

DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND, MID-ATLANTIC  
MARINE CORPS AIR STATION, CHERRY POINT, NORTH CAROLINA

REPAIRS TO WASTEWATER TREATMENT PLANT (CP2304M)

AT THE  
MARINE CORPS AIR STATION  
CHERRY POINT, NORTH CAROLINA

PROJECT: 7217368

DESIGNED BY:

NRW ENGINEERING,

SPECIFICATION PREPARED BY:

NRW ENGINEERING

SPECIFICATION APPROVED BY:

Design Director: Patrick A. Faulkner  
PATRICK FAULKNER, PE

Date: \_\_\_\_\_

DEPARTMENT OF NAVY  
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND, MID-ATLANTIC  
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

WO7217368 REPAIRS TO WASTEWATER TREATMENT PLANT (WWTP) CP2304M

AT THE  
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

CONTRACT: N40085-17-D-0008  
WO# 7217368

DESIGNED BY:

DEWBERRY ENGINEERS INC.  
2610 WYCLIFF ROAD SUITE 410  
RALEIGH, NORTH CAROLINA 27607  
NC LICENSE NO. F-0929

FINAL SPECIFICATION PREPARED BY:

CIVIL-PROCESS: R. SCOTT EHRHARDT, P.E.  
CIVIL-SITE: JACOB HILTON, P.E.  
ELECTRICAL: JEFFREY STOUT, P.E.



SPECIFICATION APPROVED BY:

Design Director: \_\_\_\_\_  
PAT FAULKNER, P.E.

Date: \_\_\_\_\_



**DIVISION 26 - ELECTRICAL**

26 20 00	08/19, CHG 2: 05/21	INTERIOR DISTRIBUTION SYSTEM
26 29 01.00	11/08	ELECTRIC MOTORS, 3-PHASE VERTICAL INDUCTION TYPE

**DIVISION 27 - COMMUNICATIONS**

27 21 10.00	11/20	FIBER OPTIC DATA TRANSMISSION SYSTEM
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**DIVISION 31 - EARTHWORK**

31 23 00.00 20	02/11, CHG 2: 08/15	EXCAVATION AND FILL
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**DIVISION 32 - EXTERIOR IMPROVEMENTS**

32 31 13	11/21	CHAIN LINK FENCES AND GATES
32 92 19	08/17, CHG 1: 08/21	SEEDING
32 92 23	04/06, CHG 1: 08/21	SODDING

**DIVISION 33 - UTILITIES**

33 30 00	05/18	SANITARY SEWERAGE
33 71 02	08/21	UNDERGROUND ELECTRICAL DISTRIBUTION

**DIVISION 40 - PROCESS INTERCONNECTIONS**

40 60 00	05/20	PROCESS CONTROL
40 96 00	02/20	APPLICATIONS SOFTWARE

**DIVISION 46 - WATER AND WASTEWATER EQUIPMENT**

46 30 00	08/17	CHEMICAL FEED SYSTEMS
46 43 21	03/19	SECONDARY CLARIFIER RECONDITIONING
46 44 20	05/22	MECHANICAL BAR SCREEN RECONDITIONING
46 51 00.00	05/21	AIR DIFFUSION SYSTEM
46 61 00	02/11	FILTRATION EQUIPMENT

-- End of Project Table of Contents --

DOCUMENT 00 01 15

LIST OF DRAWINGS  
02/11, CHG 1: 08/14

PART 1 GENERAL

1.1 SUMMARY

This section lists the drawings for the project pursuant to contract clause "DFARS 252.236-7001, Contract Drawings, Maps and Specifications."

1.2 CONTRACT DRAWINGS

Contract drawings are as follows:

NAVFAC NO.	SHEET NO.	TITLE
12866009	G000	COVER SHEET
12866010	G001	INDEX OF DRAWINGS
12866011	G002	GENERAL NOTES & BID OPTIONS PLAN
12866012	G003	SHEET LAYOUT AND SURVEY CONTROL PLAN
12866013	C001	CIVIL GENERAL NOTES & LEGEND
12866014	C011	EXISTING CONDITIONS PLAN
12866015	C012	EXISTING CONDITIONS PLAN
12866016	C013	EXISTING CONDITIONS PLAN
12866017	C014	EXISTING CONDITIONS PLAN
12866018	CD011	SITE DEMOLITION PLAN
12866019	CD012	SITE DEMOLITION PLAN
12866020	CD013	SITE DEMOLITION PLAN
12866021	CD014	SITE DEMOLITION PLAN
12866022	CD100	DEMOLITION - HEADWORKS STRUCTURE
12866023	CD101	DEMOLITION - POLYMER BUILDING 4827 PLAN
12866024	CD102	DEMOLITION - PRIMARY CLARIFIER SWEEP & BRIDGE PLAN AND SECTION
12866025	CD300	DEMOLITION - SECONDARY CLARIFIERS 1 & 2 EQUIPMENT PLAN
12866026	CD301	DEMOLITION - SECONDARY CLARIFIERS 1 & 2 EQUIPMENT SECTION

