moisture-cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

6. Provide liquid membrane curing as follows:

    a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within three (3) hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

    b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

7. Curing formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

8. Curing Unformed Surfaces

    a. Initially cure unformed surfaces, such as slabs, floor topping and other flat surfaces by moist curing, whenever possible.

    b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

    c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

9. Provide liquid curing-hardening compound as follows:

    a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer's directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5°F in any one-hour and 50°F in any 24-hour period.

D. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

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. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.12 REMOVAL OF SHORES AND FORMS

A. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulative curing at not less than 50°F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained 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.

D. Form facing material may be removed four (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.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter 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. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to

be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through

non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the 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.

6. 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 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. 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. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all lose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer's requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.14 PLACEMENT OF TREMIE SEAL

A. Concrete deposited in water shall be carefully placed in a compact mass, in its final position, by means of a tremie and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit.

B. All underwater concrete shall be placed continuously from start to finish. The surface of the concrete shall be kept as near horizontal as practical at all times. To ensure thorough bonding, each succeeding layer of concrete shall be placed before the preceding layer has taken set.

C. A tremie shall consist of a tube having a minimum diameter of ten inches of sufficient length to reach the bottom of the excavation with an attached receptacle or hopper for receiving concrete. The tremie pipe shall be supported so as to permit free movement of the discharge end over the top of the work and to permit rapid lowering when necessary, to retard or stop the flow of concrete.

D. At the start of the work and during any withdrawal of the tremie pipe for moving to a new location, the discharge end shall be closed to prevent water entering the pipe. During the progress of the work, the pipe shall be entirely sealed at all times, and kept full of concrete to the bottom hopper. The lower end of the pipe shall be well embedded in concrete and the concrete shall not be dropped through water, but will flow outward from the end of the pipe. If the charge is lost, the tremie pipe shall be withdrawn and refilled.

E. Contractor shall provide sufficient equipment and supply of concrete to effect a continuous flow of concrete through all tremies.

3.15 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the OWNER, ENGINEER, and the CONTRACTOR.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump Test - ASTM 143; one (1) test for each set of compressive strength test specimens. Samples shall be taken at point of discharge.

3. Air Content - ASTM C231, pressure method; one (1) for each set of compressive strength test specimens.

4. Compression Test Specimen - ASTM C31; One (1) Set which consist of a minimum of four (4) standard cylinders to allow for compressive strength testing, unless otherwise directed. If early loading of members or sections is desired by the CONTRACTOR, additional tests cylinders shall be collected for testing. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature - Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; One (1) Set for each 100 cubic yards or fraction thereof, of each concrete class placed in any one (1) day, OR for each 5,000 square feet of surface area placed, OR as per minimums outlined below.

    a. When the frequency of testing will provide less than five (5) Sets of cylinders by which to perform strength tests for a given class of concrete, conduct testing, as follows.

        1) For a class of concrete with a total batch size of greater than 500 cubic yards or 25,000 square feet of surface area, collect test Sets as outlined above.

        2) For a class of concrete with a total batch size of less than 500 cubic yards or 25,000 square feet of surface area, but greater than 300 cubic yards or 15,000 square feet of surface area, collect four (4) Sets for testing. Two (2) Sets near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

        3) For a class of concrete with a total batch size of less than 300 cubic yards or 15,000 square feet of surface area, but greater than 50 cubic yards or 2,500 square feet of surface area, collect four (3) sets of testing. One (1) Set near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

        4) When the total quantity of a given class of concrete is less than 50 cubic yards, and NO anchors are embedded in the concrete, the ENGINEER may waive the strength tests if, in their judgment, adequate evidence of satisfactory strength is provided. Otherwise testing shall occur as outlined in 3.14.B.6.a

    b. Testing Procedure: A Set of specimens with yield four (4) cylinders. Therefore, five (5) Sets will yield 20 cylinders, four (4) Sets will yield 16 cylinders, three (3) Sets will yield 12 cylinders, From each set test one (1) cylinder at seven (7) days,

test two (2) cylinders at 28 days, and one (1) cylinder shall be retained in reserve for later testing if required. Additional cylinders can be obtained, at the CONTRACTOR's or OWNER's discretion, for testing at alternate times.

c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the 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.

C. Report test results in writing to the ENGINEER and the CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and concrete mixing truck number, name of concrete testing service, concrete type and class, location of concrete batch in the 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.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to form, mix, place, cure, repair, finish, and perform all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this Section includes:

1. Patching, grouting, and sealing.
2. Grouting of door frames in CMU wall
3. Grouting for support of plumbing, and HVAC equipment
4. Grout for support of mechanical, electrical, and communications equipment
5. Removal of loose and spalling grout and concrete.
6. Anchoring cement for metal fabrications

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete Work.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 03 30 00, Cast-in-Place Concrete Work and as referred to herein.

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

B. Codes and Standards

1. American Society for Testing and Materials (ASTM)

a. C31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field”

b. C33, “Standard Specification for Concrete Aggregate”

c. C39, “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens”

d. C40, “Standard Test Method for Organic Impurities in Fine Aggregate for Concrete”

e. C1084, “Standard Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete”

f. C88, “Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate”

g. C94, “Standard Specification for Ready-Mixed Concrete”

h. C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”

i. C131, “Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine”

j. C136, “Standard Test Method for Sieve Analysis to Fine and Coarse Aggregate”

k. C143, “Standard Test Method for Slump of Hydraulic Cement Concrete”

l. C150, “Standard Specification for Portland Cement”

m. C156, “Standard Test Method for Water Loss Through Liquid Membrane Forming Curing Compounds for Concrete”

n. C173, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method”

o. C231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method”

p. C233, “Standard Test Method for Air-Entraining Admixtures for Concrete”

q. C260, “Standard Specifications for Air-Entraining Admixtures for Concrete”

r. C289, “Standard Test Method for Potential Alkali Silica Reactivity of Aggregates (Chemical Method)”

s. C441, “Standard Test Method for Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction”

t. C457, “Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete”

u. C494, “Standard Specification for Chemical Admixtures for Concrete”

v. C531, “Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

w. C579, “Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

x. C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

y. C670, “Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials”

z. C803, “Standard Test Method for Penetration Resistance of Hardened Concrete”

2. American Concrete Institute (ACI)

a. “Specifications for Structural Concrete,” ACI 301 as supplemented and modified herein.

b. “Standard Practice for Selecting Proportions for Normal Heavyweight, and Mass Concrete,” ACI 211.1.

3. CRD-C 621, Corps of Engineers Specification for Non-Shrink Grout

1.4 SUBMITTALS

A. Manufacturer Technical Data and Strength Test Results: For sack-mix grouts used on minor-structure/systems provide datasheet information verifying the compressive strength, shrinkage, and expansion requirements specified herein for grout used.

B. Manufacturer's Literature: Containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place grout when temperature or humidity will affect the performance or appearance of the grout.

B. Do not place grout on dirty, wet, or frozen substrates

1.6 QUALITY ASSURANCE

Field Tests

A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with these specifications. The specimens will be made by the ENGINEER or its representative.

B. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven (7) days, 28 days, and each additional time period as appropriate.

C. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

D. The cost of all laboratory tests on grout shall be borne by the CONTRACTOR and the CONTRACTOR shall obtain the specimens for testing. The CONTRACTOR shall also be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

PART 2 PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents, unless another type is specifically referenced.

B. Non-shrink grout shall be a prepackaged, inorganic, non-gas- liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

C. Class A non-shrink grouts shall have minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested.

D. Class B non-shrink grouts shall have minimum 28-day compressive strength of 5000 psi and meeting the shrinkage and expansion requirements for Class A non-shrink grout.

E. General Non-Metallic and Non-Shrink Grout shall have minimum 28-day compressive strength of 4000 psi when tested and meet the shrinkage and expansion requirements for Class A non-shrink grout.

F. Application

1. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under the exterior rim of the steel tank and all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

2. Class B non-shrink grout shall be used or the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

3. General Non-Metallic and Non-Shrink Grout shall be used for non-repair interior or exterior grout applications.

2.2 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where “dry pack” is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

2.3 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers approved by the ENGINEER. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified by the manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the ENGINEER.

3.2 GROUTING PROCEDURES

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

3.3 INSTALLATION

A. Grout Below Bearing Plates:

1. Support bearing plates above cleaned bearing surfaces with double-nutted anchor bolts or wedges.

2. Fill space below bearing plates supporting structural members and stationary equipment with non metallic non shrink grout.

3. Fill space below bearing plates supporting vibrating equipment with metallic non shrink grout.

B. Grout in Steel Bollards:

1. Fill steel bollards with non metallic non shrink grout.

2. Smooth trowel grout to 1 inch high convex curve at top of bollards.

C. Grout in Steel Door Frames: Install non metallic non shrink grout between masonry rough opening and door frames in masonry walls, fully filling frames with grout.

3.4 COMPLETION

A. Adjusting Defective Work: Replace or patch grout and anchoring cement as directed by Architect.

B. Physical Barrier Protection:

1. Cover fresh grout and anchoring cement for 24 hours minimum.

2. Cover fresh grout and anchoring cement with plywood where exposed to construction traffic.

END OF SECTION

SECTION 04 05 17 - MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SCOPE

A. This Section includes all labor, materials and equipment required to complete masonry mortar and grout work required by the Contract Documents including, but not limited to, these major items:

1. Installation
2. Grouting.
3. Placement of vertical and horizontal reinforcing.
4. Cleaning of masonry.

B. Section Includes:

1. Masonry Grout.
2. Mortar.
3. Admixtures.
4. Masonry cleaners.

C. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete Work
2. Section 03 21 00 – Reinforcing Steel
3. Section 04 22 00 – Concrete Masonry Units

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C204 - Standard Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus.
3. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

6. ASTM C476 - Standard Specification for Grout for Masonry.

1.3 SUBMITTALS

A. Masonry Grout design: Indicating type and proportions of the ingredients according to the proportion requirements herein and ASTM C 476.

1. In lieu of Masonry Grout design, submit the mix designs and grout strength test performed in accordance with ASTM C 476.

B. Mortar design: Indicating type and proportions of ingredients in compliance with the proportion specification herein and ASTM C 270.

1. In lieu of mortar design, submit the mix design and mortar tests performed in accordance with the property specification of ASTM C 270.

C. Color samples for OWNER selection of mortar color.

D. Material certificates certifying each material is in compliance for all Mortar and Grout materials and admixtures.

E. Construction procedures for Cold Weather Construction and/or Hot Weather Construction.

1. Adhere to the procedures and general practices provided for cast-in-place concrete in Section 03 30 00 Cast-in-Place Concrete Work

F. Masonry Cleaner: Product information

1.4 QUALITY ASSURANCE

A. Testing Service -- The OWNER will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

B. Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. All initial testing required by the Contract Documents shall be done at the OWNER's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

C. Minimum Testing Frequency:

1. An independent testing agency or laboratory shall make test specimens of masonry grout and mortar on job site.

2. One mortar test and one grout test shall be taken for each 5,000 square feet of wall area but at least one set of tests shall be taken.

3. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

D. Inspection Criteria:

1. Masonry construction shall be inspected and evaluated in accordance with the requirements of Chapter 17 of the Oregon Structural Specialty Code, per TMS 402/ACI 530/ASCE 5 Table 1.19.3 – Level C Quality Assurance and TMS 602/ACI 530.1/ASCE 6, Table 5 – Level C Quality Assurance requirements (ACI 530 Table 1.19.1, Table 1.19.2, & Table 1.19.3), unless otherwise indicated.

2. The Contract Documents shall dictate the required level of inspection per above reference or provide a project specific special inspection program.

3. If the Contract Drawings do not specify the level of required inspection, provide Level C Quality Assurance, or obtain written direction from the ENGINEER to the required level of inspection.

E. Environmental:

1. The cold weather construction provisions of ACI 530.1/ASCE6/TMS 602, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F.

2. The hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph.

3. No salt, anti-freeze chemicals or related materials permitted. Store masonry units and bagged materials off ground and protect from rain.

4. Do not build on work having film of water or frost on surfaces.

5. Protect work by covering in rainy weather; protect green masonry from freezing.

6. Before stopping work for day, cover tops of walls at new work with non-staining waterproof covering extended 2 feet minimum down both sides of wall and secured.

F. Delivery, Storage and Handling – Deliver and store packaged materials in original, unopened containers and store in dry weathertight enclosures. Stockpile and handle aggregates to prevent segregation and contamination. Maintain sand for volume proportioning of mortar and grout in a damp loose condition.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C150.

B. Fine and coarse aggregate: ASTM C404 for grout.

C. Sand:

1. Clean, sharp, well graded, and free from salt, loam, clay, and other foreign matter.

2. Sand shall conform to ASTM C144 for mortar.

3. Sand shall be graded as follows:

Sieve Size	Percent Passing
4	100
8	95 – 100
16	70 -100
30	40 – 75
50	15 – 35
100	2 – 15
200	0

D. Lime: Hydrated type conforming to ASTM C207, Type S.

E. Water: Clean, fit for drinking (potable), and free from strong acids, alkalis, oils, or organic material.

F. Waterproofing admixture: Powder.

1. Type: Grace Hydratite Plus, CemMaster Hydrolox 400, BASF Rheomix, BASF Rheopel or approved equal.

G. Accelerator or retardant

1. May be added when required by weather conditions.

2. Type: Anti-Hydro, Grace Dehydratine 80 or Dehydratine 80M, BASF Pozzolith, Sika Plastiment, Sonneborn Sonotard, Trimex, or approved equal.

H. Intrusion (water-reducing) admixture for masonry grout.

1. Type: BASF Pozzolith, IntrusionAid or approved equal.

I. Water-reducing admixture for mortar.

1. Type: BASF Rheomix or approved equal.

J. Mortar Color.

1. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders.

2. Color shall be as shown on the Drawings.

3. Color shall be selected by OWNER from manufacturer's standard range of colors.

2.2 PROPORTION OF MIXES

A. Mortar

1. Conform to ASTM C270 and be of the type and color specified.

2. Type S with minimum 28-day compressive strength of 1,800 psi minimum.

3. Mixed by volume in ratio of 1-part Portland cement (6 sacks per cubic yard minimum), 1/4 to 1/2-part lime, 2-1/4 to three (3) parts (to cement-lime combined volume) sand.

4. Pointing mortar shall be one part cement, 1/4 lime, three (3) parts sand by volume. Add one (1) pound of water-reducing admix for mortar per bag of cement and one pound per cubic foot of lime.

5. Add waterproofing in amounts recommended by manufacturer, 0.2 pounds of waterproofing per 100 pounds of cement minimum.

6. Do not use admixtures containing more than 0.2 percent chloride ions.

7. Limit the maximum percentage of mineral oxide or carbon black job site pigments by weight of cement as follows: For pigmented Portland cement-lime mortar; 10 percent maximum mineral oxide pigment or 2 percent maximum carbon black pigment.

B. Masonry grout

1. Conform to ASTM C476.

2. Minimum 28 days compressive strength greater than or equal to 2,500 psi, seven (7) sacks of cement minimum per cubic yard.

3. Waterproofing admix and intrusion admix in amounts recommended by manufacturer, 0.2 lb. of waterproofing per 100 pounds of cement minimum.

C. Masonry grout for pouring:

1. Fluid consistency, seven (7) to eight (8) inches slump.

2. Accurately mix by volume 1-part Portland cement: two (2) parts minimum to three (3) parts maximum of damp loose sand: two (2) parts maximum of 3/8-inch minus aggregate.

3. For masonry grout spaces less then three (3) inches in any dimension, omit 3/8-inch minus aggregate.

D. Masonry grout for pumping:

1. Without segregation of the constituent parts.

2. Mixed to a consistency that has a slump between eight (8) to eleven (11) inches.

E. Empty bags for waterproofing and intrusion admixes shall be retained for verification prior to their disposal. Use accelerator or retardant in strict accordance with manufacturer's printed instructions.

2.3 MASONRY CLEANER

A. Sure Kleen #101 Lime Solvent or approved equal.

PART 3 EXECUTION

3.1 MIXING

A. Masonry grout shall be plant batched.

B. Mortar:

1. All tools and equipment used in mixing of mortar shall be clean and free of contaminants.

2. Measure materials by volume or equivalent weight, not by shovel.

3. Supply only as much water as necessary to obtain desired workability; required compressive strength must be met.

4. Mix by placing 1/2 of the water and sand in the operating mixer. Then add the cement, lime and the remainder of the sand and water.

5. After all ingredients are in the batch mixer, they shall be mechanically mixed for not less than three (3) minutes.

6. Hand mixing shall not be employed.

7. Heat aggregates when air temperature is below 32 degrees F to maintain mortar at 70 to 120 degrees F until used.

8. Maintain workability of mortar by retempering.

    a. Retemper by adding only as much water as required to maintain high plasticity.

    b. Retempering shall only be done by adding water within a basin formed from mortar on a mortar board and working mortar into water.

    c. Discard all mortar which has begun to stiffen, or which is unused after 2-1/2 hours from the initial mixing.

3.2 INSTALLATION

A. See Section 04 22 00, Concrete Masonry Units.

B. All masonry shall be laid true straight level, plumb and neatly in accordance with the drawings; lay out in advance so that no concrete unit less than eight (8) inches in length occur except where necessary as in reveals, etc.

C. All units shall be saw cut accurately to fit all openings, and for electrical and plumbing work.

    1. No plumbing or electrical boxes or conduit shall be placed in any cell or course that contains reinforcing.

    2. All cutting shall be done with masonry saw and produce neat and true surface.

D. All units shall be sound, dry, clean, and free from cracks and chips.

E. No construction supports shall be attached to the wall except where specifically permitted by the ENGINEER.

F. Units shall be “air” dry at time of laying.

3.3 REINFORCEMENT

A. Refer to Section 03 21 00, Reinforcing Steel.

B. The following minimum requirements shall be met unless shown otherwise:

1. Provide #5 verticals at forty (40) inches maximum on center.

2. Locate two #5 at each jamb of door, window, louver, and other openings and end of walls; run full height of wall. Reinforcement adjacent to openings need not be provided for openings smaller than 16-inches in either the horizontal or vertical direction, unless the spacing of distributed reinforcing is interrupted by such openings.

3. Position one #5 vertical at each wall corner and each wall intersection; run full height of wall.

4. Dowel verticals to foundation with one #5 dowel four (4) feet long minimum per vertical; embed dowel two (2) feet in foundation unless otherwise shown on drawings.

5. Horizontal reinforcement, unless shown otherwise, shall be two #4 rebars in the bond beams which are located at forty (40) inches maximum on center and at all floor and roof levels. Bend rebar at corners and intersections, or supply two (2) feet by two (2) feet rebar of same size and number as horizontal reinforcement. Horizontal reinforcement shall be anchored around vertical reinforcing bars with a standard hook at all wall ends, corners, and intersections that are not continuous around the corner or through the intersection. For openings, minimum lintel size and reinforcement shall be two (2) #4 rebars in bottom of 8-inch lintel for less than four (4) feet span, and two (2) #5 rebars in bottom of 16 inches lintel for four (4) feet to 10 feet span. Lintel reinforcement to extend two (2) feet beyond each side of jamb.

6. Before placing reinforcement remove mud, oil, mills scale, loose rust, ice, and any other coatings from it. Position reinforcement accurately; center in cells unless noted otherwise. Secure against displacement, holding vertical reinforcement firmly in place by means of frames, rebar spacers, or other suitable devices, and place horizontal reinforcement as laying progresses. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

7. Minimum clear distance between longitudinal bars shall be nominal diameter of bar or 1-inch, whichever is larger. Minimum thickness of mortar or grout between masonry and reinforcement shall be 1/4-inch for fine grout and 1/2-inch for coarse grout. Unless noted otherwise, reinforcing bars and dowels shall be lapped 40 bar

diameters or 2-foot six (6) inches minimum, where spliced end shall be separated by 1 bar diameter or wired together.

8. Splice reinforcement only at points shown on Drawings or reviewed shop drawings; any other locations must be specifically reviewed by ENGINEER.

    a. Splices in adjacent bars shall be staggered; in horizontal reinforcement of walls separate at least 10 feet longitudinally for bars of same tier.

    b. Splices in reinforcement shall be made only at such points and in such a manner that the structural strength of the member will not be reduced.

    c. Lapped splices shall provide sufficient lap to transfer the working stress of the reinforcement by bond and shear.

    d. Minimum lap shall be 40 bar diameters, where spliced end shall be separated by 1 bar diameter or wired together.

    e. Welded or mechanical connections shall develop the full yield strength of the reinforcement.

    f. Bond beams shall be continuous around corners.

9. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowel shall be grouted into a core in vertical alignment, even though it may be in cell adjacent to cell holding vertical wall reinforcing.

10. Bond beam reinforcement shall be laid continuously on webs of bond beam units. Intersecting masonry walls shall be tied to one another by horizontal reinforcement, unless noted otherwise; where masonry walls intersect with concrete walls, connect with 1/2-inch diameter by 15-inch mechanical bolts in flush shells at bond beams.

11. To allow bonding masonry, clean laitance from top of concrete foundation before proceeding. The stating joint on foundations or slabs shall be laid with full mortar coverage except at the area where grout occurs, which shall be kept free of mortar so that grout is in contact with the foundation slabs.

12. Lay units in regular running bond except where soldier or other coursing is shown on drawings; maintain even module. Corners shall have same masonry bond by overlapping units. Joints shall be uniform throughout all work having same type of masonry units.

13. At running bond, thread vertical reinforcing through alternately overlapping cells. Lay units according to “face and shell” method; provide full mortar coverage on all

face shells, and on faces and webs surrounding vertical and horizontal cells to be filled with grout.

14. Do not furrow bed joints. Shove tightly each new unit against existing unit so that mortar bonds well to both.

15. Rock closures into place. Do not pound corners and jambs to fit stretcher units after they are set in position. Remove all excess grout and mortar spilled on masonry units during construction.

16. Dry brush all masonry surfaces at end of each day's work. Stop off horizontal run of masonry by racking back one-half length of unit in each course at end of day's work. Toothing is not permitted. Where fresh masonry joins partially set masonry, remove loose units and mortar clean and then lightly wet exposed surface of set masonry before starting new work.

17. Joints of walls to be covered or furred may be left flush, without tooling. Joints of all walls which are to be exposed shall be tooled when "thumb right" hard mortar is partially set but still sufficiently plastic to bond) with round jointer or bar to produce a dense, slightly concave surface, well bonded at edges. All tooling shall be done with a tool which compacts the excess mortar out of joint rather than dragging it out. Joints which are not tight at the time of tooling shall be raked out, pointed, then tooled. If it is necessary to move to a unit after it has been once set in place, the unit shall be removed from wall, cleaned, and set in fresh mortar. Remove any mortar fins from joint junctions.

18. Unless shown otherwise on drawings, provide 8-inch lintel for concrete masonry openings four (4) feet wide or less and 16-inch lintel for openings greater than four (4) feet wide. Forms and shores for lintels shall be substantial. Brace or tie forms to maintain position and shape. Forms shall be tight with no leakage of mortar or grout. Do no remove forms and shores until masonry has hardened sufficiently to carry its own weight and other temporary loads that may be placed on it during construction, 10 days minimum.

3.4 MASONRY GROUTING

A. Masonry grouting shall be by low lift method.

1. The repetitive construction procedure of erecting a masonry wall to a height not greater than four (5) feet, grouting the wall as required and then repeating this cycle until the top of the wall is reached shall be classified as low-lift grouting. Grout shall be placed while mortar joints are still soft and plastic or the grout spaces shall be cleaned of mortar dropping and protruding mortar joints shall be removed.

B. Cells containing reinforcement or embedded items shall be solidly filled with grout. Before grouting starts, reinforcing steel shall be secured in a place and observed by ENGINEER and inspected by Building Inspector from governmental unit having authority.

C. Vertical cells to be filled shall have vertical alignment to maintain continuous unobstructed cell area. To confine grout to horizontal masonry beams, the tops of unfilled cell cavities or cores in masonry units under beams shall be covered with metal lath, or special bond beam or lintel units shall be used, or another method may be employed if approved by ENGINEER, building paper shall not be permitted.

D. All bolts, anchors, etc., inserted in walls shall be fully and solidly grouted in place. Embedment shall not be less than 3/4 of the wall thickness, unless otherwise noted.

E. Masonry shall cure at least 24 hours before grouting. Keep clean of mortar and drippings those cavities and cores which are to be grouted. Mortar projections and droppings shall be washed out of spaces and off reinforcing with a jet stream of water.

F. Masonry grout shall be poured in lifts not exceeding five (5) feet. All masonry shall be laid using the Low-Lift grouting method with maximum grout pour heights not to exceed five (5) feet unless otherwise allowed in writing by the ENGINEER. In addition, grout pour heights shall not exceed the maximum grout pour height limits of Table 7 of TMS 602/ACI 530.1/ASCE 6, based upon the minimum grout space dimensions for grouting of cells of hollow units. Lay masonry until location of a bond beam or horizontal lintel beam is reached, but not to exceed the limits of Table 7 of TMS 602/ACI 530.1/ASCE 6, and then grout full the vertical cells required to be grouted and fill the beam or lintel without pause.

G. To ensure complete filling of grout space, consolidate grout at time of pouring by puddling and then reconsolidate by later puddling before the plasticity is lost. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

H. Solid grout hollow metal door and window frames; for all wall openings over two (2) feet wide, solid grout from lintel to floor or roof above in one continuous operation.

I. Place grout within 1 1/2 hour from introducing water in the mixture and prior to initial set.

3.5 MASONRY CLEANING

A. All mortar and grout must be thoroughly set and cured before cleaning. Remove excess mortar or mortar stains or efflorescence; scraping devices shall be nonferrous. Protect

all adjacent surfaces, including sash and other corrodible metalwork, from damage by cleaning solvent.

B. Saturate all exposed masonry with water immediately before cleaning, apply solution of cleaner as per manufacturer's instructions and rinse thoroughly with fresh, clean water immediately after cleaning. Do small sections at a time, working from top to bottom. Repeat as necessary.

C. Tuckpoint any loose or defective mortar joints. At conclusion of masonry work, remove scaffolding and equipment used in work and remove debris, refuse and surplus masonry material.

END OF SECTION

SECTION 04 22 00 - CONCRETE MASONRY UNITS

PART 1 GENERAL

1.1 SCOPE

A. Work included under this section shall include all materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the work, including, but not limited to, these major items:

1. Concrete masonry units.

2. Vertical and horizontal reinforcing and dowels projecting into subsequently placed concrete.

3. Setting of flashing and other work to be embedded in masonry.

B. Related Sections:

1. Section 03 21 00, Reinforcing Steel.

2. Section 04 05 17, Masonry Mortar and Grout.

1.2 SUBMITTALS

A. Samples -- Before any concrete unit masonry materials are delivered to the job site, submit one sample of each proposed concrete masonry unit.

B. Submit color samples for OWNER selection of concrete masonry unit colors.

C. Material Certificates -- Prior to delivery of concrete masonry materials, anchors, ties, fasteners, and metal accessories to the job site, deliver a letter from the manufacturer of the proposed masonry units, anchors, ties, fasteners, and metal accessories certifying that all such units to be delivered to the job site are in strict conformance with the provisions of this Section.

D. Construction procedures for Cold Weather Construction and/or Hot Weather Construction for review and approval by OWNER in compliance with the requirements herein prior to use on the project.

E. A letter of certification from the Supplier of the materials prior to delivery of the materials to the site to verify f'm according to the Chapter 17 of the International Building Code (IBC).

1.3 QUALITY ASSURANCE

A. Qualifications of Workers

1. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

2. Provide one skilled journeyman mason who shall be present at all times during execution of this portion of the work and who shall personally direct all work performed under this Section.

B. Standards, Specifications and Codes

Comply with the applicable provision of the following codes, specifications and standards to the extent indicated by reference thereto:

1. American Concrete Institute (ACI)
2. American Society of Testing and Materials (ASTM)
3. National Concrete Masonry Association (NCMA)
4. Structural Clay Products Institute (SCPI)
5. American Society of Civil Engineers (ASCE)
6. The Masonry Society (TMS)
7. The International Building Code (IBC)

Comply with building code requirements which are more stringent than the above and all O.S.H.A. requirements.

C. Testing Service -- The OWNER will engage an independent testing laboratory to perform material evaluation tests and to perform required Special Inspections.

D. Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing required by the contract documents shall be done at the OWNER's expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

E. Inspection Criteria:

1. Masonry construction shall be inspected and evaluated in accordance with the requirements of Chapter 17 of the Oregon Structural Specialty Code, per TMS 402/ACI 530/ASCE 5 Table 1.19.3 – Level C Quality Assurance and TMS 602/ACI 530.1/ASCE 6, Table 5 – Level C Quality Assurance requirements (ACI 530 Table 1.19.1, Table 1.19.2, & Table 1.19.3), unless otherwise indicated.

2. The Contract Documents shall dictate the required level of inspection per above reference or provide a project specific special inspection program.

3. If the Contract Drawings do not specify the level of required inspection the CONTRACTOR shall provide Level C inspection or obtain written direction from the ENGINEER to the required level of inspection.

F. Minimum Testing Frequency:

1. An independent testing agency or laboratory shall verify the compressive strength (f'm) of the proposed construction prior to construction and at regular intervals during construction as indicated in the Contract Documents, but at least one test for every 5,000 square feet during construction.

2. The compressive strength (f'm) shall be determined for each wythe of multiwythe walls.

3. Unless specifically directed within the Contract Documents, use the unit strength method specified by TMS 602/ACI 530.1/ASCE 6.

4. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the

1.4 PRODUCT HANDLING

A. Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Protect concrete masonry units from wetting.

B. Handle unit on pallets or flatbed barrows.

C. Replacements -- In the event of damage, immediately make all repairs and replacements necessary to the approval of the OWNER and at no additional cost to the OWNER.

D. Reinforcing, metal ties, and anchors shall be protected from contact with soil and water and before being placed shall be free of loose rust and other coatings that will reduce or destroy bond.

E. Environmental Conditions - Implement the following special construction procedures based on the environmental conditions encountered during masonry construction. Failure to maintain the conditions specified below during the construction of masonry work will be just and sufficient cause for such work to be rejected.

1. Cold Weather - The cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F. All masonry units and all work on which new masonry is constructed shall be free of frost, ice, snow, and surface moisture and their temperature shall not be lower than 40 degrees F. Protect green masonry from freezing. No salt, anti-freeze chemicals or related materials are permitted.

2. Hot Weather - The hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph.

3. Wet Weather - Store masonry units and bagged materials off ground and protected from rain. Do not build on work having a film of water on any surfaces. Protect work by covering in rainy weather. Before stopping work for the day, cover the tops of walls at new work with non-staining, waterproof covering extended 2 feet minimum down both sides of wall and secured in place.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. One-sided, exterior facing, split face and/or ground face concrete block as shown on DRAWINGS.

B. Unit shall be in modular sizes. Exposed-to-view units in anyone building shall be of the same appearance. The texture of units shall match the approved samples for the types of construction and locations designated on the plans. Units shall not contain iron spots or other substances that will stain plaster or paint.

C. Hollow load-bearing units shall conform to ASTM C90 type 1.

D. The composition shall be 50 percent lightweight (pumice) and 50 percent sand. The lightweight aggregate shall conform to ASTM C331 and the sand shall conform to ASTM C33.

E. Minimum compressive strength of all blocks shall be 2,000 psi based on the net area.

F. Maximum water absorption permitted for units at the time of delivery to the job site shall be 15 pounds per cubic foot (15 pcf) of concrete as an average of five units for normal weight aggregate per ASTM C140.

G. Maximum moisture content permitted for standard weight aggregate units at time of delivery shall be 30 percent of total absorption. The tests for moisture content shall be determined from an average of five units per ASTM C140.

H. Maximum linear shrinkage shall not exceed 0.035-inch/unit. Concrete masonry units shall include lintel, and bond beam units, and special shapes and sizes required to complete the work indicated.

I. Certification required above shall show results of tests made not more than 12 months prior to delivery of concrete masonry units to the job site, shall show compliance with the specified values, and shall certify that the mix design, yield per batch, and curing procedures for the units delivered to the job site will be equal to those submitted for the test.

J. Unit Colors. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders. Colors shall be as shown on the plans. Colors shall be selected by ENGINEER from manufacturer's standard range of colors.

2.2 MORTAR AND GROUT

Provide mortar and grout as indicated on the drawings in conformance with the requirements of Section 04 05 17, Masonry Mortar and Grout, of these specifications.

2.3 REINFORCEMENT STEEL

Provide reinforcement steel as indicated on the drawings and in conformance with the requirements of Division 3 of these specifications and of Section 04 05 17, Masonry Mortar and Grout.

2.4 OTHER MATERIALS

All other materials, not specifically described but required of a complete and proper installation of the work of this Section, shall be as selected by the CONTRACTOR subject to the approval of the OWNER.

PART 3 EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 INSTALLATION

A. Masonry shall be plumb, true to line, with level courses accurately spaced, and built to thickness and bond pattern indicated. Where no pattern is indicated, masonry shall be laid in running bond pattern. Concrete masonry units shall be dry when laid. Each unit shall be adjusted to final position in the wall while mortar is still soft and plastic. Any unit disturbed after mortar has stiffened shall be removed and re-laid with fresh mortar. Chases shall be built in and not cut in. Chases shall be plumb and shall be minimum one unit length from jambs of openings. Chases and raked-out joints shall be kept from mortar or debris. Spaces around metal door frames and other built-in items shall be solidly filled with mortar as each course is laid. Anchors, wall plugs, accessories, flashings, and other items to be built in shall be installed as the masonry work progresses. All cutting and fitting of masonry, including that required to accommodate the work of other sections shall be done by masonry saws.

B. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry, and remove all loose mortar. If it is necessary to “stop off” a horizontal run of masonry, this shall be done by raking back one-half brick or block length in each course. Toothing will not be permitted.

C. Before closing up any pipe, duct or similar inaccessible spaces or shafts with masonry, remove all rubbish and sweep out the area to be enclosed.

D. Provide level and solid bearing in masonry walls under all bearing structural floor and roof elements. Solid bearing shall be bond beams unless otherwise indicated.

E. All masonry walls shall extend to underside of floor beams or roof metal decking unless otherwise indicated.

F. If blowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt at no additional cost to the OWNER.

G. Mortar Beds and Joints

1. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall be also be bedded in all courses of the starting course on footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced and/or filled with grout or concrete.

2. Horizontal and vertical face joints shall be 3/8-inch thick unless otherwise indicated. Vertical joints shall be shoved tight. Mortar joints in exposed or painted

surfaces shall be tooled when thumbprint hard to a flush joint. Joints in unparged masonry below grade shall be pointed tight with a trowel. Mortar joints in surfaces to be plastered, stuccoed, or covered with other masonry shall be cut flush. Mortar protrusions extending into cells or cavities to be reinforced and filled shall be removed.

H. Placing Reinforcement

1. Place reinforcing as covered in Section 04 05 17 – 3.3, Masonry Mortar and Grout, of these specifications.

    a. Vertical reinforcement shall be rigidly secured at the top and bottom of CMU wall and at intervals necessary to hold the reinforcing in proper position.

    b. Reinforcement shall be placed at the wall centerline unless indicated otherwise.

I. Low-Lift Grouting

1. Place reinforcing as covered in Section 04 05 17 – 3.4, Masonry Mortar and Grout, of these specifications.

    a. Set steel lintels in beds of mortar. Fill spaces around jambs and head of metal door buck and frames solidly with mortar.

J. Pointing and Cleaning

1. At the completion of the work, all holes in joints of masonry surfaces to be exposed or pointed except weep holes shall be filled with mortar and suitably tooled, masonry walls shall be dry brushed at the end of each day's work and also final pointing, and shall be left clean and free from mortar spots and droppings. Any cracks in masonry shall be repaired. Defective joints shall be cut out and repointed.

2. Remove efflorescence, mortar spots and other areas that appear unclean with cleaning agent to a sample wall area as directed by the OWNER. The OWNER retains the right to change proposed cleaning methods and shall be notified before any additional cleaning agent is used. The cleaning methods agent shall be applied to a small section of the wall at a time and work shall proceed from the top to the bottom. Protect all metal sashes, lintel, louvers, and other corrodible parts when masonry is cleaned.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. The extent of metal fabrications work is shown on the Drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, sheets, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems in other sections of these specifications.

B. Section Includes:

1. Shop-fabricated metal items
2. Bollards
3. Ladders
4. Anchor bolts
5. Handrails and railings
6. Gratings
7. Access hatches
8. Cable Trench
9. Fasteners
10. Miscellaneous fabricated architectural details

1.2 RELATED SECTIONS

A. Section 03 30 00, Cast-In-Place Concrete

B. Section 09 90 00, Painting and Coating

C. Section 33 05 17, Precast Concrete Valve Vaults and Meter Boxes

D. Section 33 16 10, Prestressed Concrete Water Utility Storage Reservoir

1.3 REFERENCE STANDARDS

A. Aluminum Association (AA):

1. AA DAF-45 - Designation System for Aluminum Finishes

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum

2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American National Standards Institute (ANSI):

1. ANSI A14.3 - American National Standard (ASC) for Ladders - Fixed - Safety Requirements

D. American Welding Society (AWS):

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination

2. AWS D1.1 - Structural Welding Code - Steel

3. AWS D1.6 - Structural Welding Code - Stainless Steel

E. ASTM International (ASTM):

1. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

2. ASTM A36 - Standard Specification for Carbon Structural Steel

3. ASTM A47, grade as selected - Malleable Iron Castings

4. ASTM A48, Class 30 - Gray Iron Castings

5. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

6. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

7. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

8. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

9. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

10. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

11. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

12. ASTM A283, Grade C - Steel Plates to be Bent or Cold Formed

13. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes

14. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

15. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

16. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

17. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

18. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

19. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

20. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing

21. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts

22. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

23. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

24. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

25. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

26. ASTM A992 - Standard Specification for Structural Steel Shapes

27. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings

28. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings

29. ASTM B177 - Standard Guide for Engineering Chromium Electroplating

30. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

31. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

32. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

33. ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication - Structural Aluminum Shapes and Plates

34. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

35. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

36. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings

37. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

38. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

39. ASTM F436 - Standard Specification for Hardened Steel Washers

40. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

F.

41. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength

G. Builders Hardware Manufacturers Association (BHMA):

1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges and Hasps

National Ornamental & Miscellaneous Metals Association (NOMMA):

1. NOMMA Guideline 1 - Joint Finishes

SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual
2. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer
3. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic)
4. SSPC SP 1 - Solvent Cleaning
5. SSPC SP-7 Brush-off Blast Cleaning
6. SSPC SP 10 - Near-White Blast Cleaning

H.

1.4 SUBMITTALS

Section 01 33 00 - Submittal Procedures: Requirements for Submittals.

A. Manufacturer's Data: For information only, submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation

B. instructions for products to be used in miscellaneous metal work, including paint products.

C. Shop Drawings:

1. General: Submit copies of shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work which are not completely shown by the manufacturer's data sheets.

    a. Include plans, elevations, and details of sections and connections and fabricators proposed shop coat paint or galvanizing specifications.

    b. Show anchorage and accessory items.

    c. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction.

    d. Indicate welded connections using standard AWS A2.4 welding symbols.

    e. Indicate net weld lengths.

2. Stairs, Handrails, and Railings:

    a. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

3. Gratings:

    a. Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances.

Samples:

1. Submit two sets of representative samples of materials, illustrating factory finishes as may be requested by the Engineer.

D.

2. Engineer's review will be for color, texture, style and finish only.

Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F.

Qualifications Statement:

G.

1. Submit qualifications for licensed professional to perform Delegated Design Submittals as noted above.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transporting, handling, storing, and protecting products shall be in accordance with manufacturer's requirements.

B.

C. Inspection: Accept metal fabrications on-site in labeled shipments. Inspect for damage.

Protect metal fabrications from damage by exposure to weather or by ground contact.

A.

1.6 EXISTING CONDITIONS

Field Measurements: Verify field measurements prior to preparation of Shop Drawings and fabrication. Indicate field measurements on Shop Drawings.

1. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication.

A.

PART 2 PRODUCTS

2.1 GENERAL

For the fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting,

seam marks, roller marks, rolled trade names, roughness and defects which impair strength, durability and appearance. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

2.2 BOLLARDS

Description:

1. Aluminum pipe

A.