12866027	CD302	DEMOLITION - RAS PUMP STATION PLAN
12866028	CD303	DEMOLITION - RAS PUMP STATION SECTION
12866029	CD400	DEMOLITION - TERTIARY FILTERS PLAN AND SECTION
12866030	CD500	DEMOLITION - GRAVITY THICKNER DIVERSION SCUM PIT PLAN & SECTION
12866031	CD501	DEMOLITION - BLENDING TANK & EFFLUENT PUMP STATION PLAN
12866032	CD600	DEMOLITION - BNR EQUIPMENT PLAN
12866033	CD601	DEMOLITION - BNR EQUIPMENT SECTION
12866034	CD700	DEMOLITION - PRIMARY SLUDGE PUMP STATION PLAN
12866035	CD701	DEMOLITION - PRIMARY SLUDGE PUMP STATION SECTION
12866036	CD800	DEMOLITION - GRAVITY THICKENER SLUDGE WELL PLAN
12866037	CS011	SITE LAYOUT, GRADING, & EROSION CONTROL PLAN
12866038	CS012	SITE LAYOUT, GRADING, & EROSION CONTROL PLAN
12866039	CS013	SITE LAYOUT, GRADING, & EROSION CONTROL PLAN
12866040	CS014	SITE LAYOUT, GRADING, & EROSION CONTROL PLAN
12866041	CS051	SITE LAYOUT, GRADING, & EROSION CONTROL PLAN
12866042	CS900	SITE DETAILS
12866043	CS901	SITE DETAILS
12866044	CU020	INFLUENT TO BNR PIPING PLAN AND PROFILE
12866045	CU030	RAS PIPING PLAN AND PROFILE
12866046	CU040	B175 SUMP PUMP & DIGESTER SUPERNATANT PIPING PLAN & PROFILES
12866047	CU050	PLANT PROCESS FLOW & MASS BALANCE - LIQUID STREAM
12866048	CU051	PLANT PROCESS FLOW & MASS BALANCE - SOLID STREAM
12866049	CU052	HYDRAULIC PROFILE
12866050	CU100	HEADWORKS STRUCTURE
12866051	CU101	POLYMER BUILDING 4872 EQUIPMENT PLAN
12866052	CU102	CONVERSION OF PRIMARY CLARIFIER TO EQ TANK PLAN AND SECTION
12866053	CU200	SECONDARY CLARIFIER NO. 4 EQUIPMENT PLAN

12866054	CU300	SECONDARY CLARIFIERS 1 & 2 EQUIPMENT PLAN
12866055	CU301	SECONDARY CLARIFIERS 1 & 2 EQUIPMENT SECTION
12866056	CU302	RAS PUMP STATION PLAN
12866057	CU303	RAS PUMP STATION SECTION
12866058	CU400	TERTIARY FILTER PLAN AND SECTION
12866059	CU500	GRAVITY THICKNER DIVERSION SCUM PIT PLAN AND SECTION
12866060	CU501	BLENDING TANK & EFFLUENT PUMP STATION PLAN
12866061	CU600	BNR EQUIPMENT PLAN
12866062	CU601	BNR EQUIPMENT SECTION
12866063	CU700	TRUCK FILLING STATION PLAN AND SECTIONS
12866064	CU701	TRUCK FILLING STATION DETAILS
12866065	CU900	DETAILS
12866066	CU901	DETAILS
12866067	S-301	STRUCTURAL DETAILS
12866068	E001	LEGEND, ABBREVIATIONS AND SYMBOLS
12866069	E002	SHEET LAYOUT PLAN
12866070	E100	SITE PLAN
12866071	E101	SITE PLAN
12866072	E102	SITE PLAN
12866073	E103	SITE PLAN
12866074	E104	SITE PLAN - FIBER CONNECTION
12866075	E200	BNR SUMP PUMP
12866076	E201	HEADWORKS STRUCTURE PLAN
12866077	E202	EQUALIZATION TANK PLAN
12866078	E203	SECONDARY CLARIFIERS 1 & 2 EQUIPMENT PLAN
12866079	E204	RAS PUMP STATION PLAN
12866080	E205	RAS PUMP STATION SECTION

12866081	E206	SECONDARY CLARIFIER 4 EQUIPMENT PLAN
12866082	E207	GRAVITY THICKENER SCUM PIT PLAN
12866083	E208	BLENDING TANK PLAN
12866084	E209	BNR REACTOR EQUIPMENT PLAN
12866085	E210	RECLAIMED WATER TRUCK FILL STATION PLAN
12866086	E211	POST AERATION BASIN PLAN
12866087	E212	EFFLUENT PUMP STATION
12866088	E300	RISER DIAGRAM
12866089	E301	PANEL SCHEDULE
12866090	E400	CONTROL ONE LINE
12866091	E500	CONDUIT & WIRE SCHEDULE
12866092	E600	DETAILS
12866093	I001	P&ID LEGEND AND INSTRUMENTATION
12866094	I100	CONTROL SYSTEM BLOCK DIAGRAM
12866095	I101	PLC NO.1 PICTURES AND SCHEDULES
12866096	I102	PLC NO.2 PICTURES AND SCHEDULES
12866097	I103	PLC NO.3 PICTURES AND SCHEDULES
12866098	I104	PLC NO.4 PICTURES AND SCHEDULES
12866099	I105	PLC NO.7 PICTURES AND SCHEDULES
12866100	I106	PLC NO.9 AND NO.10 PICTURES AND SCHEDULES
12866101	I107	PLC NO.11 AND NO.12 PICTURES AND SCHEDULES
12866102	I108	PLC NO.13 AND NO.14 PICTURES AND SCHEDULES
12866103	I109	PLC NO.15 AND NO.16 PICTURES AND SCHEDULES
12866104	I110	PLC NO.17 PICTURES AND SCHEDULES
12866105	I111	PLC NO.18 PICTURES AND SCHEDULES
12866106	I200	PROCESS AND INSTRUMENTATION DIAGRAM
12866107	I300	PROCESS AND INSTRUMENTATION DIAGRAM



12866108	I400	PROCESS AND INSTRUMENTATION DIAGRAM
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### 1.3 SUPPLEMENTARY DRAWINGS

These supplementary drawings may not be a part of the contract but are included with the drawings for information.

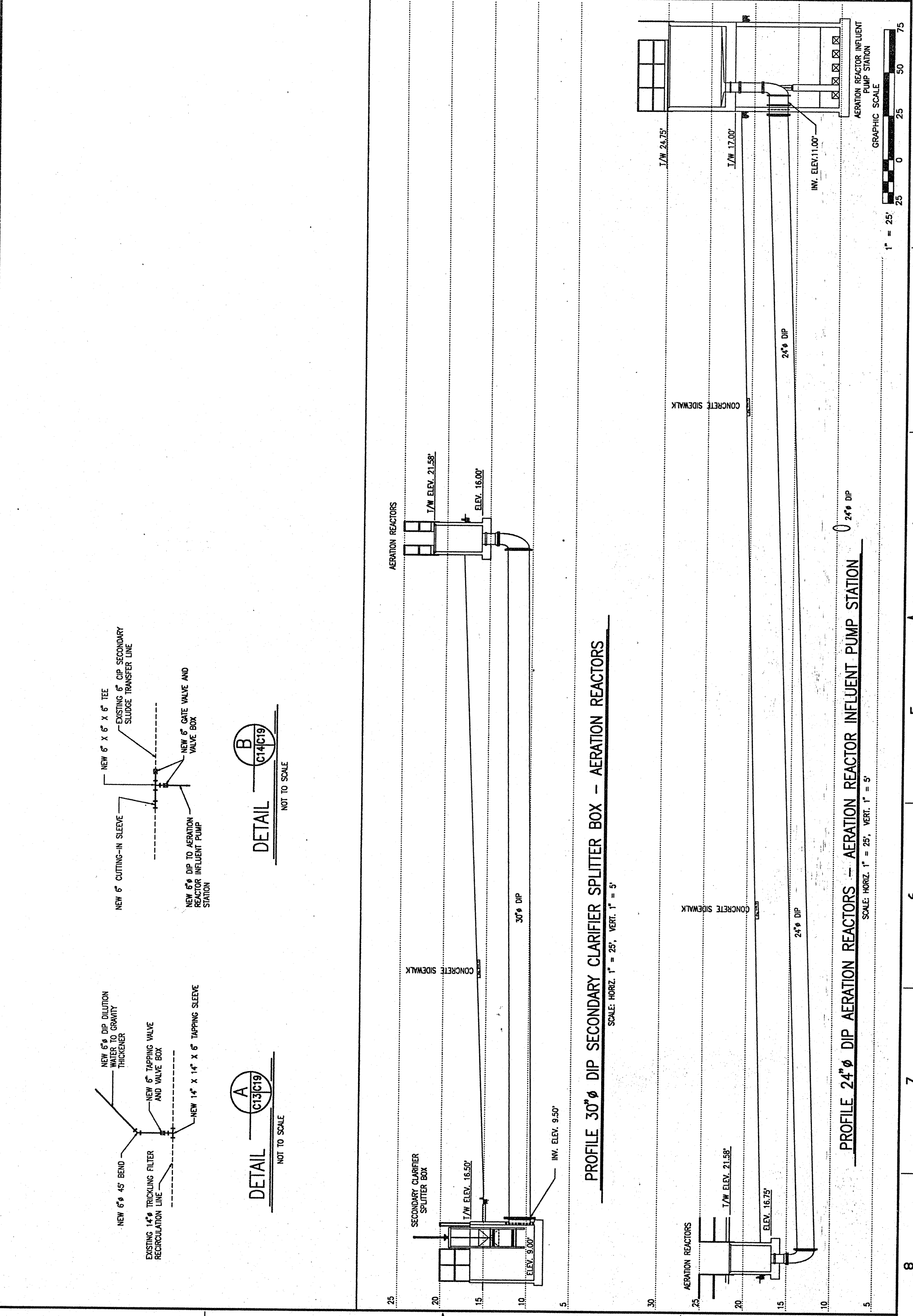
#### 1.3.1 Reference Drawings

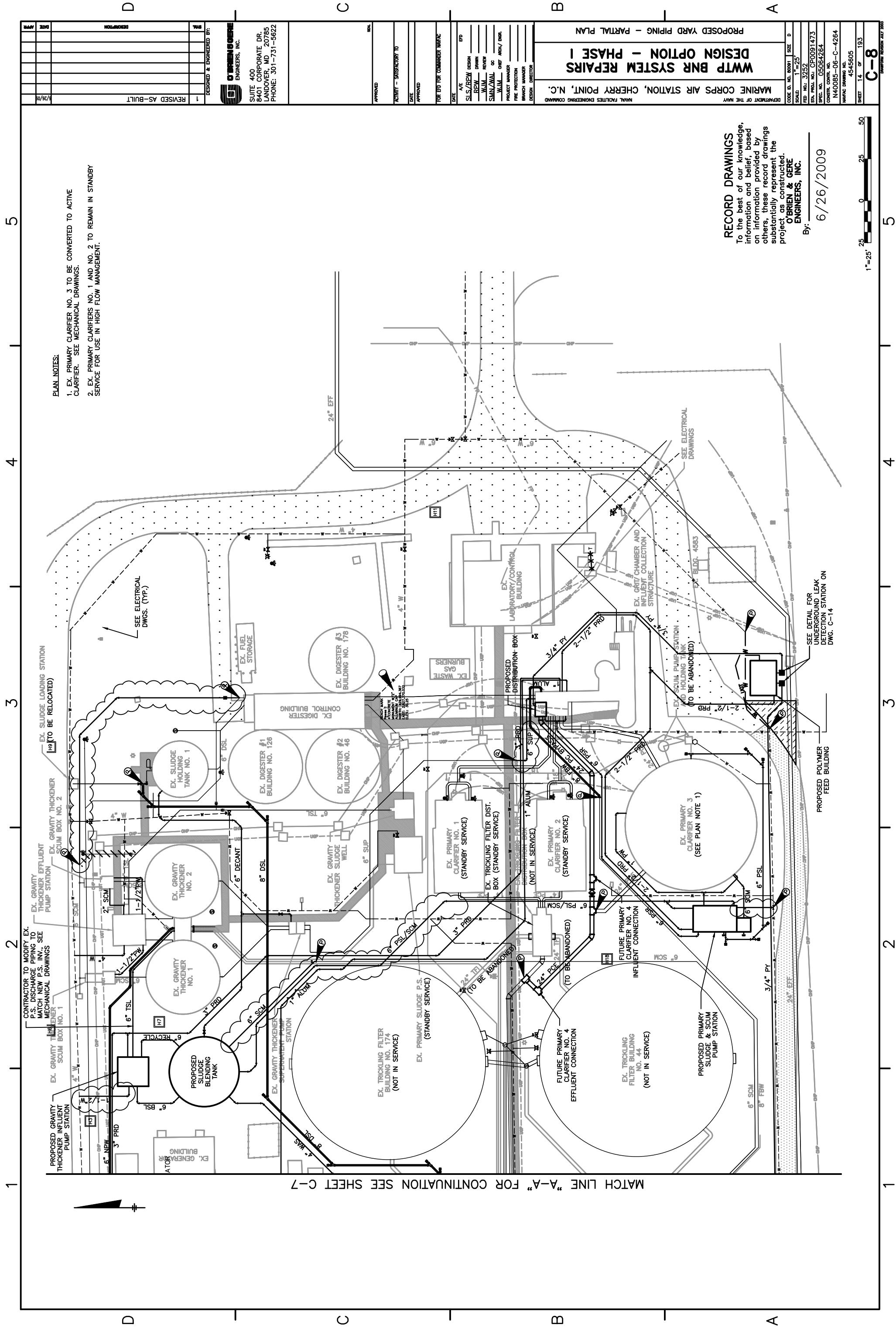
The following reference drawings are intended only to show the original construction. Drawings are the property of the Government and shall not be used for any purpose other than that intended by the contract. Information on procuring these full-size drawings may be obtained from the Contracting Officer.

NAVFAC DWG NO.	TITLE
4236927	SEWER LINE PROFILES AND DETAILS (STP), UPGRADE WASTEWATER TREATMENT PLANTS, BY DAVIS & FLOYD, INC., DATED 11/1991.
4545605	PROPOSED YARD PIPING - PARTIAL PLAN, WWTP BNR SYSTEM REPAIRS DESIGN OPTION - PHASE 1, BY O'BRIEN & GERE ENGINEERS, INC., DATED 6/2009.
4545607	PROPOSED YARD PIPING - PROFILES, WWTP BNR SYSTEM REPAIRS DESIGN OPTION - PHASE 1, BY O'BRIEN & GERE ENGINEERS, INC., DATED 6/2009.