2. Crowned cap

3. Size: 4-inch diameter, length as indicated on Drawings.

4. Bollard shall be removeable, as shown on Drawings.

5. Cover: Yellow 1/8" thick high density polyethylene dome top bollard cover by Post Guard or Approved Equal.

Concrete Fill:

B.

1. Minimum Compressive Strength: 3,000 pounds per square inch (psi).
2. As specified in Section 03 30 00, Cast-in-Place Concrete.

C.

Anchors: Concealed type as indicated on Drawings.

2.3 LADDERS

A.

Vault Ladder:

1. ANSI A14.3.

2. Aluminum-welded construction.

3. Siderails:

   a. Size: 1/2 by 2 inches
   b. Spacing: 20 inches on center

4. Rungs:

   a. Solid rod. Hex rod or gnarled rebar
   b. Size: 1-inch diameter
   c. Spacing: 12 inches on center

5. Mounting:

    a. Space rungs as shown on Drawings, a minimum of 7 inches from wall surface.
    b. Provide steel mounting brackets and attachments per Drawings.

6. Shop Finish: Mill Finish

2.4 ANCHORS

All anchors shall be epoxy anchors or expansion anchors as shown in the Drawings.

Materials:

A.

1. As shown in the Drawings.

B.

2. For direct bury:

    a. Malleable iron complying with ASTM A47
    b. Cast steel complying with ASTM A27
    c. Iron and steel galvanized in compliance with ASTM A153

3. For wetted atmospheric conditions

    a. Type 316 stainless steel

4. Threaded rod, nuts, bolts, and washers:

    a. Material matching anchor insert type

C.

Types:

1. Threaded-type Concrete Inserts:

    a. Internally threaded to receive machine bolts
    b. Malleable iron, ASTM A47
    c. Cast steel, ASTM A27
    d. Stainless steel, type 304, ASTM A320

2. Wedge-type Concrete Inserts:

    a. Box-type ferrous castings designed to accept bolts having special wedge-shaped heads.

3. Slotted-type Concrete Inserts:

    a. Box-type welded construction with slot designed to receive square head bolt and with knockout cover.

Manufacturers:

1. Hilti, Inc.
2. Simpson Strong-Tie Co., Inc.
3. Proprietary products as named in the Drawings.

D.

2.5 HANDRAILS AND RAILINGS

General -- Maximum spacing between members shall be as directed by local code and OSHA requirements unless otherwise noted on plans.

A. Provide 3 foot 6-inch high aluminum handrail, 2 inches outside diameter for top and vertical segments, 1-1/2 inches all others.

B.

1. Top corners of handrail are to be bent to the smallest radius possible without causing grain separation or otherwise impairing the work.

2. Radius Sections -- Roll to radii shown on plans

3. Vertical segments of handrail are to be set plumb and mount as shown on plans or as otherwise specified.

4. Spacing between vertical segments will be according to drawings.

5. Floor flanges shall be round base flanges and accommodate four fasteners.

6. Toe kick shall be aluminum 1/4" x 4" and shall be provided on all handrail installations except were specifically noted. Toe kick shall be secured to handrail with toe kick clamps to allow movement and not fastened directly to handrail.

C.

Welded Connections

1. Cope intersections of rails and posts, weld joints of tailings or use welding connectors, at fabricator's option. Other methods of welding may be used when acceptable to the ENGINEER.

2. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces. Discoloration of finished surfaces and sharp edges will not be acceptable.

D.

A.

Primer coat and finishes shall be in accordance with Division 9, Finishes.

2.6 GRATINGS

Meet all applicable codes and Occupational Safety and Health Administration (OSHA) requirements.

Minimum Design Live (Pedestrian) Load: Fabricate stair assembly to support uniform live load of 100 psf and moving concentrated load of 1,000 psf with deflection of stringer or landing framing not to exceed 1/120 of span.

B. Layout:

1. Provide removable grating sections with end-banding bars for each panel.

2. Exposed connections shall fit accurately together to form tight hairline joints.

C.

3. Install all gratings with bearing bars spanning the shortest dimension unless shown otherwise on the plans.

4. Provide welded positioning tabs in support angles at each grating section to prevent lateral movement of grating sections.

5. Layout units to allow grating removal without disturbing items penetrating grating.

D. Penetrations:

1. Provide for notched gratings and banding for penetrations as indicated.

2. Provide banding for openings in grating of same material and size as bearing bars unless otherwise indicated.

3. Wherever bar gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar of same material and size as bearing bars to the cut ends of the bars.

4. Divide panels into sections only to the extent required for installation wherever bar grating platforms, runways, etc., are to be placed around previously installed pipes, ducts, and structural members.

E.

A. Materials: As shown on the Drawings.

2.7 ACCESS HATCHES

B.

C. Use materials of the size and thickness shown in Drawings or, if not shown in the Drawings, of the size recommended by product manufacturer.

Work to the dimension shown in the Drawings or accepted on final shop drawings, using proven details of fabrication and support.

Use the type of materials shown or specified for the various components of the Work.

Vault Access Hatch:

1. Access hatches shall be single or double leaf diamond plate aluminum with dimensions and features as shown on the Drawings. The minimum design load shall be H-20 loading for exterior hatches.

D.

2. Hardware shall be Type 316 stainless steel. This includes nuts, bolts, washers, hinges, springs, spring assisted operators, and automatic hold open arm with release lever.

3. Each leaf shall have a spring-assisted operator to reduce lifting force to 10-30 pounds where shown.

4. Recessed padlock hasp with hinged cover.

5. The leaves shall securely latch when closed.

6. Frames shall be structural aluminum with coating, as specified herein, to protect aluminum from concrete.

7. Flush grip handle.

8. Heavy duty automatic lock open arm with red vinyl release grip.

9. Channel frame with 1-1/4" anchor flange around the perimeter, equipped with a neoprene gasket for weather tight seal and side bottom outlet 1-1/2" aluminum IPS threaded drain coupling outlet integrated into the frame.

10. Stainless steel slam-lock.

11. Shop finish of cover and frame: Mill finish.

E.

12. Provide with optional orange safety grate.

Wet Well Access Hatch:

1. Access hatches shall be double or triple leaf diamond plate aluminum with dimensions and features as shown on the Drawings. The minimum design load shall be H-20 loading.

2. Hardware shall be Type 316 stainless steel. This includes nuts, bolts, washers, hinges, springs, spring assisted operators, and automatic hold open arm with release lever.

3. Each leaf shall have a spring-assisted operator to reduce lifting force to 10-30 pounds where shown.

4. Recessed padlock hasp with hinged cover.

5. Provide with optional orange safety grate under each hatch.

6. The leaves shall securely latch when closed.

7. Framed shall be structural aluminum with coating, as specified herein, to protect aluminum from concrete.

8. Flush lift handle.

9. Heavy duty automatic lock open arm with red vinyl release grip.

10. Angle type frame with strap anchors.

11. Stainless steel slam-lock.

12. Shop finish of cover and frame; Mill finish.

Access hatches shall be manufactured by U.S.F. Fabrication, or approved equal.

F.

2.8 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting systems. Acceptable manufacturers are Simpson or approved equal.

B. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish galvanized steel washers.

A.

2.9 MISCELLANEOUS FABRICATIONS, FRAMING, AND SUPPORTS

B. Provide miscellaneous steel framing and supports required to complete the Work.

C. Fabricate miscellaneous units to the sizes, shapes and profiles shown in the Drawings or, if not shown, of the required dimensions to receive adjacent grating, plates doors, or other work to be retained by the framing.

D. Except as otherwise shown, fabricate from structural steel shapes and plate and steel bars, all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

Cut, drill, and tap units to receive hardware and similar items to be anchored to the work.

Equip units with integrally welded anchors for casting into concrete, bolting to structural steel or building into masonry. Furnish inserts if units must be installed after concrete is placed.

Galvanize all miscellaneous fabrications unless otherwise noted.

F.

2.10 NON-SHRINK GROUT

F. Where required for anchoring, patching, or sealing, grouting and sealing compounds shall conform to the requirements of Section 03 60 00, Grouting.

2.11 MATERIALS

A.

Materials listed below shall be provided unless otherwise noted in the Drawings or other sections of these specification.

A. Steel:

B.

1. Structural W Shapes: ASTM A992
2. Structural Shapes: ASTM A36
3. Channels and Angles: ASTM A36
4. Steel Plate: ASTM A36
    a. Steel Plate to be Bent or Cold Formed: ASTM A283, Grade C
5. Hollow Structural Sections: ASTM A500, Grade B
6. Structural Pipe: ASTM A53, Grade B, Schedule 40 unless shown otherwise in Drawings
7. Bar: ASTM A36
    a. Cold-Finished Steel Bar: ASTM A108, grade as selected by fabricator
8. Sheet Steel: ASTM A653, Grade 33 Structural Quality
9. Tubing: ASTM A513, Type 5, minimum 50 kilopounds per square inch (ksi) yield strength
10. Standard Bolts: ASTM A307; Grade A
    a. Washers: ASTM F844
11. High Strength Bolts: ASTM A325

a. Washers: ASTM F436; Type 1

12. Nuts: ASTM A563; heavy-hex type

13. Welding Materials: AWS D1.1; type required for materials being welded

Stainless Steel:

1. Bars and Shapes: ASTM A276; Type 316
2. Tubing: ASTM A269; Type 316

C.

3. Pipe: ASTM A312, seamless; Type 316
4. Plate, Sheet, and Strip: ASTM A666; Type 316
5. Bolts, Nuts, and Washers: ASTM A354; Type 316
6. Welding Materials: AWS D1.6; type required for materials being welded

Aluminum:

D.

1. Structural Aluminum Shapes and Plates: ASTM B308, Alloy 6061, Temper T66, Anodic Coating Class I, anodized after fabrication

2. Aluminum-Alloy-Drawn Seamless Tubes: ASTM B210 Alloy 6063, Temper T6

3. Aluminum-Alloy Bars: ASTM B211 Alloy 6063, Temper T6

4. Bolts, Nuts, and Washers: Stainless steel or Steel, galvanized

5. Welding Materials: AWS D1.1; type required for materials being welded

E.

Bolts, Nuts, and Washers for Equipment and Piping:

1. Select fasteners for the type, grade, and class required for the installation of miscellaneous metal items.

2. Carbon Steel:

   a. General: Zinc-coated, ASTM A153
   b. Structural Connections: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized
   c. Anchor Bolts: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized
   d. Pipe and Equipment Flange Bolts: ASTM A193, Grade B-7
   e. High Strength Bolts: ASTM F3125, Heavy Hex Head

3. Stainless Steel: Required for all bolts, nuts and washers in wet wells and valve vaults.

   a. Type 316 stainless steel, Class 2; ASTM A193 for bolts; ASTM A194 for nuts

b. Where stainless steel bolts are in contact with dissimilar metals, glass epoxy insulating sleeves and washers shall be used to electrically isolate the bolts.

2.12 FABRICATION

Workmanship:

A.

1. Use materials of the size and thicknesses shown in the Drawings or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use as approved by the Engineer.

2. Work to the dimensions shown in the Drawings or accepted on Shop Drawings, using proven details of fabrication and support.

3. Use the type of materials shown in the Drawings or specified for the various components of work.

4. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

5. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown in the Drawings.

6. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.

B. Fit and shop-assemble items in largest practical sections for delivery to Site.

C.

D. Fabricate items with joints tightly fitted and secured.

E. Continuously seal join members by means of continuous welds in accordance with the recommendations of AWS, unless otherwise noted or approved.

F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.

G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

H. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

2. Drill plates to receive anchor bolts and for grouting as required.

3. Galvanize after fabrication.

Miscellaneous Steel Trim:

1. Provide shapes and sizes for profiles shown in the Drawings.

I.

2. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.

3. Use concealed field splices wherever possible.

4. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

Fabrication Tolerances:

J.

1. Squareness: 1/8-inch maximum difference in diagonal measurements.
2. Maximum Offset between Faces: 1/16-inch.
3. Maximum Misalignment of Adjacent Members: 1/16-inch.
4. Maximum Bow: 1/8-inch in 48 inches.
5. Maximum Deviation from Plane: 1/16-inch in 48 inches.

2.13 FINISHES

A.

Steel:

1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2. Do not prime surfaces in direct contact with concrete or where field welding is required.

3. Prime-paint items with one coat, except where galvanizing is specified.

4. Coatings as specified per Section 09 90 00, Painting and Coating.

    a. Primer paint selected must be compatible with the required finish coats of paint.

    b. At locations in contact with potable water, use only primer approved for potable water use.

5. Galvanizing for Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123; hot-dip galvanize after fabrication

6. Galvanizing for Fasteners, Connectors, and Anchors:

    a. Hot-Dip Galvanizing: ASTM A153
    b. Mechanical Galvanizing: ASTM B695; Class 50 minimum

7. Chrome Plating: ASTM B177, nickel-chromium alloy, satin finish

8. Sheet Steel: Galvanized

9. Bolts: Hot-dip galvanized

10. Nuts: Hot-dip galvanized

11. Washers: Hot-dip galvanized

12. Touchup Primer for Galvanized Surfaces: ASTM A780 (A780M), A1. Repair Using Zinc-Based Alloys (Heat and Stick Method)

B. Stainless Steel:

1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.

C. Aluminum:

1. Protection of All Aluminum:

    a. Aluminum surfaces in contact with cementitious, masonry or dissimilar materials, apply the following coating system:

        1) One (1) coat of epoxy primer, 1 to 2 mils dry film (D.F.).

        2) Followed by two (2) coats of Bitumastic, 6 to 8 mils D.F.

        3) Followed by two (2) coats of tarset material, 6 to 8 mils D.F.

D. Shop Painting

1. Shop painting of metal fabrications shall be allowed only at the sole discretion of the Engineer.

2. Shop paint miscellaneous metal work in accordance with Section 09 90 00, Painting and Coating, with the following exceptions:

    a. Those members or portions of members to be embedded in concrete or masonry.

    b. Surfaces and edges to be field welded.

    c. Galvanized surfaces.

3. Remove scale, rust, and other deleterious materials before the shop coat of paint is applied.

    a. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7, Brush-off Blast Cleaning.

    b. Remove oil, grease, and similar contaminates in accordance with SSPC SP-1, Solvent Cleaning.

4. Immediately following surface preparation, brush or spray on metal primer paint, applied in accordance with the manufacturer's instructions or as specified below.

5. Apply one shop coat of metal primer paint to fabricated metal items, except apply two coats of paint to surfaces which will be inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

E. Touch-up Painting, Pre-painted Items:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting.

2. Apply touch-up coatings by brush or spray to provide a minimum dry film thickness of the original coating thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

Clean and strip primed steel items to bare metal and aluminum where Site welding is required.

Furnish setting drawings, diagrams, templates, instructions, and directions for the installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections. Coordinate delivery of such items to the project Site.

B.

3.3 INSTALLATION

Install items plumb and level, accurately fitted, and free from distortion or defects.

Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

A.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction, including

C. threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

Fit exposed connections accurately together to form tight hairline joints.

D.

Grind joints smooth and touch-up shop paint coat.

E.

F. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

G.

Field-weld components indicated on Drawings and Shop Drawings.

H.

Perform field welding according to AWS D1.1 with regards to procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the

I. methods used in correcting welding work.

Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

A.

3.4 TOLERANCES

B.

C. Maximum Variation from Plumb: 1/4-inch per story or for every 12 feet in height, whichever is greater, non-cumulative.

D.

Maximum Variation from Level: 1/16-inch in 3 feet and 1/4-inch in 10 feet.

A. Maximum Offset from Alignment: 1/4-inch.

Maximum Out-of-Position: 1/4-inch.

3.5 FIELD QUALITY CONTROL

Welding: Inspect welds according to AWS D1.1.

Replace damaged or improperly functioning hardware.

After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

B. Touch up factory-applied finishes according to manufacturer-recommended procedures.

C.

3.6 ADJUSTING

D. Adjust operating hardware and lubricate as necessary for smooth operation.

A. END OF SECTION

SECTION 06 05 23 - WOOD, PLASTIC, AND COMPOSITE FASTENINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for fasteners and adhesives used in the construction of the wood, plastic, and composite elements of the project.

B. Section includes:

1. Rough carpentry hardware.
2. Nails.
3. Bolts and screws.
4. Framing anchors.
5. Joist, rafter, and beam hangers.
6. Adhesives.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer’s data on all materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer’s handling, delivery, storage, and installation requirements.

PART 2 PRODUCTS

2.1 ROUGH CARPENTRY HARDWARE

Rough carpentry hardware used in CMU Control Building shall conform to the latest provisions of the Oregon State Structural Specialty Code, the International Building Code (IBC), and to any local codes and ordinances.

2.2 NAILS

A. Steel Common Nails: For framing, appropriately sized for the materials being joined.

B. Hot-Dipped Galvanized Nails: Wherever exposed.

C. Stainless Steel Nails: At locations where stainless-steel hardware is specified. Do not mix dissimilar materials without approval of the ENGINEER.

D. Treated Wood: Hot-dipped galvanized or stainless-steel nails are required at all locations where they are in contact with treated wood.

E. The number and size of nails connecting wood members shall be per the Contract Documents but shall not be less than that set forth in Table 2304.9.1 of the IBC for any members.

2.3 BOLTS AND SCREWS

A. Conforming to ASTM A307, Grade A, appropriately sized for the materials being joined.

B. Use galvanized bolts and screws where exposed or in contact with treated wood or embedded into concrete.

2.4 FRAMING ANCHORS & JOIST, RAFTER AND BEAM HANGERS

A. Use galvanized, minimum 18-gauge steel of the size and type required for the materials connected.

B. Post hot-dip galvanize all connection hardware in contact with pressure treated wood, or use stainless steel connectors.

C. Manufacturers:

1. Simpson “Strong-Tie”.
2. Teco “MiTek”.
3. Approved equal.

2.5 ADHESIVES

Use gun grade adhesive suitable for bonding various metals and non-metallic materials such as wood, plastic, and glass without primer.

PART 3 EXECUTION

3.1 GENERAL

A. Use only skilled workers and the highest standards of the craft.

B. Lay out, cut, fit, and install all rough carpentry items.

C. Anchor sufficiently to ensure rigidity and permanence as noted on the Drawings.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish materials, labor, equipment, and services necessary to provide rough framing as shown on the Drawings and as specified herein.

B. Section includes:

1. Lumber.
2. Plywood.
3. Building paper.

1.2 RELATED SECTIONS

A. Section 06 05 23 - Wood, Plastic, and Composite Fastenings.

B. Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Submit a complete list of products, product information, type, and grade for prior to beginning building construction.

1.4 QUALITY ASSURANCE

A. All work specified herein shall conform to the latest provisions of the International Building Code (IBC), the Plastic Lumber National Evaluation Service, NER-508, and the local Codes and Ordinances of all Governmental agencies having jurisdiction over the Project.

B. Where special inspection of wood structural elements is required in the Contract Documents, an independent testing agency or laboratory shall perform special inspection of the elements indicated in the Contract Documents. The OWNER or an agent of the OWNER will engage a testing laboratory acceptable to the ENGINEER to perform the required Special Inspections and/or Material Tests.

C. Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work.

1. Allow free access to material stockpiles and facilities at all times.

2. All testing required by the contract documents shall be done at the OWNER'S expense.

3. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

1.5 DELIVERY, HANDLING AND STORAGE

A. Immediately upon delivery to Site, place materials in an area protected from weather.

B. Store materials a minimum of six (6) inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Do not store seasoned materials in wet or damp portions of building.

D. Protect sheet materials from breaking corners and damaging surfaces while unloading.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber grading rules and wood species shall be in conformance with the latest edition of U.S. Department of Commerce, National Institute of Standards and Technology, Product Standard DOC PS 20 and the National Forest Products Association.

B. Wood members shall conform to the requirements above and provide design values equal to those published in the "Design Values for Wood Construction," a supplement to the 2018 edition of the National Design Specification for Wood Construction, published by the National Forests Products Association.

C. Plywood grading rules shall be in conformance with the latest edition of U.S. Product Standards PS 1 and PS 2, and be Engineered Wood Association (APA) rated Exposure 1.

D. Lap siding, soffit panels and trim shall be as specified in Section 07 46 46, Fiber Cement Siding of these Specifications.