-- End of Document --

NAVAL FACILITIES ENGINEERING COMMAND DIVISION ATLANTIC NAVAL STATION CHERRY POINT, NORTH CAROLINA		SEWER LINE PROFILES AND DETAILS (STP) UPGRADE WASTEWATER TREATMENT PLANTS	
APPROVED DATE ACTIVITY - SATISFACTORY TO PROJECT NO. NS4170-99-C-4847		DESIGNED BY CHECKED BY DATE PROJECT NO. NS4170-99-C-4847	
ARCHITECTS & ENGINEERS DAVIS & FLOYD, INC. GREENSBORO, NORTH CAROLINA		ENGINEER DATE PROJECT NO. NS4170-99-C-4847	
SPECIAL INSTRUCTIONS		REVISIONS	
DATE		REVISION	
APPROVED		REVISION	







SECTION 01 11 00

SUMMARY OF WORK  
08/15, CHG 2: 08/21

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals  
Salvage Plan

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 Project Description

The work includes rehabilitation of two 75' diameter secondary clarifiers, installation of a 24" DIP between the headworks and biological reactor, rehabilitation of a primary clarifier and convert to an EQ tank with bridge, replacement of diffuser piping and heads in one of the two reactor trains, PLC replacement, control upgrades for chemical feed systems, instrumentation installation, SCADA integration for process improvements.

1.2.2 Location

The work is located at MCAS Cherry Point, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.3 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.4 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 48 hours prior to excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are

discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

#### 1.4.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work.

#### 1.5 SALVAGE MATERIAL AND EQUIPMENT

Items designated by the Contracting Officer to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at the Government designated storage area located within 5 miles of the construction site.

Provide a salvage plan, listing material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Provide a system for property control in the salvage plan. Store and protect salvaged materials and equipment until disposition by the Contracting Officer.

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS  
11/11, CHG 14: 02/22

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

1.2 SPECIAL SCHEDULING REQUIREMENTS

- a. The WWTP will remain in operation during the entire construction period. The Contractor shall conduct operations so as to cause the least possible interference with normal operations of the activity. Coordination with Operations will be necessary to avoid possible conflicts that are not known at this time.
- b. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

**The Contractor shall allow for a 60 calendar day review period from receipt of an approved Health and Safety Plan (H&SP).**

The H&SP shall be submitted to the Contracting Officer who will forward it to the appropriate review authorities.

The H&SP shall contain and/or address as a minimum the following elements:

1. General Project Scope and Description.
2. Anticipated impacts to soil and/or groundwater.
3. Protocol for minimizing exposure to potential contaminated materials including, but not limited to:
  - a. Training
  - b. Work Area Precautions
  - c. Personnel Safety and Health Precautions
  - d. Chemical Hazard Communications Program

The Contractor shall submit seven (7) draft copies of the HS&P to the Contracting Officer for review. Written comments will be provided and shall be incorporated into the H&SP.

The Contractor shall submit seven (7) copies of the final H&SP.

### 1.3 CONTRACTOR ACCESS AND USE OF PREMISES

#### 1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, include delivery vehicles, are clearly identified with their company name.

##### 1.3.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

##### 1.3.1.2 Installation Access

Obtain access to Navy installations through participation in the Defense Biometrics Identification System (DBIDS). Requirements for Contractor employee registration, and transition for employees currently under Navy Commercial Access Control System (NCACS), are available at <https://www.cnic.navy.mil/om/dbids.html>. No fees are associated with obtaining a DBIDS credential.

Participation in the DBIDS is not mandatory, and Contractor personnel may apply for One-Day Passes at the Base Visitor Control Office to access an installation.

##### 1.3.1.2.1 Registration for DBIDS

Registration for DBIDS is available at <https://www.cnic.navy.mil/om/dbids.html>. Procedure includes:

- a. Present a letter or official award document (i.e. DD Form 1155 or SF 1442) from the Contracting Officer, that provides the purpose for access, to the base Visitor Control Center representative.
- b. Present valid identification, such as a passport or Real ID Act-compliant state driver's license.
- c. Provide completed SECNAV FORM 5512/1 to the base Visitor Control Center representative to obtain a background check. This form is available for download at <https://www.cnic.navy.mil/om/dbids.html>.
- d. Upon successful completion of the background check, the Government will complete the DBIDS enrollment process, which includes Contractor employee photo, fingerprints, base restriction and several other assessments.
- e. Upon successful completion of the enrollment process, the Contractor employee will be issued a DBIDS credential, and will be allowed to proceed to worksite.



#### 1.3.1.2.2 DBIDS Eligibility Requirements

Throughout the length of the contract, the Contractor employee must continue to meet background screen standards. Periodic background screenings are conducted to verify continued DBIDS participation and installation access privileges. DBIDS access privileges will be immediately suspended or revoked if at any time a Contractor employee becomes ineligible.

An adjudication process may be initiated when a background screen failure results in disqualification from participation in the DBIDS, and Contractor employee does not agree with the reason for disqualification. The Government is the final authority.

#### 1.3.1.2.3 DBIDS Notification Requirements

- a. Immediately report instances of lost or stolen badges to the Contracting Officer.
- b. Immediately collect DBIDS credentials and notify the Contracting Officer in writing under the following circumstances:
  - (1) An employee has departed the company without having properly returned or surrendered their DBIDS credentials.
  - (2) There is a reasonable basis to conclude that an employee, or former employee, might pose a risk, compromise, or threat to the safety or security of the Installation or anyone therein.

#### 1.3.1.2.4 One-Day Passes

Personnel applying for One-Day passes at the Base Visitor Control Office are subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government is not responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in the DBIDS.