2.2 GRADE MARKS

A. Each piece of lumber shall be stamped or branded with the grade as determined by an approved grading association indicating conformance with the latest edition of U.S. Product Standard DOC PS 20.

B. Each panel of plywood shall be identified with the appropriate grade trademark of the American Plywood Association.

C. Moisture content shall not exceed 19 percent, unless otherwise specified.

2.3 LUMBER

A. Dimensions given are nominal. Surface four sides (S4S), unless specified otherwise.

B. Unless otherwise noted, lumber shall be as follows:

Use	Minimum Grade
General framing, studs, plates, blocking, furring, braces and nailers	Douglas Fir-Larch No. 2
Structural light framing, two (2) inches to four (4) inches thick, two (2) inches to six (6) inches wide	Douglas Fir-Larch No. 2
Structural joists, rafters, and planks, two (2) inches to four (4) inches thick, five (5) inches and wider and headers	Douglas Fir-Larch No. 2
Beams, stringers, posts, timber	Douglas Fir-Larch No. 1
Fascia Board	Fiber cement board manufactured by James Hardie or approved equal
Sills and Plates	Douglas Fir-Larch No. 2, Treated in accordance with IBC 2303.1.9

2.4 PLYWOOD

A. Roof Sheathing:

1. Conform to APA-rated sheathing and shall be identified with the appropriate trademark.

2. Minimum sheathing shall be Exposure 1, 15/32-inch or greater, grade CDX. Span rated 32/16 per APA.

B. MDO -- APA rated Medium Density Overlay exterior glue.

2.5 BUILDING PAPER

A. Asphalt-saturated felt conforming to ASTM D 226 or D 250, Type I, plain non-perforated.

PART 3 EXECUTION

3.1 GENERAL

A. Use only skilled workers and the highest standards of the craft.

B. Plan work in advance and perform in proper sequence to facilitate prompt and continuous progress of the work.

C. Lay out, cut, fit, and install all rough carpentry items.

D. Anchor sufficiently to ensure rigidity and permanence and as noted on Drawings.

E. Provide for installation and support of other work.

3.2 CONDITIONS OF SURFACES

A. Verify that surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

3.3 INSTALLATION

A. Plates

1. Set level and flush with outside face of concrete or masonry unit walls or as shown on the Drawings.

2. Anchor into concrete or masonry unit walls with specified anchors.

3. Location and spacing of plate anchorages shall be as shown or if not shown in conformance with current local building codes.

B. Engineered Trusses: See Drawings for requirements and Section 06 17 53, Shop-Fabricated Wood Trusses.

C. Roof Sheathing

1. Install plywood with face grain perpendicular to supports, using panel with continuous end joints over two or more spans staggered between panels and locate over supports.

2. Allow minimum space 1/16-inch (1.6 mm) between end joints and 1/8-inch at edge joints for expansion and contraction of panels.

3. Support edge joints by use of ply clips or lumber blocking, unless noted otherwise on Drawings.

D. Ceiling and Wall Plywood

1. Install ceiling plywood where shown on Drawings with joints transverse to the members they attach to.

2. Attach plywood sheets to wood framing using finish nails.

3. Countersink nails.

4. Spackle and sand joints, knot holes, and nail holes as required to provide a smooth uniform surface prior to application of paint coating system as specified in Section 09 90 00, Painting and Coating.

E. Lap Siding: Install horizontal lap siding as required by manufacturer recommendations.

F. Fastener Requirements:

1. Connections for wood members shall be in accordance with the Contract Drawings and Section 06 05 23, Wood, Plastic, and Composite Fastenings.

2. The number and size of nails connecting wood members shall not be less than that set forth in Table 2304.9.1 of the IBC.

END OF SECTION

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for design, manufacture, and supply of wood trusses as shown on the Drawings and as specified.

B. Section includes:

1. Design and performance criteria.
2. Lumber.
3. Metal connecting hardware.
4. Manufacturing requirements.

1.2 RELATED SECTIONS

A. Section 06 05 23 - Wood, Plastic, and Composite Fasteners.
B. Section 06 10 00 - Rough Carpentry.

1.3 DEFINITIONS

A. BCSI*:* Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses jointly produced by the Structural Building Components Association and the Truss Plate Institute.

B. Contractor: The person who contracts with the OWNER, who constructs the Building in accordance with the Construction Documents and the Truss Submittal Package. The term "CONTRACTOR" shall include those subcontractors who have a direct contract with the CONTRACTOR to construct all or a portion of the construction.

C. Cover/Truss Index Sheet: Sheet that is signed and sealed by an Oregon licensed Professional Engineer, by the Truss Design Engineer, and shall contain the following information: (1) identification of the Building, including Building name and address, lot, block, subdivision, and city or county; (2) identification of Construction Documents by drawing number(s) with revision date; (3) specified Building Code; (4) computer program used; (5) roof dead and live loads; (6) floor dead and live loads; (7) wind load criteria from a specifically defined code (e.g., *ASCE 7*) and any other design loads (such as ponding, mechanical loads, etc.); ; (8) a listing of the individual identification numbers and dates of each Truss Design Drawing referenced by the Cover/Truss Index Sheet; and (9) name, address, date of drawing and license number of Truss Design Engineer.

D. Framing Structural System: Completed combination of Structural Elements, Trusses, connections, and other systems, which serve to support the Building's self-weight and the specified loads.

E. Truss: Individual metal-plate-connected wood component manufactured for the construction of a Building.

F. Truss Design Drawing: Written, graphic and pictorial depiction of an individual Truss that includes the information required in the Standard.

G. Truss Design Engineer: Person who is licensed to practice engineering as defined by the Legal Requirements of the Jurisdiction in which the Building is to be constructed and who supervises the preparation of the Truss Design Drawings.

H. Truss Designer: Person responsible for the preparation of the Truss Design Drawings.

I. Truss Manufacturer: Person engaged in the fabrication of Trusses.

J. Truss Placement Diagram: Illustration identifying the assumed location of each Truss.

K. Truss Submittal Package: Package consisting of each individual Truss Design Drawing, and, as applicable, the Truss Placement Diagram, the Cover/Truss Index Sheet, Lateral Restraint and Diagonal Bracing details designed in accordance with generally accepted engineering practice, applicable *BCSI* defined lateral restraint and diagonal bracing details, and any other structural details germane to the Trusses.

1.4 DESIGN

A. Trusses shall be designed in accordance with the Standard and, where any applicable design feature is not specifically covered herein, design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) *National Design Specification® (NDS®) for Wood Construction* and all applicable Legal Requirements.

B. Truss Manufacturer shall furnish Truss Design Drawings and Calculations prepared in accordance with all applicable Legal Requirements and signed and stamped by an Oregon licensed Professional Engineer.

C. The Truss Manufacturer shall furnish a Truss Placement Diagram, which shall provide, at a minimum, the location assumed for each Truss based on the Truss Manufacturer's interpretation of the Construction Documents.

D. The Truss Manufacturer shall submit the Truss Submittal Package to the OWNER and ENGINEER for review and approval prior to the manufacturing of the Trusses.

E. The Truss Design Drawings shall include, at a minimum, the information specified below (per the Standard):

1. Building Code used for Design, unless specified on Cover/Truss Index Sheet.

2. Slope or depth, span and spacing.

3. Location of all joints and support locations.

4. Number of plies if greater than one.

5. Required bearing widths.

6. Design loads as applicable, including:

    a. Top Chord live load (for roof Trusses, this shall be the controlling case of live load or snow load);

    b. Top chord dead load;

    c. Bottom chord live load;

    d. Bottom chord dead load;

    e. Additional loads and locations;

    f. Environmental Load Design Criteria (wind speed, snow, seismic, and all applicable factors as required to calculate the Truss loads); and

    g. Other lateral loads, including drag strut loads.

7. Adjustments to Wood Member and Metal Connector Plate design values for conditions of use.

8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.

9. Metal Connector Plate type, manufacturer, size, and thickness or gauge, and the dimensioned location of each Metal Connector Plate except where symmetrically located relative to the joint interface.

10. Size, species, and grade for each Wood Member.

11. Truss-to-Truss connection and Truss field assembly requirements.

12. Calculated span to deflection ratio and/or maximum vertical and horizontal deflection for live and total load and K_{CR} (creep factor) as applicable.

13. Maximum axial tension and compression forces in the Truss members.

14. Fabrication tolerance per the Standard.

15. Required Permanent Individual Truss Member Restraint location and the method of Restraint/Bracing to be used per the Standard.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber:

1. identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee.

2. Of the size, species, and grade as shown on the Truss Design Drawings, or equivalent as approved by the Truss Design Engineer/ Truss Designer.

3. In accordance with Article 2.3, Lumber of Section 06 10 00, Rough Carpentry.

4. Adjustment of value for duration of load or conditions of use shall be in accordance with the latest edition of the National Design Specification for Wood Construction (*NDS)*.

5. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and the Standard and shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard *C20 Structural Lumber – Fire Retardant Treatment by Pressure Processes*. Allowable values must be adjusted in accordance with *NDS*. Lumber treater shall supply certificate of compliance.

B. Metal Connector Plates:

1. Manufactured by a Truss Plate Institute (TPI) member plate manufacturer.

2. Shall not be less than 0.036 in. thick (20 gauge).

3. Meet or exceed *ASTM A653/A653M* grade 33.

4. Galvanized coating, meeting, or exceeding *ASTM A924/924M*, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with the Standard.

5. In highly corrosive environments, special applied coatings or stainless steel may be required as noted on the Contract Documents.

6. At the request of the ENGINEER, a TPI member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

2.2 MANUFACTURING

Trusses shall be manufactured to meet the quality requirements of the Standard and in accordance with the information provided in the final approved Truss Design Drawings.

PART 3 EXECUTION

3.1 HANDLING, INSTALLING, RESTRAINING AND BRACING

A. Trusses shall be handled during manufacturing, delivery and by the CONTRACTOR at the job site so as not to be subjected to excessive bending.

B. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

C. CONTRACTOR shall be responsible for the handling, installation, and temporary restraint/ bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in the latest edition of *BCSI*.

D. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.

E. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent restraint and bracing is installed.

F. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a Registered Design Professional is required.

G. Concentrated loads shall not be placed on top of Trusses until all specified restraint and bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.

H. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the CONTRACTOR to the individual or organization responsible for the installation of the Trusses.

I. Trusses shall be permanently restrained and braced in a manner consistent with good building practices as outlined in *BCSI* and in accordance with the requirements of the Construction Documents. Trusses shall furthermore be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from

simultaneously buckling together in the same direction. Such permanent lateral restraint shall be accomplished by: (a) anchorage to solid end walls; (b) permanent diagonal bracing in the plane of the web members; or (c) other suitable means.

J. Materials used in temporary and permanent restraint and bracing shall be furnished by CONTRACTOR.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Applications of insulation specified in this Section include rigid foam board and loose-fill type systems.

B. The extent of insulation work is shown on Drawings and indicated by provisions in this Section.

C. Section includes:

1. Building insulation.
2. Installation.

D. Related Requirements:

1. Section 06 10 00 - Rough Carpentry.

1.2 SUBMITTALS

A. Submit a complete list of products, product information, types, and grades for approval by the ENGINEER prior to beginning building construction.

1.3 PRODUCT HANDLING

A. General Protection:

1. Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow.

2. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. R Value: Minimum R value shall be as shown in Drawings or as required by current ANSI/ASHRAE/IES Standard 90.1-2019.

B. Ceilings

1. Insulation in ceilings shall be fiberglass batting with kraft paper faced with stapling flanges.

2. Manufacturer: Owens/Corning Fiberglass, Manville, or equal.

C. Walls

1. Insulation in walls shall be an extruded polystyrene board insulation.

a. Insulation shall conform to ASTM C578, Type X, 15 psi minimum compressive strength, 1.30 lb/cu. Ft. (21 kg/cu. M) for wall insulation.

1) Thermal resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): Type X=r-5.0 per inch of thickness with 90% lifetime limited warranty on thermal resistance.

2) Blowing Agent Formulation: Zero ozone depleting.

3) Edge Condition: Square as shown on drawings.

4) Surface Burning Characteristics (ASTM E 84): Flame spread less than 25, smoke developed less than 450, certified by independent third party such as Underwriters Laboratories (UL).

5) Indoor Air Quality: Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Children and Schools Certified℠.

6) Recycled Content: Minimum 20%, certified by independent third party such as Scientific Certification Systems.

7) Warranty: Limited lifetime warranty covering all ASTM C578 physical properties.

8) Panel Size: Provide thickness shown on drawings by 4 ft. wide by 8 ft. long.

b. Manufacturers

1) DiversiFoam Products
2) Dow Chemical Company
3) Owens Corning
4) Pactiv, Building Products Division
5) Approved Equal

D. Light Shafts and Vent Ducts

1. Insulation in framed skylight light shafts and vent ducts in attic spaces shall be rigid cellular polyurethane, polystyrene, or polyisocyanurate foam board insulation.

E. Loose-Fill Insulation

1. Perlite insulation shall conform to ASTM C549.
2. Cellulose fiber loose-fill insulation shall conform to ASTM C739.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Installer must examine substrates and conditions under which insulation work is to be performed and must notify CONTRACTOR in writing of unsatisfactory conditions.

B. Do not proceed with insulation work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

C. Install insulation system in accordance with manufacturer's recommendations or requirements.

D. Set vapor barrier faced units with vapor barrier to warm side (winter) of construction.

E. Do not obstruct ventilation spaces, except for firestopping.

END OF SECTION

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish and install a standing seam interlocking panel metal roof system with concealed fasteners where shown on the Drawings and as specified herein.

B. Section includes:

1. Metal roof panels
2. Metal finishing
3. Roofing membranes
4. Slip sheeting
5. Fasteners
6. Fabrication of metal roof panels

C. Related Requirements:

1. Section 06 05 23 - Wood, Plastic, and Composite Fasteners.
2. Section 06 10 00 - Rough Carpentry.
3. Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. ASTM A792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

3. ASTM D2626 - Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product data and materials list of items proposed to be provided under this Section.

C. Sufficient technical data to demonstrate compliance with the specified requirements.

D. Samples, to include preformed panel, seam, fastener, base sheet, finish sheet, ridge, and trims.

1.4 QUALITY ASSURANCE

A. Use skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with:

1. Underwriters' Laboratories, Inc., Class 90 wind uplift.

2. Underwriters' Laboratories, Inc., UL 790, Class A roof assembly a fire rating.

3. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) -- Pertinent recommendations contained in the "Architectural Sheet Metal Manual".

C. Warranty: Installer and manufacturer shall furnish a written 5 year warranty stating that they will be responsible for replacement at their cost of any portion of the roof system that leaks due to defects in material or installation.

1.5 DELIVERY, HANDLING AND STORAGE

A. Comply with manufacturer's requirements for product delivery, handling, and storage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Panels:

1. 13-1/2-inch maximum width

2. Continuous length

3. Interlocking

4. Hot-dipped zinc coated steel sheets, ASTM A653, Grade C, ASTM A792 zinc coating, surface treated for maximum coating performance

5. Minimum 26-gauge thickness.

B. Metal Finish:

1. Polyvinylidene fluoride resin (minimum 70 percent resin) finish coat applied over baked-on compatible prime coat.

2. One-mil minimum total coating system thickness.

3. Color: In manufacturer's standard color as selected by ENGINEER.

C. Roofing Membrane: Comply with ASTM D2626, Type 1, 30-pound.

D. Slip sheet:

1. Rosin-surfaced building paper weighing not less than 3 pounds per 100 square foot.
2. Manufacturer: W.R. Meadows Red Rosin Paper or equal.

E. Anchors: 1-inch long, large head galvanized wood screws.

2.2 FABRICATION

A. Shop fabricate to the maximum extent practicable.
B. Brake-form to the indicated profiles, length and width.

2.3 ACCEPTABLE MANUFACTURERS

A. Bruce & Dana, Inc., Salem, Oregon
B. ASC Pacific, Inc., Tacoma, Washington
C. Ray F. Becker, Co., Portland, Oregon

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Do not allow the installed work of this Section to be used as a storage space for other materials.

2. Do not permit unnecessary walking on the finished roof. Require all personnel to wear rubber-soled shoes when installing or walking on the finished surfaces.

3. Install per approved submittal drawings only.

4. Discrepancies between Site conditions and Drawings as approved shall be brought to the attention of the Engineer for resolution.

B. Apply the specified roofing membrane over the entire area to be covered by sheet metal roofing.

1. Start at the low edge, and place succeeding courses shingle fashion, lapping edges 2-inch minimum.

2. Lap the membrane with flashings as necessary to provide a positive barrier against penetration of water.

C. Apply the specified slip sheet over the entire assembly, scatter nail to sheathing as required to hold in position prior to application of metal panels.

D. Install concealed anchor cleats at minimum 18-inch centers into roof sheathing.

E. Install preformed metal panels in strict accordance with manufacturer's approved written installation instructions.

1. Do not drive fasteners through panels or seams.
2. Do not use tools or methods that scratch or mar the finish on exposed surfaces.

3.2 CLEANING AND PROTECTION

A. Damaged Units: Replace panels and other components of the Work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning:

1. Remove protective coverings and strippable films (if any) at time in project construction sequence which will afford greatest protection of Work.

2. Clean finished surfaces upon completion of Work as recommended by panel manufacturer.

C. Protection: Installer shall advise the CONTRACTOR of protection and surveillance procedures, as required to ensure that Work of this Section will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 07 46 46 - FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish all necessary labor, material, and equipment for complete installation of fiber cement siding, fascia, molding, and related work as shown on Drawings or specified herein.

B. Section includes:

1. Lap siding
2. Trim
3. Soffit panels
4. Fasteners
5. Finishes

C. Related Requirements:

1. Section 06 05 23 - Wood, Plastic, and Composite Fasteners
2. Section 06 10 00 - Rough Carpentry

1.2 REFERENCE STANDARDS

A. Building Officials and Code Administrators International, Inc. (BOCA):

1. National Building Code
2. National Fire Prevention Code

B. International Code Council (ICC):

1. International Building Code (IBC)
2. Southern Building Code Congress International (SBCCI)
3. ICC-ES Legacy Report, NER-40

C. ASTM International (ASTM):

1. ASTM C1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards

2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Samples of siding design, size, and color for approval
2. Preparation instructions and recommendations
3. Storage and handling requirements and recommendations
4. Installation methods

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years' experience with installation of similar products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface.

C. Protect edges and corners from chipping.

D. Store sheets under cover and keep dry prior to installing.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Product Warranty: Limited product warranty against manufacturing defects.

1. Lap siding: 50 years
2. Trim: 10 years

PART 2 PRODUCTS

2.1 MATERIALS

A. Fiber Cement Siding, Fascia, and Molding:

1. General:

a. Flexural strength in accordance with ASTM C1185.

1) Along direction of sheet: 1,850 pounds per square inch (psi).
2) Across direction of sheet: 2,000 psi.

b. Non-combustible, in accordance with ASTM E136.

c. Surface burning characteristics in accordance with ASTM E84.

1) Flame Spread = 0
2) Fuel Contribution = 0
3) Smoke developed = 5

2. Lap Siding:

a. Type: Cedarmill Select 7-1/4 inches (191 millimeters) with 6 inches (152 millimeters) exposure or approved equal

b. Hardieplank as manufactured by James Hardie Building Products, Inc. or approved equal.

3. Trim:

a. Type: Trim to be 1-inch thickness and width as shown on Drawings.

b. Hardietrim Fascia and Molding as manufactured by James Hardie Building Products, Inc. or approved equal.

4. Soffit Panels:

a. Type: 1/4-inch Vented Cedarmill panels or approved equal.

b. HardieSoffit as manufactured by James Hardie Building Products, Inc. or approved equal.

2.2 FASTENERS

A. Wood Framing Fasteners: All fasteners shall be stainless steel. Select in accordance with local codes and manufacturers installation recommendations.

2.3 FINISHES

A. Factory Primer: Provide factory applied universal primer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

C. Nominal minimum of 2-inch by 4-inch (51-millimeter by 102-millimeter) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 millimeters) face and straight, true, of uniform dimensions and properly aligned.

1. Install water-resistive barriers and claddings to dry surfaces.

2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.

3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, FIBER CEMENT LAP SIDING

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Starting: Install a minimum 1/4-inch (6-millimeter) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 millimeters) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer’s installation instructions.

D. Align vertical joints of the planks over framing members.

E. Maintain clearance between siding and adjacent finished grade.

F. Locate splices at least one stud cavity away from window and door openings.

G. Wind Resistance: Where a specified level of wind resistance is required, lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

3.4 INSTALLATION, FIBER CEMENT TRIM, AND SOFFIT

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4-inch (19-millimeter) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

C. Place fasteners no closer than 3/4-inch (19-millimeter) and no further than 2 inches (51 millimeters) from side edge of trim board and no closer than 1-inch (25-millimeter) from end. Fasten maximum 16 inches (406 millimeters) on center.

D. Maintain clearance between trim and adjacent finished grade.

E. Trim inside corner with single board.

F. Outside Corner Board: For 3/4-inch (19-millimeter) trim only. Install single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten trim board to trim board.

G. Allow 1/8-inch gap (+/- 1/32-inch) between trim and siding.

H. Seal gap with high quality, paint-able caulk.

I. Shim frieze board as required to align with corner trim.

J. Install trim fascia over structural sub-fascia.

3.5 FINISHING

A. Finish factory primed siding in accordance with specifications Section 09 90 00, Painting and Coating.

3.6 PROTECTION

A. Protect installed products until completion of Project.
B. Touch-up, repair or replace damaged products before Final Completion.

END OF SECTION

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish and install flashing and sheet metal work, including gutters and downspouts, as indicated on the Drawings and by provisions of this Section.

B. Section includes:

1. Galvanized metal flashings
2. Roof-drainage sheet metal fabrications

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

2. ASTM G90 - Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Samples of flashing design, size, and color for approval
2. Preparation instructions and recommendations
3. Storage and handling requirements and recommendations
4. Installation methods

1.4 DELIVERY, STORAGE, AND HANDLING

A. Per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pre-finished Galvanized Steel Sheet:

1. Steel Sheet: 24-gauge, commercial quality.

2. Finish: Complying with ASTM A653, ASTM G90 for hot-dip galvanizing.

    a. Pre-finished with baked-on polyester coating, not less than 1.0-mil thick.

3. Color: Provide material in color selected by Owner.

B. Galvanized Steel Sheet:

1. Steel Sheet: 24-gauge minimum, commercial quality.

2. Finishing: Galvanized, with minimum of 0.20 percent copper content. Complying with ASTM A653, G90 for hot-dip galvanizing, mill phosphatized, unless otherwise indicated.

C. Miscellaneous Materials and Accessories

1. Solder: Except as otherwise indicated or recommended by metal manufacturer, provide 100 percent lead free solder for tinning and soldering galvanized metal joints.

2. Visually Exposed Fasteners: Stainless steel pop rivets with heads finished to match color of pre-finished metal material.

3. Concealed Fasteners: Zinc coated, type as required and recommended by manufacturer for materials and substrates involved.

4. Mastic Sealant -- Polyisobutylene, non-hardening, non-skinning, non-migrating sealant typical for flashing lap joint applications.

2.2 FABRICATED UNITS

A. General

1. Shop fabricate metal counter flashings, cap and sill flashings, and similar items to comply with profiles and sizes shown, and to comply with standard industry details as shown by SMACNA in the “Architectural Sheet Metal Manual.”

2. Comply with metal producers’ recommendations for tinning, soldering, and cleaning flux from galvanized metal fabrications. Provide stainless steel rivets at exposed fastenings in pre-finished metal fabrications.

3. Form exposed sheet metal work without oil-canning, buckling and tool marks, true to line and level with exposed edges folded back to form hems.

4. Where movable joints are required for proper installation of mastic sealant, in compliance with SMACNA standards.

B. Pipe Jack Sleeve Fastenings

1. Fabricate pipe, roof penetration sleeves from galvanized material fully tinned and soldered at seams. Provide stack sleeve of diameter 1/2-inch greater than penetrating pipe and same height above with 3-inch high conical base and embedment flange 12-inch greater than diameter of base. Furnish flanges at top of stack sleeve for attachment of counter flashing cap.

2. Fabricate counter flashing cap with interior pipe sleeve and conical cap to fit over pipe and stack sleeve. Size interior sleeve to tightly fit pipe diameter and to into pipe not less than 3 inches. Size conical cap to extend not less than 3 inches below top of stack sleeve with space above to permit not less than 1-inch pipe movement. Rivet counter flashing cap to flanges of stack sleeve.

C. Counter Flashings

1. Fabricate counter flashings from galvanized material to size and profiles shown in 10-foot minimum lengths with continuous 20-gauge galvanized cleat at hemmed lower drip edge.

2. Where top leg of counter flashing is not covered by other applied materials or otherwise supported, provide with integral hemmed sealant dam and anchor to wall substrates with 1/8-inch by 1-1/2-inch galvanized float bar, prepared with fastener holes drilled or punched at 8-inch on center. Coordinate size of holes with anchors to be used. Form sealant dam with 3/4-inch minimum outward-turned hemmed leg.

3. At inside and outside corners, provide double lapped, tinned and fully soldered assemblies, shop assembled prior to installation. Do not solder flashing corners after installation other than to render remedial surface repairs. If joint separation should occur, remove flashings and re-solder as required.

D. Cap Flashings

1. Fabricate lap seamed cap flashings from galvanized material with hemmed drips on both sides and continuous 20-gauge galvanized cleat at front edge.

2. Shop assemble cap end-to wall closure flashings with double lapped, riveted, and mastic sealed construction. Provide vertical legs with sealant dam as required for counter flashings.

E. Wall Flashings

1. Fabricate wall flashings from galvanized material with flat locked, mastic filled vertical seams spaced not greater than 4 feet on-center.

2. Form as required to closely follow substrate profile and interlock with counter and cap flashing assemblies without exposed fasteners. Secure to walls with 20-gauge galvanized cleat concealed by edge hems.

2.3 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers and gutter accessories from same metal as gutter.

1. Gutter Profile: Style A according to cited sheet metal standard.

2. Expansion Joints: Built in.

3. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.

4. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricated Hanger Style: Fig 1-35A according to SMACNA's "Architectural Sheet Metal Manual."

2. Manufactured Hanger Style: Fig 1-34A according to SMACNA's "Architectural Sheet Metal Manual."

3. Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

C. Splash Pads: All downspouts to outlet to a splash pad.

1. Minimum 12”x24” splash block made of prefabricated reinforced concrete.

2. Installed per manufacturer’s requirements.

3. Manufactured by Oldcastle or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. Comply with manufacturer's instructions and recommendation for handling and installation of flashing and sheet metal work.

B. Coordination:

1. Coordinate Work with other work for the correct sequencing of items which make up the entire membrane or system of weatherproofing and rain drainage.

2. Coordinate Work of this Section with interfacing and adjoining work for proper sequence of each installation.

C. It is required that the flashing and sheet metal work be permanently water-tight, and not deteriorate in excess of manufacturer's published limitations.

D. Provide flashing and sheet metal work which is fully compatible with interfacing or adjoining work to ensure the best total assembly performance for weather resistance and durability.

3.2 INSTALLATION OF METAL WORK

A. Comply with details and profiles as shown and comply with SMACNA "Architectural Sheet Metal Manual" recommendations for installation of the work.

B. Non-Moving Seams: Provide sealed flat-lock seams, except as otherwise indicated. Comply with metal producers' recommendations for tinning, soldering and cleaning the joints of soldered work.

C. Provide for thermal expansion of all exposed sheet metal work exceeding 20-foot running length, except as otherwise indicated.

D. Conceal fasteners and expansion provisions wherever possible. Fold back edges on concealed side of exposed edges, to form a hem and stiffen material.

E. Provide flashing reglets as shown or as required to seal work to existing substrates. Seal assembled joint with sealant as indicated.

F. Do not proceed with the installation of flashing and sheet metal work until curb and substrate construction, blocking, and other construction to receive the work is completed.

G. Examine the substrate and the conditions under which flashing, and sheet metal work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.3 CLEANING AND PROTECTION

A. Clean visually exposed metal surfaces and other surfaces indicated to be painted. Remove corrosive substances, including soldering flux, which might cause deterioration of metal surfaces or final finish.

B. Provide surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration at time of acceptance by Owner.

END OF SECTION

SECTION 07 92 00 - SEALANTS AND CAULKING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish and install sealing or caulking joints between dissimilar materials for watertight seal.

B. Section includes:

1. Sealants
2. Filler gaskets
3. Primers and bond breakers

1.2 DEFINITIONS

A. Sealants: Where the words “sealants” or “caulking” are used in this text, they shall be considered to be synonymous and shall mean sealant or caulking compounds as specified under Part 2 of this specification.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product data and materials list of items proposed to be provided under this Section.

C. Sufficient technical data to demonstrate compliance with the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type A Sealant

1. Application: General building sealant.

2. Material: One component polyurethane sealant.

a. Vulkem 116, as manufactured by Tremco.
b. Sonolastic NP1, as manufactured by BASF.

B. Type B Sealant

1. Application - General building sealant for wide joints.

2. Materials - Self leveling one component polyurethane.

    a. Vulkem 45, as manufactured by Tremco

C. Filler Gasket (Backer Rod) Cord Strip

1. Ethafoam, as manufactured by Dow Chemical
2. Sonolastic Closed-cell Backer Rod, as manufactured by Sonneborn
3. Equal, as approved by ENGINEER

PART 3 EXECUTION

3.1 PREPARATION

A. Surfaces to receive caulking materials shall be thoroughly clean and free of any non-compatible primers or protective coatings, including lacquers, form coatings, clear sealers, etc.

B. Brush out all foreign matter and loose particles.

C. Clean metal surfaces with solvents and wipe dry while the surface is still wet with solvent.

3.2 INSTALLATION

A. Primers and Bond Breakers

1. Apply to surfaces as required; verify with manufacturer.

2. In general, prime all concrete and Portland cement-based plaster or grout surfaces.

3. Prime wood surfaces where specifically required.

4. Use proper type primers and bond breakers, apply per sealant manufacturer's printed instructions.

B. Sealants

1. Provide watertight caulked joints at all building exterior locations where possible water penetration through joint may occur.

2. If caulking systems for such joints are not shown, provide as specifically approved.

C. Gaskets or Fillers

1. Compress all gaskets to tight fit. Where required as backing for caulking system, roll or stretch in gasket sections to depth from sealant face or as shown (in general, to 3/8-inch).

2. Install gun grade material with gun nozzle of similar size as joint width as shown. Tool all beads, after application to assume full firm contact. Strike off excess material.

3. Maintain edge surfaces adjacent to joints clean and free of caulking stain and excess material. Trim joints as required per manufacturer's printed instructions.

4. Do not apply caulking materials to a "bleeding" type of surface, such as asphaltic or other oil-emitting types. Where such material occurs at caulking joint (roofing, etc.), isolate from caulking with gasket filler.

5. Avoid mixing any water in caulking mixture before and during application. Do not thin material.

3.3 CORRECTIONS AND CLEANUP

A. Remove all damaged, defective or improperly installed sealant and/or caulking and replace.

B. Clean and remove all sealant and caulking from adjacent surfaces.

C. Upon completion of the work, remove all disused implements, rubbish, and debris, and leave premises neat and clean.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

Standard hollow metal doors and frames.

B. Related Sections:

1. Division 08 Section 08 71 00 "Door Hardware" for door hardware for hollow metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings and removable stops.

C. Other Action Submittals:

Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.

E. Provide two material Samples for each color of Kynar Finish.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

Provide additional protection to prevent damage to finish of factory finished units.

1.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1.

Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements:

Ceco Door Products; an Assa Abloy Group company.
Fleming Door Products Ltd.; an Assa Abloy Group company.
Steelcraft; an Ingersoll-Rand company.
Approved equal.

1.
2.
3.
4.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 pounds per cubic foot density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

1.

A. Provide 1-3/4-inch thick doors of materials and ANSI/SDI-100 grades and models specified below, or as indicated on drawings or schedules:

Exterior Doors: Level 3, Model 3 – Seamless (with center rail)

a. Exterior doors shall be minimum 16-gauge galvanized or galvanealed steel with both lock and hinge rail edge of door intermittently welded, filled, and ground

smooth the full height of door. Exterior doors shall be insulated with a solid slab of expanded polystyrene or polyurethane foam permanently bonded to the inside of each face skin. The top of all doors shall be closed flush by the addition of a 16-gauge screwed-in top cap and sealed to prevent water infiltration. The bottom channel shall include weep-holes.

1) Ceco Door, Inc.
2) Curries, Inc.
3) Steelcraft, Inc.
4) Approved equal.

B. All doors shall be reinforced for hardware as shown below where necessary to preclude the use of thru-bolts.

Exit Devices: 14-gauge
Door Closers: 12-gauge

1.
2C. All doors shall be beveled 1/8-inch in 2-inch and shall have top and bottom channels of not less than 16-gauge, flush or inverted, welded to the face sheets. Doors shall have a full height 14-gauge hinge rail reinforcement channel, or individual 10-gauge hinge reinforcements.

D. All doors to conform to ANSI-A250.4 Level "A" criteria and shall be tested to 1,000,000 operating cycles and 23 twist tests. Certification of Level "A" doors is to be submitted with approval drawings by supplier upon request. Do no bid or supply any type or gauge of door not having been tested and passed these criteria.

2.4 STANDARD HOLLOW METAL FRAMES

A. Provide hollow metal frames for doors of types and styles as shown on the drawings and schedules. Conceal fastenings unless otherwise indicated.
1.

2.

Exterior Frames: Level 2, 16-gauge, galvanized or galvanealed

Security Grade Frames: 14-gauge

a. Ceco: SU Series
b. Curries: M Series
c. Steelcraft: F Series

B. All frames over 36-inch in width shall be 14-gauge.

C. Fabricate frames with mitered and faces only welded corners, re-prime at the welded areas. All welds to be flush with neatly mitered or butted material cuts.

D. All frames shall have minimum 7-gauge hinge reinforcements, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.

E. All frames shall have minimum 7-gauge hinge reinforcements with an additional high frequency 12-gauge hinge reinforcement welded to the top hinge, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.

F. Provide temporary shipping bars to be removed before setting frames.

G. Except on weatherstripped frames, drill stops to receive three silencers on strike jambs of single frames and two silencers on heads of double frames.

H. Provide minimum 0.0179-inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.5 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Astragals: Provide overlapping astragal on one leaf of pairs of doors where indicated. Extend minimum 3/4-inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or

1. handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

   Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:

3. 1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

4. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in
1. Division 08 Section 08 71 00 "Door Hardware."

2. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

3. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.

1. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Stops and Moldings: Provide stops and moldings around steel panel where indicated.
2. Form corners of stops and moldings with butted or mitered hairline joints.

Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

Provide loose stops and moldings on inside of hollow metal work.

2.6 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2. Finish Coat:

a. Door - Kynar 2-Mil Finish – Enduring Bronze
b. Frame –Kynar 2-Mil Finish – Enduring Bronze

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

1.

B. Prior to installation, adjust and securely brace welded hollow metal frames for

2. squareness, alignment, twist, and plumbness to the following tolerances:

Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.

Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

Plumbness: Plus or minus 1/16-inch, measured at jambs on a perpendicular line from head to floor.

3. C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

4.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

b. Install frames with removable glazing stops located on secure side of opening.

c. Install door silencers in frames before grouting.

d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. f. Field apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.

Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames so no gap exists. Caulking shall not be used to fill gaps greater than ¼".

D. Steel Panel: Comply with installation requirements in hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 DESCRIPTION

A. The WORK specified in this Section includes the requirements for furnishing and installing door hardware as designated in the Contract.

1. Furnish door hardware in accordance with hardware groups scheduled. Coordinate with existing City's master keying system.

2. Furnish templates and hardware list of hardware as required.

1.2 DEFINITIONS

A. References

1. American National Standards Institute (ANSI)

A115.1 – Specification for Standard Steel Door and Frame Preparation for Mortise Locks and 1-3/8-inch and 1-3/4-inch Doors.

A156.18 – Materials and Finishes.

2. ASTM International (ASTM)

a. E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

E152 – Fire Tests of Door Assemblies

E283 – Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.

3. Door and Hardware Institute (DHI) - A115 Series

a. RL - Recommended Locations for Builders Hardware for Standard Steel Doors and Frames.

4. Underwriter Laboratories (UL)

a. 10B – Fire Tests of Door Assemblies

5. Structural Specialty Code (SSC)

6. NFPA 101: Life Safety Code

1.3 SUBMITTALS

A. Comply with the requirements of Section 01 33 00.

B. Product Data: Submit manufacturer's product data for each item of door hardware, installation instructions, and maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

1. Final hardware schedule, incorporating the OWNER'S REPRESENTATIVE'S door numbering system, coordinated with doors, frames, and related WORK to ensure proper size, thickness, hand, function, and finish of door hardware.

2. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finish of each hardware item.

b. Name and manufacturer of each item.

c. Fastenings and other pertinent information.

d. Location of each hardware set cross-referenced to indications on the Drawings both on floor plans and in door and frame schedule.

e. Explanation of all abbreviations, symbols, and codes contained in schedule.

f. Mounting locations for hardware.

g. Door and frame sizes and materials.

h. Keying information.

C. Templates for doors, frames, and other WORK specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

A. Supplier shall have a factory direct status with all manufacturers specified.

1.5 PROJECT CONDITIONS

A. Coordinate the WORK with other directly affected Sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

B. Provide construction cylinders during Project's construction through arrangement with the specified cylinder manufacturer. Return-for-credit arrangements with cylinder manufacturer at the end of construction.

C. Coordinate OWNER'S keying requirements during the course of the WORK.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers

1. Acceptable Manufacturers: As follow:

a. Butts and Hinges: McKinney, Stanley. "MCK, STN"
b. Lockset and Latchset: Best lock. "BST"
c. Cylinders: Best lock. "BST"
d. Overhead Closers: LCN, Norton. "LCN, NTN"
e. Stops: Quality. "QLTY"
f. Gasketing: Pemko. "PEM"
g. Thresholds: Pemko. "PEM"
h. Latch Guards: Glynn-Johnson. "GLN"
i. Astragals: Pemko. "PEM"

B. General

1. Fasteners

a. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.

b. Where necessary, furnish fasteners with toggle bolts, expansion shields, sex bolts, and other anchors approved by the OWNER'S REPRESENTATIVE, according to the material to which the hardware is to be applied and according to the recommendations of the hardware manufacturer.

c. Provide fasteners, which harmonize with the hardware as to finish and material.

2. Where butts are required to swing 180 degrees, furnish butts of sufficient throw to clear the trim.

3. Furnish silencers for doorframes at the rate of three for each single door and two for each door or pair of doors except weather-stripped doors and doors with light seals, smoke seals or sound seals.

4. Tools and Manuals: Deliver to the OWNER one complete set of adjustment tools and one set of maintenance manuals for locksets, closers, and panic devices in accordance with Project close-out requirements.

C. Keying

1. Door Locks: The city will provide all keys and keying, using Best 5C keyway system to establish the facility standards.

2. Provide a construction keying system for Contractor's and/or City's use during construction. Provide five construction keys for City use during construction period. Contractor shall retain construction keys and inserts and turn over to the City upon completion of construction.

3. Coordinate the changeover to permanent keyways with the City at completion of station commissioning.

D. Hinges

1. Provide butt hinges of the five-knuckle, full mortise type, having two or four ball or iolite bearing as noted, stainless steel pins, and complying with ANSI A156.1.

2. Provide all out swinging doors to the exterior with butt hinges of the stainless steel or non-ferrous materials, with non-removable pins of the set screw.

3. Hinge size: Door 1-3/4-inch in thickness to 38-inch in width shall be provided with 4-1/2-inch x4-inch butt hinges provided with at least two ball or iolite bearing; wider and heavier doors with 5-inch x 4-1/2-inch extra heavy butt hinges provided with four ball or iolite bearing.

4. Number of hinges per door leaf: Provide three hinges per leaf for door up to 86-inch high, one additional butt hinge for each additional 30 inches of height, or fraction thereof.

E. Locksets and Latchsets

1. Cylinders: The Contractor shall furnish and install all screw-in type cylinders and keyways to establish the facility standard. The Contractor shall provide construction cylinders and keys for use during construction. Following acceptance, City will re-key the cylinders with Best 5C cylinders.