#### 1.3.1.3 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

#### 1.3.2 Working Hours

Regular working hours will consist of an 9 1/2 hour period, between 7 a.m. and 4:30 p.m., Monday through Friday, excluding Government holidays.

#### 1.3.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods

of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

#### 1.3.4 Occupied Buildings

The Contractor shall be working around existing buildings which are occupied. Do not enter the buildings without prior approval of the Contracting Officer.

#### 1.3.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, and compressed air are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

### 1.4 SECURITY REQUIREMENTS

#### 1.4.1 Station Regulations

No employee or representative of the contractor will be admitted to the work site without an Identification Badge or is specifically authorized admittance to the work site by the FEAD, Facilities Engineering & Acquisition Division.

IMPORTANT NOTE: FEAD personnel (Construction Managers, Engineers/Architects, Engineering Technicians, Contract Specialists, or Contract Surveillance Representatives) will not receive, process, re-transmit, or otherwise handle IN ANY WAY Personally Identifiable Information (PII) related to the badging process. Do NOT forward any of this information to the FEAD.

#### 1.4.2 Contractor Access to MCAS Cherry Point and Outlying Areas

1. Documentation requirements for granting access to MCAS Cherry Point for commercial and contract employers and employees. This document is an aid in meeting ASO 5560.6A requirements and is not a substitute for the order.
2. The Pass & Identification Office at Building 251 will issue credentials to authorized contractors. Sub-Contractors and suppliers must coordinate through the Prime-Contractor:
3. Criminal Activity. In accordance with ASO 5560.6A, the below list of

criminal activities within an applicant's record are considered not in the best interest of the Marine Corps and will be grounds for automatic denial of access aboard the Installation:

- a. Conviction of any felony offense.
- b. Conviction of any misdemeanor offense, which was the result of a plea bargain of a felony offense.
- c. Conviction of any offense involving a weapon.
- d. Conviction of any drug offense involving manufacturing or trafficking.
- e. More than one misdemeanor conviction of drug related offenses over the applicant's lifetime or one misdemeanor drug related offense within the last five years.
- f. Conviction of any assault charge.
- g. Conviction of any offense involving theft or larceny.
- h. Conviction of any offense of domestic violence.
- i. Conviction of any offense related to the abuse/neglect of a child.
- j. Conviction of any sexual in nature related offense or registration as a sex offender.
- k. Commission of any grievous criminal offense/misconduct while aboard any Federal installation, including blatant disregard for rules and regulations of the Installation, but excluding minor traffic offenses.
- l. Other than Honorable, Bad Conduct, and Dishonorable discharges from the U.S. Military.
- m. Those identified as undocumented citizens.
- n. Those on the National Terrorist Watch List.
- o. Any individual who attempts to hide or purposely fails to disclose all past criminal history during the vetting process.
- p. Any individual that the Provost Marshal's Office determines to present a risk to the security and safety of the Installation and whose access is deemed not in the best interest of the Marine Corps.
- q. Any individual who has been debarred from the Installation by the Installation Commander or is currently listed as debarred from any other Federal installation.
- r. Any individual with an outstanding warrant for their arrest or apprehension.
- s. Any individual with a pending criminal court case that, if convicted, would result in access denial in accordance with the

criteria listed above.

#### 1.4.3 Staging Area

As indicated on the plans, the Contractor must coordinate location of staging area with the Contracting Officer. Amount of material on site shall be kept to a minimum and shall only be material that is pertinent to the work currently being performed. All stockpiling of equipment and materials shall be closely coordinated with the Government and shall not disrupt activities at the site.

#### 1.4.4 Bypass Pumping

The contractor is responsible for providing all bypass pumping necessary to perform work. Bypass pumps required for pumping wastewater while making connections for the BNR influent line installation and the repair of the tertiary filter influent piping shall have a combined capacity of at least 4200 gpm at 100 feet of head. A redundant pump shall be provided with the capacity equal to or larger than the largest pump placed in service. All pumps shall include a noise proof enclosure and level control system with high level alarming. Pumps shall include full integral spill containment or a temporary spill containment area provided by the contractor for operation of the pumps. Pumps shall be manned at all times unless fully automated with remote alarming to both the contractor and the WWTP operator control room. A minimum 8 hour demonstration test of the pumping system shall be performed prior to placing the pumping system in service.

Adequate power is available onsite for the use of electric bypass pumps if chosen by the Contractor in lieu of diesel pumps. Contractor is responsible for providing all necessary materials, equipment and labor for connection of electric pumps. In the case bypass pumping via electric pumps is selected, the Government will pay for all related power cost for operation for up to 30 days of pumping. Contractor shall reimburse the Government for cost of the power if bypassing beyond a total of 30 days is required.

The following is provided as guidance for bypass pumping:

BNR influent line bypassing - Divert flow from the headworks to the EQ tank (formally the circular primary clarifier) utilizing the weir gates downstream of the influent parshall flume. Wastewater from this location shall be piped direct to the influent flume of the BNR tank. The weir gates located downstream of the parshall flume are not water tight. Prior to performing work to tie-in the new BNR pipe to the headworks structure the contractor shall provide temporary sheeting and sealant over the weir gate opening to eliminate leakage so that work can be performed under dry conditions.

Repair of Tertiary Filter Piping - wastewater from the secondary clarifier pump station wetwell will be pumped direct to the influent flume of one or two of the tertiary filters that will remain in service while work is performed on the influent piping of the third tertiary filter.

#### 1.4.5 Dewatering

All dewatering on the WWTP site must be sent to the polishing pond. The

polishing pond is adjacent to the WWTP site. All groundwater is anticipated to be contaminated with PFAS. The contractor is not allowed to discharge to any other plant processes or sewer lines.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --



# UNITED STATES MARINE CORPS

PROVOST MARSHAL'S OFFICE  
POSTAL SERVICE CENTER BOX 8035  
MARINE CORPS AIR STATION  
CHERRY POINT, NORTH CAROLINA 28533-0035

IN REPLY REFER TO:  
5512  
PMO

From: Pass & Identification Office  
To: (1) PMO Records Manager  
(2) Criminal Investigation Division Office

Subj: Request for Local Records check for the below named individual.

Ref: ASO 5500.14

Attach: (1) Individual 50 State Criminal History Report  
(2) Authorization to Release of Information (back of this page)

1. The following information is provided for pending access aboard MCAS, Cherry Point, NC

FULL NAME: \_\_\_\_\_

FULL SSN: \_\_\_\_\_

COMPANY/SPONOR'S NAME: \_\_\_\_\_

DATE OF BIRTH: \_\_\_\_\_

CURRENT ADDRESS: \_\_\_\_\_

CONTACT PHONE NUMBER: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

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## PMO / CID USE ONLY

Provost Marshal's Office

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Results: \_\_\_\_\_

Name of Processor \_\_\_\_\_

**PMO RECORDS**

## TLO VERIFIED (DATE/TIME/INITIALS) \_\_\_\_\_

Provost Marshal's Office

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Results: \_\_\_\_\_

Name of Processor \_\_\_\_\_

**Criminal Investigation Division**

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INDIVIDUAL CONTACTED (DATE/TIME/INITIALS): \_\_\_\_\_

☐

APPROVED

☐

DENIED

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APPROVAL OFFICIAL SIGNATURE

# Authorization for Release of Information

*Carefully read this authorization to release information about you, then sign and date it in ink.*

**I Authorize** any investigator, special agent, or other duly accredited representative of the OPM, the Federal Bureau of Investigation, the Department of Defense, the Department of State, and any other authorized Federal agency, to request criminal record information about me from criminal justice agencies for the purpose of determining my eligibility for requesting access to the facilities aboard Marine Corps Air Station Cherry Point N.C.

**I Authorize** custodians of records and other sources of information pertaining to me to release such information upon request of the investigator, special agent, or other duly accredited representative of any Federal agency authorized above regardless of any previous agreement to the contrary.

**I Understand** that, for some sources of information, a separate specific release will be needed, and I may be contacted for such a release at a later date.

**I Understand** that the information released by records custodians and sources of information is for official use by the Federal Government only for the purpose provided above, and it may be disclosed by the Government only as authorized by law.

**Photocopies of this authorization that show my signature are NOT VALID**

Signature(sign in ink)	Full Name (First, Middle, Last)	Date Signed (mm/dd/yyyy)
Other Names Used	Date of Birth	Social Security Number
Current Street Address	City, State, Zip Code	Contact Telephone Number

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

11/20, CHG 2: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 1110-1-8 (2016) Construction Equipment Ownership  
and Operating Expense Schedule

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Schedule of Prices

1.3 SCHEDULE OF PRICES

1.3.1 Data Required

Within 15 calendar days of notice of award, prepare and deliver to the Contracting Officer a Schedule of Prices (construction Contract) as directed by the Contracting Officer. Schedule of Prices must have cost summarized and totals provided for each construction category. Provide a detailed breakdown of the Contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Contractor overhead and profit including salaries for field office personnel, if applicable, must be proportionately spread over all pay items and not included as individual pay items.

1.3.2 Payment Schedule Instructions

Payments will not be made until the Schedule of Prices has been submitted to and accepted by the Contracting Officer.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause DFARS 252.236-7000 Modification Proposals-Price Breakdown, and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, base equipment use rates upon the applicable provisions of the EP 1110-1-8.



## 1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

### 1.5.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27 Prompt Payment for Construction Contracts and FAR 52.232-5 Payments Under Fixed-Price Construction Contracts. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies. The requests for payment shall include the documents listed below.

- a. The Contractor's invoice, on NAVFAC Form 7300/30 furnished by the Government, showing in summary form, the basis for arriving at the amount of the invoice. Form 7300/30 must include certification by Quality Control (QC) Manager as required by the Contract.
- b. The Estimate for Voucher/Contract Performance Statement on NAVFAC Form 4330/54 furnished by the Government. Use NAVFAC Form 4330, unless otherwise directed by the Contracting Officer, on NAVFAC Contracts when a Monthly Estimate for Voucher is required.
- c. Contractor's Monthly Estimate for Voucher and Contractors Certification (NAVFAC Form 4330) with Subcontractor and supplier payment certification. Other documents, including but not limited to, that need to be received prior to processing payment include the following submittals as required. These items are still required monthly even when a pay voucher is not submitted.
- d. Monthly Work-hour report.
- e. Updated Construction Progress Schedule and tabular reports required by the contract.
- f. Contractor Safety Self Evaluation Checklist.
- g. Updated submittal register.
- h. Solid Waste Disposal Report.
- i. Certified payrolls.
- j. Updated testing logs.
- k. Other supporting documents as requested.