2. Lock Type: For all exterior doors where cylindrical locksets or latches are called for, provide locks of the Best 9K Heavy Duty Lever Type, with backset of 2-3/4-inch, unless otherwise noted. Provide all locks for the entire Project from the same manufacturer.

3. Design: Provide lever handles at all locksets of the Best 9K Series, unless otherwise noted.

4. Strikes: Provide each lockset, handset, or deadlock with a box strike. Provide standard type strikes with extended lips where required to protect adjacent trim from being marred by latch bolt. Verify cutout types provided in metal frames.

5. All padlocks shall be provided and installed by the Owner when it takes over the operation of the facility. During construction the contractor is to provide temporary construction padlocks as needed. Contractor is to provide the Owner a minimum of five construction keys for use during the construction period.

F. Closers

1. General

a. Comply with SSC, Section 905.3 and Section 1003.3.1.5 for maximum effort to operate doors.

b. Closers are attached with sex bolts.

c. Adjust closers in accordance with manufacturer's directions for size of door.

d. Provide modern closers having:

1) Full rack and pinion with steel spring and non-gumming, nonfreezing hydraulic fluid.

2) Provide complete set of separate controls for regulating sweep speed, latch speed, backcheck, and backcheck positioning. Sizes as recommended by reviewed manufacturer.

2. Door Surface Applied Modern Closers

a. Provide drop plates at doors having narrow frames.
b. Product: LCN or approved equal.

3. Quantity: Provide each leaf in pairs of doors scheduled to receive closers.

G. Stops and Holders

1. It is the intent of these specifications that each door leaf is provided with a door stop.

Built-in stops in door closers, wall bumpers, and overhead stops, where called for, shall satisfy the requirements of this paragraph. Provide stops of proper size and height to prevent doors from hitting walls of fixed objects.

H. Thresholds

1. Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum and shall provide proper clearance and an effective seal with specified gasketing. Threshold shall be set in a full bed of mastic.

2. Provide countersink, flathead screws, same material and finish as threshold.

I. Door Bottom

1. Door Bottoms shall be surface type with aluminum housing cover, anodized clear finish. Door bottoms shall have a neoprene seal and shall be actuated by the opening and closing of the door. The door bottoms shall exclude light when the door is in the closed position and shall inhibit the flow of air through the unit.

2. Provide countersink, flathead screws, same material and finish as door bottom.

J. Gasketing

1. Gasketing shall be compressive type seal, silicon based, self-adhesive product for use on steel door frames with steel doors for 20 minutes and1-hour B labels. Air leakage rate of weather-stripping shall not exceed 0.5 cubic feet per minute per linear foot of crack when tested in accordance with ASTM E283 at standard test conditions.

2. Provide countersink, flathead screws, same material and finish as door gasketing.

K. Silencers

1. Provide each door with a press-metal frame with rubber silencers. Omit at doors to receive gasketing. Provide each single door with three silencers, each pair of doors with four.

L. Finishes

1. All hardware shall have brushed chrome finish (626) for interior and exterior installation typically, unless noted otherwise.

    a. Provide over steel base metal (BHMA 626), typical, where required by code.

    b. Provide over bronze base metal (BHMA 612) for exterior installations and unheated spaces expose to the weather, unless otherwise noted. Exterior installations include exit doors to covered exterior pads and walkway locations, loading dock areas, areaways, and where noted.

2. All thresholds and weather-strip shall be fabricated of extruded aluminum, clear anodized finish, to match specified finish of other aluminum, unless noted otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of AMSI/NFPA 80, and DHI. Use the templates provided by the hardware item manufacturer.

B. Provide architectural finish hardware with all necessary (plus prudent spares) screws, bolts, or other devices or fastenings of suitable size and type to secure the hardware in position for heavy use and long life, harmonizing as to material and finish. These fastening shall be furnished, where necessary, with expansion shields or other approved anchors according to the material to which it is applied and as recommended by the manufacturer. Secure all hardware to concrete with expansion sleeve anchors as indicated by best current practice; plastic or "Rawl" plugs will not be permitted. Hardware screws shall be of sufficient length to firmly engage backing and shall be fully threaded. All screws normally exposed to view, including all screws for butt hinges, shall have "Phillips" heads, finish to match hardware.

C. Keying:

1. City will remove construction plugs and install permanent cylinders as required.

2. The master key chart will be furnished by the City. The City is responsible for all keying and permanent keys. Contractor shall provide construction cylinders and keys as required during construction.

3.2 FINISHING

A. Typical: Brushed stainless steel, US32D.

B. Adjusting, Cleaning, and Demonstrating

1. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made. The operation of the ventilation system does not cause doors to slam shut or fail to close completely.

a. Adjust operation of all doors to meet ADA and SSC, Section 905.3 and Section 1003.3.1.5 for requirements for opening force.

b. Where door hardware is installed more than 1 month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.

c. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Clean adjacent surfaces soiled by hardware installation.

D. Instruct OWNER'S personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3.3 HARDWARE GROUPS

A. The following manufacturer's number designations are used in hardware groups:

Butts	Lawrence
Cylinders	Meet OWNER requirements
Lockset	Best
Latchset	Best
Panic Bar	Von Duprin
Thumb Latch	Von Duprin
Closer	LCN
Extension Flush Bolts	Glynn Johnson
Stops/Holders	Glynn Johnson
Silencers	Ives
Stile	Pemco/Mfg.
Thresholds	Pemco
Weatherstripping	Zero

B. Hardware Group 1 (Exterior Single Doors)

Quantity	Item
2	Keys
1	Closer
1	Lockset (Key from exterior, Interior always unlocked)
1	Cylinder
1	Panic Bar
1.5 PR	Butts
2	Drip Caps (3/0 EA)
1	Threshold
1 Set	Weatherstripping
3	Silencers

C. Hardware Group 2 (Exterior Double Doors)

Quantity	Item
2	Keys
2	Closer
1	Lockset (Key from exterior, Interior always unlocked)
1	Cylinder
2	Panic Bars
3 PR	Butts
2	Stop & Hold
2	Drip Caps (6/0 EA)
1	Threshold
2 Set	Weatherstripping
6	Silencers
2	Flush Bolts
1	Astragal

END OF SECTION

SECTION 09 20 10 - GYPSUM WALLBOARD

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the work necessary to furnish and install gypsum drywall and accessories where shown on the Drawings, as specified herein and as needed for a complete and proper installation.

B. Section includes:

1. Gypsum wallboard
2. Metal trim
3. Jointing systems
4. Fastening devices
5. Access doors

C. Related Work:

1. Section 06 10 00 - Rough Carpentry.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
2. ASTM C1396 - Standard Specification for Gypsum Board.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.
B. Product Data: Manufacturer's data sheets on each product to be used.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GYPSUM WALLBOARD

A. General: Provide gypsum wallboard complying with ASTM C1396, in 48-inch widths and in such lengths as will result in a minimum of joints.

B. Regular wallboard: Provide 5/8-inch thick, except as may be shown otherwise on the Drawings.

C. Fire-retardant wallboard: Provide Type X, 5/8-inch thick.

D. Fire-resistant wallboard: Provide Type C, 5/8-inch thick, except as may be shown otherwise on the Drawings.

E. Foil-backed wallboard -- Provide as shown on the Drawings.

2.2 METAL TRIM

A. Form from zinc-coated steel not lighter than 26-gauge, complying with Fed Spec QQ-S0775, Type I, class D or E.

B. Casing beads

1. Provide channel shapes with an exposed wing and with a concealed wing not less than 7/8-inch wide.

2. The exposed wing may be covered with paper cemented to the metal but shall be suitable for joint treatment.

C. Corner beads

1. Provide angle shapes with wings not less than 7/8-inch wide and perforated for nailing and joint treatment or with combination metal and paper wings bonded for joint treatment.

D. Edge beads for use at perimeter of ceilings

1. Provide angle shapes with wings not less than 3/4-inch wide.
2. Provide concealed wing perforated for nailing and exposed wing edge folded flat.
3. Exposed wing may be factory-finished in white color.

2.3 JOINTING SYSTEM

A. Provide a jointing system, including reinforcing tape and compound, designed as a system to be used together and as recommended for this use by the manufacturer of the gypsum wallboard approved for use on this Work.

B. Jointing compound may be used for finishing if so recommended by its manufacturer.

2.4 FASTENING DEVICES

A. For fastening gypsum wallboard in place on metal studs and metal channels, use flat-head screws, shouldered, specially designed for use with power-driven tools, not less than 1-inch long, with self-tapping threads and self-drilling points.

B. For fastening gypsum wallboard in place on wood, use 1-1/4-inch type W bugle-head screws or annular ting type nails complying with ASTM C514 and of the length required by governmental agencies having jurisdiction.

2.5 ACCESS DOORS

A. In partitions and ceilings installed under this Section, provide doors where required for access to mechanical installations, electrical installations, and attic spaces.

B. Types:

1. Unless otherwise required, provide 22-inch by 30-inch metal access doors with concealed hinges to metal frame and with Allen key lock.

2. For piercing fire-rated surfaces, provide access doors having the same fire rating as the surface being pierced.

3. Provide prime-coated steel access doors and frames for finish painting to be performed at the job site under Section 09 90 00, Painting and Coating.

2.6 OTHER MATERIALS

A. Provide other materials not specifically described but required for a complete and proper installation, as selected by the CONTRACTOR subject to the approval of the ENGINEER.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Correct conditions detrimental to timely and proper completion of the Work.
C. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install gypsum wallboard in accordance with the Drawings and with the separate boards in moderate contact but not forced into place.

2. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.

3. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.

B. Ceilings:

1. Install gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.

2. Wallboard may be installed with the long dimension parallel to supporting members that are spaced 16-inch on centers when attachment members are provided at end joints.

C. Walls:

1. Install the gypsum wallboard to studs at right angles to the furring or framing members.

2. Make end joints, where required, over framing or furring members.

D. Attaching:

1. Drive the specified screws with clutch-controlled power screwdrivers, spacing the screws 12 inches on centers at ceilings and 16 inches on centers at walls.

2. Where framing members are spaced 24 inches apart on walls, space screws 12 inches on centers.

3. Attach double layers in accordance with the pertinent codes and the manufacturer's recommendations as approved by the ENGINEER.

4. Attach to wood as required by governmental agencies having jurisdiction.

E. Access Doors:

1. By careful coordination with the Drawings and with the trades involved, install the specified access doors where required.

2. Anchor firmly into position and align properly to achieve an installation flush with the finished surface.

3.3 JOINT TREATMENT

A. General:

1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.

2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees Fahrenheit (F) for 24 hours prior to commencing the treatment and until joint and finishing compounds have dried.

3. Apply the joint treatment and finishing compound by machine or hand tool.

4. Provide a minimum drying time of 24 hours between coats with additional drying time in poorly ventilated areas.

B. Embedding Compounds:

1. Apply to gypsum wallboard joints and fastener heads in a thin uniform layer.

2. Spread the compound not less than 3-inch wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.

3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6-inch wide at joints, and feather edged.

4. Sandpaper between coats as required.

5. When thoroughly dry, sandpaper to eliminate ridges and high points.

C. Finishing Compounds:

1. After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and fastener heads.

2. Feather the finishing compound to not less than 12-inch wide.

3. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care to not scuff the paper surface of the wallboard.

3.4 CORNER TREATMENT

A. Internal Corners:

1. Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.

B. External Corners:

1. Install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.

2. Space the fasteners approximately 6-inch on centers and drive through the wallboard into the framing or furring member.

3. After the corner bead has been secured into position, thread the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from 8-inch to 10-inch on each side of the corner.

3.5 OTHER METAL TRIM, GENERAL

A. The Drawings do not purport to show all locations and requirements for metal trim.

B. Carefully study the Drawings and the installation and provide all metal trim normally recommended by the manufacturer of the gypsum wallboard approved for use in this Work.

3.6 CLEANING UP

A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.

B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 GENERAL

A. This specification is applicable to coated pipe, steel, concrete and other surfaces listed in the coating schedule at the end of this section.

B. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

C. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

D. Related Work Specified in Other Sections -- Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the ENGINEER to unify a wall finish or color scheme, at the ENGINEER's discretion.

E. Exclusions -- Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze and other corrosion-resistant material (except for valve bodies and piping); Electrical switch-gear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits and items specified elsewhere for special linings and coatings.

F. Damaged Factory Finish -- If directed by the ENGINEER, refinish the entire exposed surfaces of equipment chipped, scratched or otherwise damaged in shipment or installation.

G. All coating coming in contact with potable water shall be NSF approved.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. "Systems and Specifications" - Volume 2 of Steel Structures Painting Council (SSPC).

3. National Sanitation Foundation (NSF) Standard No. 61.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Pipe Coating Commercial Standards

ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
ANSI/AWWA C210	Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
ANSI/AWWA C214	Tape Coating systems for the Exterior of Steel Water Pipelines.

D. Federal Specifications

DOD-P-23236A(SH)	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast.

1.3 CONTRACTOR SUBMITTALS

A. Coating Materials List -- The CONTRACTOR shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein. The amount of copies to submit shall be as specified within Division 01- General Requirements.

B. Coating Manufacturer's and Applicator Information -- For each coating system to be used the CONTRACTOR shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet (MSDS) for each product used.

6. The manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate -- Submit manufacturer's certificate of compliance with the specifications and standards signed by a representative in the manufacturer's employ.

9. Samples -- Provide painted surface areas at the job for approval of main color selections, or submit sample on 12-inch sample of substrate using required finish system at ENGINEER’s discretion.

1.4 QUALITY ASSURANCE

A. The CONTRACTOR shall give the ENGINEER a minimum of three (3) days advance notice of the start of any field surface preparation work of coating application work, and a minimum of seven (7) days advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval to perform such work in its absence.

C. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

D. Surface Preparation -- Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

E. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be provided by the CONTRACTOR to cover all areas to be inspected.

F. Paint Products -- No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the CONTRACTOR and ENGINEER may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

G. Manufacturer's Representative -- Require coating manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

H. Labels -- Deliver to the job site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

I. Colors -- Colors will be selected from manufacturer's standard colors as reviewed by ENGINEER and approved by the OWNER. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of manufacturer's standard colors, provided that the manufacturer's product line represents a color range comparable to similar products of other manufacturers.

J. Flame Spread -- Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

K. Film Thickness Testing -- On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using wet film gage readings and destructive film thickness tests.

1.5 DELIVERY, HANDLING AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Do not apply coating in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips or other damage.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions -- The terms "paint," "coatings" or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General -- Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility -- In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors -- All colors and shades of colors of all coatings shall be as selected or specified by the ENGINEER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the ENGINEER. Color pigments shall be lead free.

F. Protective Coating Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS

A. General

Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications and as directed by the ENGINEER. Coat all existing and new exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this section or on the drawings or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows

1. Coating System 100

a. Location -- Exposed, unprimed, non-galvanized, nonsubmerged metal surfaces, both interior and exterior including piping and structural steel.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply prime coat and topcoat, 4.0-6.0 mils each coat of Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

2. Coating System 101

   a. Location -- Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tnemec-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 66 Hi-Build Epoxoline, and 3.0 - 4.0 mils DFT of Tnemec Series 73 Endura Shield, or approved equal. Color as selected by OWNER.

3. Coating System 102

   a. Location -- Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel and all other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime, intermediate and topcoat, 4.0-6.0 mils each coat of Tnemec Series 20 Pota-Pox, or approved equal. Color as selected by OWNER.

4. Coating System 103

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Paint System -- Apply two coats 2.0-3.0 mils each, Kop-Coat Bitumastic Super Service Black, or approved equal.

5. Coating System 104

   a. Location - Nonsubmerged, exposed to view, PVC piping.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply one coat, 4.0-6.0 mils Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

6. Coating System 105

    a. Location – Nonsubmerged, exposed to view, HDPE and polyurethane coated surfaces.

    b. Surface Preparation – As specified herein.

    c. Coating System – Apply two coats, 3.0 - 4.0 mils DFT of Tnemec Series 73 Endura Shield, or approved equal. Color as selected by OWNER.

2.3 SPECIAL PIPE AND SEVERE SERVICE COATING SYSTEMS

A. General

The following coatings are for buried pipe and surfaces used in severe service conditions. The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " 'Or-Equal' Clause" in Division 01- General Requirements.

B. Special pipe and severe service coating systems shall be as follows:

1. Coating System 200 -- Cement Mortar Coating

    a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

    b. Surface Preparation - As specified herein.

    c. Coating System -- A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to three (3) parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least six (6) inches. At the ENGINEER's discretion, the hot applied coal tar epoxy coating may be used as the curing membrane for the mortar coating.

2. Coating System 201 -- Hot Applied Coal Tar Epoxy Coating

    a. Location -- Exterior surface of concrete pipe and cement-mortar coated pipe and fittings.

    b. Surface Preparation -- As specified herein.

c. Coating System -- The hot applied coal tar epoxy shall be a solvent free 100 percent solids coal tar epoxy chemically compatible with hydrating cement and suitable for application on moist surfaces of freshly placed cement mortar or concrete and properly prepared cured surfaces. The coal tar epoxy coating material shall be Amercoat 1972B or approved equal. The finish coal tar epoxy coating shall have a minimum DFT of 26 mils.

3. Coating System 202 -- Coal-Tar Epoxy Coating System

   a. Location -- Exterior surface of buried steel pipe, fittings and other ferrous surfaces.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- High build, 2-component amine or polyamide cured coal-tar epoxy shall have a solids content of at least 68 percent by volume, suitable as a long term coating of buried surfaces, and conforming to AWWA C210. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field. The coal-tar epoxy coating system shall include:

      1) Prime coat (DFT = 1.5 mils), Amercoat 83HS, Tnemec P66, or equal.

      2) Finish coats (2 or more, DFT = 18 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

      3) Total system DFT = 19.5 mils.

4. Coating System 203 -- Fusion Bonded Epoxy

   a. Location -- Ferrous surfaces of sleeve couplings, steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

      1) Liquid Epoxy -- For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT 16 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

      2) Coating (DFT = 16 mils), Scotchkote 203, or equal.

3) Total system DFT = 16 mils.

5. Coating System 204 -- Hot, Coal-Tar Enamel

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation - As specified herein

   c. Coating System -- Coal-Tar Enamel materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a primer layer, coal-tar enamel layer, coal-tar saturated nonasbestos felt outerwrap and a finish coat. Total system DFT = 188 mils.

6. Coating System 205 -- Hot Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a cold-applied liquid primer and heated coal-tar base tape. Total system DFT = 50 mils.

7. Coating System 206 -- Cold Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consists of a primer layer, inner layer tape of 35 mils, and an outer layer tape of 35 mils. Total system DFT = 70 mils.

8. Coating System 207 -- PVC Tape

   a. Location -- Small galvanized steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils.

9. Coating System 208 -- Mastic

    a. Location -- Pipe and fitting joints, and general buried surface coating repair and touch up.

    b. Surface Preparation - As specified herein.

    c. Coating System -- Mastic shall be a one-part solvent drying heavy bodied thixotropic synthetic elastomeric coating with chemically inert resins and fillers and an average viscosity of 650,000 CPS at 77 degrees Fahrenheit, thereby requiring generous applications by hand or trowel. Total coat thickness shall be 30 mils, minimum. Mastic shall be Protecto Wrap 160 H or approved equal and be fully compatible with pipeline coating systems.

10. Coating System 209 -- Polyethylene Encasement

    a. Location -- Ductile iron, steel and concrete cylinder pipe and fittings.

    b. Surface Preparation -- None required.

    c. Coating System -- Except as otherwise specified, application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

11. Coating System 210

    a. Location – Wet well interior concrete surfaces where shown.

    b. Surface Preparation – Per manufacturer's requirements, pressure wash concrete interior and apply non-shrink grout to all voids prior to coating application. Surface shall be clean and free of all foreign materials. Saturate surface immediately prior to application. Surface shall be damp but without running water or noticeable droplets of free water.

    c. Coating System -- Apply Strong Seal High Performance Mix cementious coating by Strong Company, or approved equal, in one or more passes, to a thickness of ¾-inch. Thickness at any location shall not exceed 1-inch nor be less than ½-inch. Trowel surface to a smooth finish, but avoid over-trowelling.

12. Coating System 211

    a. Location – Force main discharge manholes interior concrete surfaces.

    b. Surface Preparation – Per manufacturer's requirements, pressure wash concrete interior and apply non-shrink grout to all voids prior to coating application. Perform the manufacturers 7-point checklist evaluation and fill any

cracks with a chemical or hydraulic sealant designed for sealing and stopping ground water. Surface shall be clean and free of all foreign materials.

c. Coating System – Solvent-free 100% solids, self-priming polyurethane coating system, thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance with high physical strengths and broad range of chemical resistance. Coating shall be meet these requirements:

Compressive Strength, psi	18,000
Tensile Strength, psi	7,450
Tensile Elongation, %	<4%
Flexural Modulus, psi	735,000
Adhesion	Excellent
Superior Corrosion Resistance	

d. Polyurethane liner coating system shall be applied by a certified applicator of the manufacturer and according to manufacturer specifications.

e. Coating system shall be Sprayroq system using a spray on self-priming polyurethane mixture.

2.4 ARCHITECTURAL COATING SYSTEMS

A. General

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

Fungus Control: Submit evidence for all paints attesting the passing of Federal Test Method Standard No. 141, Method 6271.1 showing no fungus growth or other approved test results.

Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Acrylics require 60 degrees Fahrenheit (°F) and above temperature and below 50 percent relative humidity. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.

B. Architectural coating systems shall be as follows:

1. Coating System 300

a. Location -- Exterior above grade concrete, brick, block masonry and stucco surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- Surfaces shall be cleaned with a manufacturers approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint and other contaminants before the coating system is applied. Coating system shall be applied according to the manufacturers published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty.

c. Coating System -- Apply two flood coats of an RTV silicone rubber water repellent and graffiti protectant, Chemprobe Series 626 Dur A Pell GS, or equal. All coatings to be clear. Apply per manufacturer's instructions.

2. Coating System 301

a. Location -- Vertical concrete exterior walls and flat concrete exterior roofs and slabs exposed to view.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply two coats 6.0-9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by OWNER.

3. Coating System 302

a. Location -- Interior concrete masonry unit walls and interior and exterior wood walls, ceilings and other wood surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- As specified herein.

c. Coating System -- Prime as specified by coating manufacturer. Apply two coats 6.0 - 9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by OWNER.

4. Coating System 303

a. Location -- Wood surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply an alkyd primer as recommended by the manufacturer, two (2) mils. Apply finish coats (two (2) or more coats six (6) mils total) of single component, water based acrylic latex coating, Tnemec Series 6, Carboline Carbocrylic 3350 or equal. Total DFT = eight (8) mils. Color as selected by OWNER.

5. Coating System 304

    a. Location -- Interior drywall surfaces not otherwise specified, exposed to view.

    b. Surface Preparation - As specified herein.

    c. Coating System -- Apply two (2) coats 2.0 - 3.0 mils each coat of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Color as selected by OWNER.

6. Coating System 305

    a. Location – Horizontal concrete surfaces, interior floor surface, vertical exterior brick or masonry surfaces, exposed to view.

    b. Surface Preparation -- Surfaces shall be cleaned with a manufacturers approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint and other contaminants before the coating system is applied. Coating system shall be applied according to the manufacturers published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty.

    c. Coating System -- Apply two coats of masonry water retardant material. The system shall be clear, non-staining, silane-modified-siloxane, Chemprobe Dur A Pel 20, Tex-Cote Rainstopper 1500, or equal. The selected coating system shall provide a minimum of a 5-year manufacturer's warranty.

7. Coating System 306

    a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

    b. Surface Preparation -- Per manufacturer's requirements, surface shall be clean and free of all oil, grease, dirt, laitance, and loose or foreign materials. Surface shall be dampened with water and kept damp until application of the coating.

    c. Paint System -- Apply two coats of BASF MasterSealor approved equal, in accordance with manufacturer's recommendations. Allow first coat MasterSeal 610 to dry tacky before applying second coat of MasterSeal 614. Ensure a continuous, pinhole-free coating from the top and outside edge of the footing to the finished grade.

    d. Backfilling -- Follow manufacturer recommendations for backfilling. Provide protection board or geotextile fabric to protect the coating from damage while backfilling. Geotextile fabric shall be Mirafi 140N, or approved equal.

8. Coating System 307

   a. Location -- Exterior siding, trim and related products, all comprised of fiber cement material with a factory installed primer.

   b. Surface Preparation – If cleaning is required, surface shall be cleaned with a in a manner approved by both the coating system manufacturer and the siding manufacturer. Under no circumstances shall fiber cement siding products be cleaned with high pressure water blasting, sand blasting, or acid washing as these techniques may damage the surface of the fiber cement. Low pressure water spray and a medium-stiff, nonmetallic bristle brush may be used for cleaning fiber cement products. Coating system shall be applied according to the coating system manufacturer's published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty. Coating system must be applied within 180 days of installation of the factory primed siding products, or less if the siding product manufacturer's warranty requires painting in less than 180 days.

   c. Coating System -- Apply primer coat of high performance acrylic primer/sealer specifically engineered for high-performance protection of exterior, above-grade, cementitous surfaces and fiber cement siding. Apply topcoat of 100% acrylic latex, cross-linked. The system shall Sherwin Williams Loxon Concrete & Masonry Primer/Sealer and Sherwin Williams Emerald Exterior Acrylic, or approved equal. The selected coating system shall provide a minimum of a five-year manufacturer's warranty.

PART 3 EXECUTION

3.1 STORAGE, MIXING AND THINNING OF MATERIALS

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing -- Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification.

1. Solvent Cleaning (SSPC-SP1) -- Removal of oil, grease, soil, salts and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.

2. Hand Tool Cleaning (SSPC-SP2) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) -- Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.3 CORRECTIONS AND CLEANUP

At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair and cleaning to the satisfaction of the ENGINEER. Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.4 SURFACE PREPARATION

A. General

Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the ENGINEER prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by coating manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

1. Exposed metal items, nonsubmerged, unprimed, non-galvanized both interior and exterior, including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

2. Exposed metal items, shop primed, both interior and exterior including: piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose or peeling or chipped paint.

3. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

4. Stainless Steel - Nonsubmerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

5. Polyvinyl Chloride (PVC) - Nonsubmerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

6. Nonsubmerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds or other incompatible matter. Etch and prime if required by manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

7. Concrete Masonry Units -- Repair all breaks, cracks and holes with concrete grout. The surface must be free of dirt, dust, loose sand and other foreign matter. Brush

clean. Allow minimum 28-day cure of concrete joint mortar and repair grout prior to application of coatings system.

8. Wood -- Wood surfaces shall be thoroughly cleaned and free of all foreign matter with cracks, nail holes and other defects properly filled, smoothed and sandpapered to fine finish. Wipe clean of dust.

9. Preparation of All Existing Coated Surfaces -- Removed rough and defective coating film from material surfaces to be painted. Touch up with approved primer. Clean all greasy or oily surfaces, to be painted, with benzine or mineral spirits or Rodda's Gresof before coating, or as recommended by manufacturer. For walls, patch existing nicks and gouges, sand to match wall finish.

3.5 PRIME COATING

A. Exposed Steel -- Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above.

B. Galvanized Metal -- After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 66 Hi-Build Epoxaline or equal, verifying with manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal -- Where indicated on the plans or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.2 above, the CONTRACTOR shall apply intermediate and topcoats of the specified paint system to shop primed metal. The CONTRACTOR shall verify with the manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping -- Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

E. Cast-In-Place Reinforced Concrete -- After surface preparation specified above, prime coat concrete as specified in the coating schedule found elsewhere in the specifications.

F. Concrete Masonry Units -- After surface preparation specified above, prime coat as specified in the coating schedule found elsewhere in the specifications.

G. Wood Surfaces -- Following surface preparation specified above, prime coat exterior exposed wood surfaces with appropriate coating system as specified in the painting schedule.

3.6 FIELD PRIME

Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or returned to the shop for resurfacing and repriming, at the ENGINEER's discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 APPLICATION

A. Thickness -- Apply coatings in strict conformance with the manufacturer's application instructions. Apply each coat at the rate specified by the manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Porous Surfaces -- Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Ventilation -- Adequately ventilate enclosed rooms and spaces during painting and drying periods.

H. Drying Time -- Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather or drying conditions. Coating manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 COATING SCHEDULE

Provide protective coatings in accordance with following Coating Schedule:

Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed and in vaults (exterior surface)	Ductile Iron	Coating System 101
Piping	In Wet Well (exterior surface)	Ductile Iron	Coating System 102
Piping	Buried	Ductile Iron	See Note 5
Valves & Couplings[2]	All	--	See Note 2
Concrete Wet Well	Interior	Concrete	No Coating
Force Main Discharge Manhole	Interior	Concrete	Coating System 211
Exterior Walls (below grade)	Wet Well and Vault	Concrete	Coating System 306
Concrete Floors and Slabs	All Interior Floors, All Exterior Slabs, Landings and Sidewalks	Concrete	Coating System 305
Miscellaneous Metals	Exposed Surfaces, Exterior and Interior	Steel, Galvanized Steel	Coating System 101
Interior Ceiling and Walls	Building Interior, Exposed Surfaces	Gypsum Board	Coating System 304
Interior of CMU Walls	Building Interior, Exposed Surfaces	Concrete Masonry	No Coating
Exterior of CMU Walls	Building Exterior Surfaces	Concrete Masonry	Coating System 305
Interior Trim	Building Interior, Exposed Surfaces	Wood	Coating System 303
Exterior Walls: Siding, Battens, Trim, Fascia & Soffit	Building Exterior, Exposed Surfaces	Cementitious fiber	Coating System 307
Doors	Exposed Surfaces, Interior & Exterior Surfaces	Steel	Coating System 101

Notes:

1 Pipe linings shall be as specified elsewhere in these specifications.

2 Coating of exposed valves and couplings to be shop-applied fusion-bonded epoxy. Finish coat shall be same coating system as adjacent piping to match in color and total mil thickness, unless otherwise directed by the ENGINEER

3 Refer to other specification sections for coating requirements of specific equipment and items.

4 See sheet A-2 for Material Finish Schedule of architectural items.

5 Lining and Coating for buried ductile iron piping and fitting shall be as specified in Section 33 31 23 Sanitary Sewerage Force Main Piping.

END OF SECTION

SECTION 10 14 10 - IDENTIFYING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish and install, complete, identifying devices for the Project.

B. Section includes:

1. Process pipe color coding and labeling
2. Process equipment nameplates
3. Door and warning signs

1.2 RELATED SECTIONS:

A. Section 40 05 13 - Common Work Results for Process Piping

1.3 STANDARDS, SPECIFICATIONS, AND CODES

A. All safety related signs, markers, labeling, and symbols shall conform to the applicable provisions or codes of the Occupational Safety and Health Administration (OSHA), unless specifically modified hereinafter.

B. All signage providing emergency information or general circulation directions, or identifies rooms for the physically handicapped, shall comply with the requirements of the latest edition of American National Standards Institute (ANSI A117.1).

1.4 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Manufacturer's Data - Specifications and installation instructions for each type of sign required.

C. Samples - Submit three full size samples of each color and finish of pipe labeling, process equipment nameplates, and warning signs with sample letters.

1. ENGINEER's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.

2. Submit samples of any other special identifying or signing provided for elsewhere in this specification.

PART 2 PRODUCTS

2.1 PIPE LABELING AND COLORS

A. Unless noted otherwise on the Drawings or specified differently hereinafter, pipe labeling and colors shall conform to the following schedule:

Service	Symbol (label)	Symbol Color (label)	Pipe Color
Potable Water	PW	White	-
Non Potable Water	NPW	Green	-
Drains	D	White	Gray
Raw Sewage	RS	Green	Tan
Vents	V	Black	Green
Misc. Piping	As directed by the ENGINEER	As directed by the ENGINEER	As directed by the ENGINEER

B. Pipe identification labels and flow direction arrows shall consist of lettering and symbols applied over the pipe base color.

C. Coating systems and surface preparation requirements used in color coding piping and lettering and flow arrows shall be as specified in Section 09 90 00, Painting and Coating.

2.2 PROCESS EQUIPMENT NAMEPLATES

A. Nameplates shall be used to identify all process equipment including but not limited to pumps, chlorinators, control panels, and any other equipment requiring identification as directed by the Engineer.

B. Fabricated from 1/16-inch thick satin-surfaced Setonply, all edges beveled neatly.

C. Furnish with drilled holes for mounting to the appropriate equipment or nearest adjacent surface. As an alternative, acceptable adhesive attachment methods may be used if approved by the Engineer.

D. Nameplate background color, lettering color, and wording shall be as directed by the Engineer and approved by the Owner.

E. Minimum Size: 4-inch x 1-1/2-inch.

F. Manufacturer: Seton Nameplate Company, New Haven, CT, Style 2060-40 or approved equal.

2.3 CONFINED SPACE WARNING SIGNS

A. Painted aluminum with a yellow background and black lettering.

B. Each sign shall contain the following wording:

"DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER"

PART 3 EXECUTION

3.1 PIPE LABELS AND FLOW DIRECTION ARROWS

A. Location: At all connections to equipment, valves, branching fittings, at wall boundaries, and at intervals along the piping not greater than 5 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe. Exposed piping not normally in view, such as behind ceilings and in closets and cabinets, shall also be labeled.

B. Labels shall not be applied to the pipe until all pipe painting is complete or as approved by the ENGINEER.

C. Application: By stencil over pipe base color. Base coat shall be cured, clean, and dry, prior to application of lettering.

D. Lettering sizes for pipe labels shall be in accordance with ANSI A13.1, Table 3, and based upon the outside diameter of the pipe to which they are applied.

E. Stripes on solution pipe shall be applied at intervals along the piping not greater than 5 feet on center with at least one stripe applied to each exposed horizontal and vertical run of pipe.

3.2 PROCESS EQUIPMENT NAMEPLATES

A. Location: As directed by the ENGINEER.

B. Mounting of process equipment nameplates shall be in accordance with the manufacturer's instructions, and as directed by the ENGINEER.

3.3 PAINTED SIGNS

A. Prepare and mask base material as required to provide clean surface for application of letters by stencil.

B. Unless otherwise noted, color of letters shall be black.

C. Paint Type: Semi-gloss alkyd enamel.

3.4 CONFINED SPACE WARNING SIGNS

A. Securely fasten signs to the underside of all hatches entering vaults such that the sign can be read when the hatch is opened.

3.5 EXTERIOR STATION SIGNS

A. Mount signs in the locations as directed by the ENGINEER.

B. Secure signs to fences using stainless steel fasteners.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes requirements to furnish and install, complete, portable fire extinguishers.

B. Section includes:

1. Fire extinguishers

1.2 SUBMITTALS

A. Manufacturer, catalog data for each item including certifications and mounting information.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened protective packaging.

B. Store and handle products in accordance with manufacturer's instructions to protect them from damage.

PART 2 PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

A. General

1. All Extinguishers:

a. UL listing
b. Charged and ready for service

2. Provide heavy-duty brackets with clip-together strap for wall mounting.

3. Manufacturers: Products of the following, or equal, meeting these Specifications, may be used on this Project:

a. Amerex Corp.
b. Ansul Co.
c. General Fire Extinguishing Corp.
d. J.L. Manufacturing Co.

e. Kiddle Belleville
f. Larsen's Manufacturing Co.
g. Modern Metal Products
h. Potter-Roemer, Inc.
i. W.D. Allen Manufacturing Co.

B. Multi-Purpose Hand Extinguisher (F. Ext-1)

1. Tri-class dry chemical extinguishing agent.
2. Pressurized, red enameled steel shell cylinder.
3. Activated by top squeeze handle.
4. Agent propelled through hose or opening at top of unit.
5. For use on A, B, and C class fires.
6. Minimum UL Rating: 4A-60B:C, 10-pound (4.5-kilogram) capacity.

PART 3 EXECUTION

3.1 INSTALLATION

A. Portable Fire Extinguishers

1. Provide at locations shown on Drawings.

2. Mount hangers securely in position, in accordance with manufacturer's recommendations.

3. Top of Extinguisher: No more than 5 feet (1.5 meters) above the floor.

END OF SECTION

SECTION 11 05 00 - COMMON WORK RESULTS FOR EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing and operation of equipment and appurtenant work, complete and operable, all in accordance with the requirements of the Contract Documents.

B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise specified or shown.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All equipment, products and their installation shall be in accordance with the following standards, as applicable and as specified in each section of these specifications:

1. ASTM International (ASTM)
2. American Public Health Association (APHA)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineers (ASME)
5. American Water Works Association (AWWA)
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. Federal Specifications (FS)
10. National Electrical Manufacturers Association (NEMA)
11. Manufacturer’s published recommendations and specifications
12. Oregon Occupational Safety and Health Division (OR-OSHA)

B. The following standards have been referred to in this Section of the specifications.

1. ASTM International:

a. ASTM A48 - Specification for Gray Iron Castings.

b. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

2. American National Standards Institute (ANSI):

a. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.

b. ANSI B16.5 - Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys.

c. ANSI B46.1 - Surface Texture.

d. ANSI S12.6 - Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors.

3. American Society Mechanical Engineers (ASME):

a. ANSI/ASME B1.20.1 - General Purpose Pipe Threads (Inch).
b. ANSI/ASME B31.1 - Power Piping.

4. American Water Works Association (AWWA):

a. AWWA C206 - Field Welding of Steel Water Pipe.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Furnish complete shop drawings for all equipment specified in the various sections, together with all piping, valves, and controls for review by the ENGINEER.

2. Include calculations showing equipment anchorage forces and the capacities of the anchorage elements where required.

C. Special Tools:

1. Supply one complete set of special tools where necessary for the assembly, adjustment, and dismantling of the equipment.

2. Tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal.

D. Spare Parts:

1. Obtain and submit from the manufacturer a list of suggested spare parts for each piece of equipment.

2. Furnish the name, address and telephone number of the nearest distributor for each piece of equipment.

3. Spare parts shall be supplied when indicated in the appropriate equipment specification sections.

E. Torsional and Lateral Vibration Analysis:

1. Where required by the individual equipment sections, provide a torsional and lateral vibration analysis of the equipment, in accordance with Section 01 13 00, Submittals.

2. Equipment shall be designed and constructed such that the natural frequency of the drive train is avoided by a minimum of 25 percent throughout the entire operating range.

3. Analysis shall be performed by a specialist experienced in this type of work and approved by the Engineer.

a. The specialist, or their assigned representative who shall similarly be experienced in this type of work and who shall be approved by the Engineer, shall visit the Site during startup and testing of the equipment to analyze and measure the amount of equipment vibration, certify that the operating frequency avoids the natural frequency by 25 percent, and make a written recommendation for keeping the vibration at a safe limit.

1.4 QUALITY ASSURANCE

A. Demonstrate all equipment meets the specified performance requirements. Provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment, who shall visit the Site to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. Inspect, check, adjust if necessary, and approve the equipment installation.

3. Start-up and field-test the equipment for proper operation, efficiency, and capacity.

4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.

5. Instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. The costs of all inspection, startup, testing, adjustment, and instruction work performed by said factory-trained representatives shall be borne by the Contractor. When available, the Owner's operating personnel will provide assistance in the field testing.

C. Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.

D. The type of finish shall be the most suitable for the application and shall be in accordance with ANSI B46.1.

E. Unless otherwise noted, all equipment furnished shall have a record from the same manufacturer of at least 3 years successful, trouble-free operation in similar applications.

1.5 DELIVERY, HANDLING, AND STORAGE

A. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage.

B. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

C. All equipment shall be protected from exposure to corrosion and shall be kept thoroughly dry at all times.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Hearing Protection:

1. At each high noise level location, where equipment produces noise exceeding 85 dBA at 3 feet or exceeding OSHA noise level requirements for operator safety, supply two pairs of high attenuation hearing protectors.

2. Ear protectors shall meet the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz.

3. Hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband.

4. Protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise producing equipment.

B. Welding:

1. Unless otherwise specified or shown, all welding shall be by the metal arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. Qualification of welders shall be in accordance with the AWS Standards governing same.

C. Protective Coatings:

1. All equipment shall be painted or coated in accordance with Section 09 90 00, Painting and Coating, unless otherwise indicated.

2. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil.

3. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

D. All equipment subject to vibration shall be provided with restrained spring type vibration isolators or pads per manufacturer's written recommendations.

E. Shop fabrication shall be performed in accordance with the Specifications and the Engineer-approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Design Loads:

1. All equipment supports, anchors, and restraint shall be adequately designed for static, dynamic, wind, and seismic loads.

2. The design horizontal seismic force shall be the greater of that noted in the general structural notes or as required by the governing building code (10 percent of gravity minimum).

3. Non-structural Architectural, HVAC, Plumbing and Electrical equipment, components and systems that require seismic anchorage design shall be designed by a Registered Professional Engineer in Oregon. All elements shall meet the requirements of Chapter 13 of ASCE 7-10 as amended by the 2014 OSSC section 1613.5. These non-structural equipment, components and systems that require seismic anchorage design include:

a. Distributed systems weighing more than 5 lbs/ft.

b. Components weighing more than 400 pounds

c. Components weighing more than 20 pound but less than or equal to 400 pounds that have a center of mass located 4-feet or more above the floor or roof level that supports the component.

d. Exceptions:

1) Furniture

B. Equipment foundations shall be as per manufacturer's written recommendations.

C. All equipment shall be mounted as shown on the manufacturer's standard details, unless otherwise shown or specified.

2.3 PIPE HANGERS, SUPPORTS, AND GUIDES

A. All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment.

2.4 FLANGES AND PIPE THREADS

A. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125 or B16.5, Class 150, unless otherwise shown.

B. All pipe threads shall be in accordance with ANSI/ASME B1.20.1 and with requirements of Section 40 05 13, Common Work Results for Process Piping.

2.5 COUPLINGS

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads. Where required for vertical shafts, three-piece spacer couplings or universal type couplings for extended shafts shall be installed.

B. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taper-lock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown, they shall be equipped with grease fittings.

2.6 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association (AFBMA).

B. All field-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

C. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

D. Except where otherwise specified or shown, all bearings shall have a minimum B-10 life expectancy of 5 years or 20,000 hours, whichever occurs first.

E. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split type housings may be used to facilitate installation, inspection, and disassembly.

F. Sleeve type bearings shall have a Babbitt or bronze liner.

2.7 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA and RMA standards.

B. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 feet per minute (fpm) may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.8 DRIVE GUARDS

A. All power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910) requirements.

B. Guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened.

C. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.9 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment.

2.10 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with the requirements of Section 40 05 13, Common Work Results for Process Piping.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron type “V” packing shall be Garlock No. 432, John Crane “Everseal” or equal.

C. Packing around rotating shafts (other than valve stems) shall be “O” rings, stuffing boxes or mechanical seals, as recommended by the manufacturer and approved by the ENGINEER.

2.11 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location.

B. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

PART 3 EXECUTION

3.1 WELDING

A. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions.

B. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed.

C. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions.

D. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.2 COUPLINGS

A. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

B. Installation shall be per equipment manufacturer's printed recommendations.

3.3 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate all necessary space and structural requirements, clearances, utility connections, signals, and outputs with his subcontractors.

B. If the packaged system has any additional features other than specified, the Contractor shall coordinate such features and furnish all material and labor necessary for a complete installation, as required by the manufacturer, at no additional cost to the Owner.

END OF SECTION

SECTION 22 00 00 - PLUMBING

PART 1 GENERAL

1.1 SCOPE

A. This section covers the work necessary to furnish materials, labor, equipment and services necessary to provide all plumbing fixtures, equipment, and specialties as shown on the drawings and specified herein.

B. Refer to section 40 05 13-Common Work Results for Process Piping for plumbing piping material specifications.

1.2 QUALITY ASSURANCE

Install plumbing to meet requirements of local and state codes and provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.3 SUBMITTALS

Submittals shall include manufacturers certificate of conformance; certified copies of test reports; documentation on plumbing fixtures; layout showing type, spacing, maximum loads and materials for hangers and supports and manufacturer's warranty statements.

PART 2 PRODUCTS

2.1 PLUMBING SPECIALTIES

A. Floor Drains (Standard)

1. Floor drains shall be of cast iron with sediment buckets. Floor drains shall be sized to match the outlet piping as shown on the plans.

2. All floor drains will have a connection for a 3/8-inch copper line from the trap primer.

3. Floor drains shall be model JR Smith 2490, or approved equal.

B. Cleanouts

1. All cleanouts shall be heavy plugs with tapered shoulders against caulked lead or heavy brass plugs. Where underground or concealed, cleanouts shall be brought to floor level and to accessible locations with access covers and frames.

2. Manufacturer's, or Equal: The following cleanouts, or equal, shall be furnished:

	Josam	J.R.Smith	Zurn
Exposed locations	58500-20	4405	Z-1440-A
Underground	53010-30	4143	ZN-1400-2
Walls, concealed	58790-20	4535	ZN-1445-1-A
Traffic areas	56070	4240	Z-1420-27

C. Reduced-Pressure Backflow Preventer

Reduced-pressure assemblies ¾-inch through 2-inch shall consist of a differential pressure relief valve located between two independently acting "Y" pattern check valves, two full ported ball valve shut-offs and four test cocks. Mainline valve body and caps, including relief valve body and cover, shall be bronze. Check valves shall be center stem guided. All seat discs shall be reversible. The relief valve shall have a removable seat ring. Assemblies shall be certified in compliance with ASSE 1013, AWWA C511-89, and CAN/CSA B64.4, and approved by the Oregon State Department of Health. The reduced-pressure assembly shall be Febco Model 825Y or approved equal.

D. Hose Bibbs and Hydrants

1. General: All hose bibbs and hydrants in exposed locations subject to freezing shall be of the non-freeze type. Where hose bibbs are connected to a non-potable water supply, they shall be provided with plastic or stainless steel warning signs "DO NOT DRINK," in clearly-legible letters and permanently attached at the hose bibb. Where shown, hose bibbs shall be provided with vacuum breakers as furnished by Crane Co.; American Standard; or equal.

2. Manufacturers, or Equal

   a. Non-Freeze Post-Type: Exposed bronze hydrant, post-type, depth of bury to suit local conditions, minimum 3 feet.

      1) Josam Mfg. Co., Series 71700
      2) J. R. Smith Mfg. Co., Series 5910
      3) Zurn Industries, Inc., Fig. Z-1385 or 1390
      4) Or approved equal.

   b. Non-Freeze Wall-Type: Heavy-duty bronze hydrant with nickel-bronze face, stainless steel hinged cover, stainless steel recessed box and key. Length to suit wall. Zurn Industries, Inc., Fig. Z-1300-SS, or approved equal.

E. Pressure-Reducing and Relief Valves

1. Pressure-reducing and relief valves shall be of the spring-loaded diaphragm type with a minimum pressure rating of 250 psi, bronze body, nickel alloy or stainless

steel seat and threaded ends. These valves are limited to use in interior plumbing systems.

2. Manufacturers, or Equal

    a. A.W. Cash Valve Mfg. Corp
    b. Fisher Controls Company
    c. Mueller Company
    d. Masoneilan
    e. Watts Regulator Company
    f. Wilkins Regulator

F. Ball Valves, 2 Inches and Under

1. Bronze Ball Valves

    a. Bronze Ball Valves shall be 400 lb. WOG with bronze body and trim, PTFE seat ring, and fluorocarbon O-ring seals. The valve shall be of three-piece construction so that maintenance can be performed without disturbing the valve body after installation. Valves shall be Nibco T-590-Y or approved equal.

2. Stainless Steel Ball Valves

    a. Stainless Steel Ball Valves shall be Type 316 SST body and trim, reinforced PTFE seat ring and Union seal. The valve shall be of three-piece construction so that maintenance can be performed without disturbing the valve body after installation. Valves shall be Nibco TM-595-S6-R-66 or approved equal.

G. Strainers (Metal Body)

1. Equipment Requirements: Strainers shall be of the Y-pattern or basket type with flush connections, bronze bodies and screwed ends for sizes 3-inch and smaller; and cast iron with flanged ends for sizes greater than 3-inch.

    a. Strainers shall be designed for not less than 250 psi working pressure in sizes 3-inch and smaller, and 125 psi working pressure in sizes over 3-inch.

    b. Strainers shall be of the same size as the entering pipe and the screens shall have a free area of not less than three times the cross-sectional area of the pipe.

2. Screens: Unless otherwise indicated or required by the service fluid, the screen shall be of Type 316 stainless steel or monel construction, easily removable, with the following mesh or perforations:

Strainer Size	Size of Perforations
1/4- through 2-inch	20 mesh
2 1/2- through 5-inch	20 mesh
6- through 8-inch	1/8-inch diameter
over 8-inch	3/16-inch diameter

3. Strainers shall be Spriax-Sarco, Type BT and IF-125, or equal

H. Pressure Gauges

1. Pressure gauges shall be 4-1/2 inch diameter with phenolic case, polycarbonate glass window, stainless steel movement, and 1/4-inch NPT stainless steel lower connection.

2. Supply gauges complete with stainless steel diaphragm seal.

3. Gauges shall be Ashcroft Type 1279, liquid-filled, or approved equal.

2.2 INSULATION

A. All hot and cold water piping valves and fittings and vent piping shall be provided with one-inch thick insulation.

B. All components of the insulation, including covering, mastics and adhesives shall have a flame spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards. Insulation shall be applied in strict accordance with the manufacturer's instructions.

C. Pipe insulation shall be molded-type pipe covering made of fibrous glass with a minimum K-factor of 0.23 at 75°F mean temperature.

D. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of Kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Where insulation protection shields are provided, the top half section of pipe insulation at support locations shall be of the same specified density; and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb./cu. ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic performed jacketing with a factory-attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and

protect the insulated fitting. Each section shall be manufactured from aluminum or PVC and all joints shall be sealed with silicon mastic or solvent welding to provide a continuous, air and weathertight joint. Strapping shall be 1/2-inch wide Type 3003 aluminum or stainless steel.

E. Manufacturers, or Equal

1. Armstrong Contracting and Supply Corporation
2. Certain-Teed Corporation
3. Manville
4. Owens-Corning Fiberglass Corporation
5. PPG Industries, Inc.

PART 3 EXECUTION

3.1 FIXTURE INSTALLATION

A. Each fixture shall be installed with trap, easily removable for servicing and cleaning, and vented in accordance with the applicable plumbing code.

B. The CONTRACTOR shall provide chrome-plated rigid or flexible supplies to fixtures with angle stops, reducers and escutcheons.

C. All fixtures shall be installed and secured in place with wall supports, wall carriers, floor carriers and bolts.

D. Fixtures shall be sealed to wall and floor surfaces with sealant as indicated in Section 07 92 00, Joint Sealants. Color shall match fixture.

3.2 PLUMBING SPECIALTIES INSTALLATION AND APPLICATION

A. The CONTRACTOR shall coordinate the work of roughing-in, wall and floor sleeves, pipe inserts, cutting of roof and floor construction to receive drains to required invert elevations. Pipes below ceilings shall be held as high as possible without interfering with other trades.

B. The CONTRACTOR shall install all plumbing specialties in accordance with manufacturer's printed instructions to permit intended performance.

C. Cleanouts shall be extended to finished floor or wall surface. Threaded cleanout plug shall be lubricated with mixture of graphite and linseed oil. The CONTRACTOR shall ensure sufficient clearance at cleanouts for rodding of drainage system.

D. Exterior cleanouts shall be encased in concrete flush with pavement or they shall be extended to above finished grade in unpaved locations.

3.3 PIPING INSULATION INSTALLATION

Piping insulation shall be installed in strict conformance with the manufacturer's recommendations.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air Moving and Conditioning Association, Inc. (AMCA): 203, Field Performance Measurement of Fan Systems.

2. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): HVAC Applications Handbook.

3. Associated Air Balance Council (AABC): National Standards for Field Management and Instrumentation Total System Balance.

4. National Environmental Balancing Bureau (NEBB):

   a. Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

   b. Procedural Standards for Measuring Sound and Vibration.

5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): HVAC Testing, Adjusting, and Balancing Manual.

1.2 SUBMITTALS

A. Informational Submittals:

1. Documentation of experience record of testing authority.

2. Documentation of current AABC or NEBB certifications for those technicians in responsible charge of the work under this Contract.

3. Submit detailed test and balance procedures, including test conditions for systems to be tested, prior to beginning the Work.

4. Written verification of calibration of testing and balancing equipment.

5. Balancing Log Report following completion of system adjustments including test results, adjustments, and rebalancing procedures.

1.3 QUALITY ASSURANCE

A. Air Balancing and Vibration Test Agency Qualifications: Have a proven record of at least five similar projects.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials, tools, test equipment, computers, and instrumentation required to complete the work included.

B. Test Hole Plugs: Plug test holes in ducts with plugs made for that purpose and replace any insulation removed to specified conditions.

PART 3 EXECUTION

3.1 GENERAL

A. Adjust and balance exhaust and supply air systems in accordance with standard procedures and recognized practices of the AABC or SMACNA.

3.2 AIR SYSTEM ADJUSTING AND BALANCING

A. Preparation: Prior to beginning the Work, perform the following activities:

1. Review Shop Drawings and installed system for adequate and accessible balancing devices and test points.

2. Recommend to ENGINEER dampers that need to be added or replaced in order to obtain proper air control.

3. Verify proper startup procedures have been completed on the system

4. Verify controls installation is complete and system is in stable operation under automatic control.

5. Verify test instruments have been calibrated to a recognized standard and are within manufacturer's recommended calibration interval before beginning the Work.

B. General:

1. When adjustments are made to a portion of a fan system, reread other portions of that same system to determine effects imposed by adjustments. Readjust as necessary.

2. Lock and mark final positions of balancing dampers with permanent felt pen.

3. Adjust or correct fan and airflow measurements as required for actual cubic feet per minute measured at Site elevation.

C. Equipment Data: Collect the following data and included in final report:

1. Type of unit

2. Equipment identification number

3. Equipment nameplate data (including manufacturer, model, size, type, and serial number)

4. Motor data (frame, horsepower (hp), volts, full load amps rate per minute (FLA rpm), and service factor)

5. Sheave manufacturer, size, and bore

6. Sheave centerline distance and adjustment limits

7. Starter and motor overload protection data

8. Include changes made during course of system balancing.

D. Fan Systems:

1. Measure fan system performance in accordance with AMCA 203.

2. Adjust Fan Air Volumes:

a. Adjust fan speeds and motor drives for required equipment air volumes, with allowable variation of plus 10 percent minus 0 percent.

b. After final adjustments, do not operate motor above nameplate amperage on any phase.

c. After final adjustments, do not operate fan above maximum rated speed.

d. Perform airflow test readings under simulated or actual conditions.

3. Read and record static pressures at unit inlet and discharge, each filter set, coils, dampers, plenums, and mixing dual-duct or adjustable-volume boxes, on every supply, return, and exhaust fan for each test condition.

4. Read and record motor amperage on all phases for each test condition.

E. Building Static Pressure: Measure building static pressure relative to outside in perimeter entrances during normal system conditions that would yield widest range in internal building pressure. Adjust accordingly to maintain minimum of 0.05-inch water column (WC) negative pressure in the room with entrance doors closed to outside.

3.3 FIELD QUALITY CONTROL

A. Vibration Performance Testing:

1. Upon completion of air system balance, perform vibration testing for all fans except restroom fan.

2. Take measurements at each bearing housing using calibrated electronic analyzer.

3. Measure velocity in direction parallel to rotating shaft, and in two directions perpendicular to shaft and to each other. Align measurement directions where possible to the horizontal and vertical planes.

4. Record log shall include equipment symbol or tag, location, identification, specified vibration velocity limits, and maximum measured velocity in each direction.

5. Notify ENGINEER if amplitude exceeds upper limit specified.

END OF SECTION

SECTION 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SUBMITTALS

A. Action Submittals: Manufacturer's product data, catalog cut sheets, installation instructions, and operations and maintenance information for specified products.

PART 2 PRODUCTS

2.1 PRODUCTS

A. General:

1. Specification applies to electric thermostats for temperature control in electrical building.

2.2 ELECTRIC THERMOSTATS

A. Room Thermostat for Process Spaces:

1. Two-position electric type for cooling and heating applications
2. Temperature Scale: 0 to 125 degrees F
3. External adjustments
4. Adjustable sensitivity
5. Insulating back where exterior wall mounting is indicated
6. Locking wire protective guard

PART 3 EXECUTION

3.1 INSTALLATION

A. Room Thermostat:

1. Install electric thermostats in locations indicated on Contract Drawings and in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 81 40 - HEAT PUMPS

PART 1 GENERAL

1.1 DESCRIPTION

A. Units shall be factory assembled, Split system, (Elec/Elec),The units shall be factory wired, piped, and charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall meet ANSI/AHRI 210/240 and 370 standards.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Acoustical Society of America (ASA)
2. Air Movement and Control Association International (AMCA)
3. American Bearing Manufacturers Association (ABMA)
4. ASTM International (ASTM)
5. National Electrical Manufacturers Association (NEMA)
6. Occupational Safety and Health Act (OSHA)
7. Underwriters Laboratories Inc. (UL)

1.3 SUBMITTALS

A. Action Submittals: Provide for all products specified, as follows:

1. Unit tag number or equipment identification as referenced in Contract Documents.
2. Manufacturer’s name and model number.
3. Descriptive specifications, literature, and drawings.
4. Dimensions and weights.
5. Capacities and ratings.
6. Construction materials.
7. Motor and Power Data including voltage, cycle, phase, input waters, and enclosure type.
8. Manufacturer's standard vibration isolation accessories.
9. Factory finish system.

B. Informational Submittals:

1. Recommended procedures for protection and handling of products prior to installation.

2. Manufacturer's installation instructions, including seismic anchorage and bracing requirements.

3. Factory test reports.

4. Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 OUTDOOR UNIT

A. Performance Requirements:

1. 36,000 BTU/hW rated
2. Cooling 3 ton 17.5 SEER
3. Heating 4 kW

B. Casing

1. Unit casing shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish.

2. Cabinet doors shall be hinged with toolless access for easy servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging, fork truck access and proper sealing on roof curb applications.

3. Dimensions: 32-11/16-inches by 35-7/16-inches by 13-inches

C. Lineset Requirements:

1. 3/8-inch diameter Liquid Refrigerant Line
2. 5/8-inch diameter Gas Refrigerant Line

D. Manufacturer:

1. Fujitsu model AOU 36RLX or;
2. Approved equal.

2.2 INDOOR UNIT

A. Ceiling mounted Cassette Heat Pump Air Handler

1. Mounted a minimum of 96-inches above floor, 47-1/4-inches above any obstructions and 39-3/8" away from all walls.

B. Performance Requirements:

1. 36,000 BTU/hW rated
2. Cooling 3 ton 14 SEER
3. Heating 4 kW

C. Manufacturer:

1. Fujitsu model AUU36RCLX or;
2. Approved equal.

2.3 WARRANTIES

A. Compressor – 7 Years, 5 Year Parts out-of-the-box Warranty

2.4 ACCESSORIES

A. Equipment Identification Plates: Furnish 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component in a readily visible location. Plate shall bear 3/8-inch high engraved or die-stamped block type equipment identification number and letters indicated in this Specification and as shown on Drawings. All units shall include factory installed permanently attached nameplate displaying unit model and serial number.

B. Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 100 pounds.

C. Wired Remote Control meeting requirements of Section 23 09 13 Instrumentation & Control Devices.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fans level and plumb.
B. Ceiling Units: Suspend units from structure; use threaded rod or metal straps.
C. Labeling: Label fans in accordance with Article Accessories.
D. Service Access: Locate units to provide access spaces required for motor, drive, bearing servicing, and fan shaft removal.

3.2 FIELD QUALITY CONTROL

A. Functional Tests:

1. Verify blocking and bracing used during shipping are removed.

2. Verify fan is secure on mountings and supporting devices, and connections to ducts and electrical components are complete.

3. Verify proper thermal-overload protection is installed in motors, starters, and disconnect switches.

4. Verify that cleaning and adjusting are complete.

5. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.

6. Verify lubrication for bearings and other moving parts.

B. Performance Tests:

1. Starting Procedures:

a. Energize motor and adjust fan to indicated revolutions per minute.
b. Measure and record motor voltage and amperage.

2. Operational Test:

a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. Repair or replace malfunctioning units; retest as specified after repairs or replacement is made.

c. Test and adjust control safeties.

d. Replace damaged and malfunctioning controls and equipment.

3.3 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

B. On completion of installation, internally clean fans according to manufacturers' written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

END OF SECTION