### 1.5.2 Submission of Invoices

If DFARS Clause 252.232-7006 Wide Area WorkFlow Payment Instructions is included in the Contract, provide the documents listed in above paragraph CONTENT OF INVOICE in their entirety as attachments in Wide Area Work Flow (WAWF) for each invoice submitted. The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction, provide it as instructed by the Contracting Officer.

Monthly invoices and supporting forms for work performed through the anniversary award date of the Contract must be submitted to the Contracting Officer within 5 calendar days of the date of invoice. For example, if Contract award date is the 7th of the month, the date of each monthly

invoice must be the 7th and the invoice must be submitted by the 12th of the month.

#### 1.5.3 Final Invoice

- a. A final invoice must be accompanied by the certification required by DFARS 252.247.7023 Transportation of Supplies by Sea, and the Contractor's Final Release. If the Contractor is incorporated, the Final Release must contain the corporate seal. An officer of the corporation must sign and the corporate secretary must certify the Final Release.
- b. For final invoices being submitted via WAWF, the original Contractor's Final Release Form and required certification of Transportation of Supplies by Sea must be provided directly to the respective Contracting Officer prior to submission of the final invoice. Once receipt of the original Final Release Form and required certification of Transportation of Supplies by Sea has been confirmed by the Contracting Officer, the Contractor must then submit final invoice and attach a copy of the Final Release Form and required certification of Transportation of Supplies by Sea in WAWF.
- c. Final invoices not accompanied by the Contractor's Final Release and required certification of Transportation of Supplies by Sea will be considered incomplete and will be returned to the Contractor.

#### 1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

##### 1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this Contract will, at the discretion of the Contracting Officer, be subject to reductions and suspensions permitted under the FAR and agency regulations including the following in accordance with FAR FAR 32.103 Progress Payments Under Construction Contracts:

- a. Reasonable deductions due to defects in material or workmanship;
- b. Claims which the Government may have against the Contractor under or in connection with this Contract;
- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and
- d. Failure to maintain accurate "as-built" or record drawings in accordance with FAR 52.236.21.

##### 1.6.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the Contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

- a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.

- b. Materials delivered on the site but not installed, including completed preparatory work, and off-site materials to be considered for progress payment must be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment consideration include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/prestressed concrete products, plastic lumber (e.g., fender piles/curbs), and high-voltage electrical cable. Materials not acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.
- c. Materials to be considered for progress payment prior to installation must be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Schedule of Prices requirement of this Contract. Requests for progress payment consideration for such items must be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 Payments Under Fixed-Price Construction Contracts have been met.
- d. Materials are adequately insured and protected from theft and exposure.
- e. Provide a written consent from the surety company with each payment request for offsite materials.
- f. Materials to be considered for progress payments prior to installation must be stored either in Hawaii, Guam, Puerto Rico, or the Continental United States. Other locations are subject to written approval by the Contracting Officer.
- g. Materials in transit to the job site or storage site are not acceptable for payment.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

11/20, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map  
Progress and Completion Pictures

1.3 VIEW LOCATION MAP

Submit, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit with the monthly invoice two sets of digital photographs, each set on a separate compact disc (CD) or data versatile disc (DVD), cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch on the CD or DVD as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Government.

1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by North Carolina law.

## 1.6 SUPERVISION

### 1.6.1 Superintendent Qualifications

Provide project superintendent with a minimum of 5 years experience in construction with at least 2 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

For projects where the superintendent is permitted to also serve as the Quality Control (QC) Manager as established in Section 01 45 00.00 20 QUALITY CONTROL, the superintendent must have qualifications in accordance with that section.

### 1.6.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

### 1.6.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and QC meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

### 1.6.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

## 1.7 PRECONSTRUCTION MEETING

Immediately after award, prior to commencing any work at the site, coordinate with the Contracting Officer a time and place to meet for the Preconstruction Meeting. The meeting must take place within 35 calendar days after award of the contract, but prior to commencement of any work at the site. The purpose of this meeting is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base access, outage requests, hot work permits, schedule requirements, QC,

schedule of prices, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections, and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

#### 1.7.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), QC Manager and major subcontractors.

#### 1.8 FACILITY TURNOVER PLANNING MEETINGS (Red Zone Meetings)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled NRZ Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

##### 1.8.1 Red Zone Checklist

- a. Contracting Officer's Technical Representative (COTR) will provide the Contractor a copy of the Red Zone Checklist template.
- b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Contracting Officer. The Contracting Officer may request additional activities be added to the Red Zone Checklist at any time as necessary.

##### 1.8.2 Meetings

- a. Conduct regular Red Zone Meetings beginning at approximately 75 percent project completion, or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first.
- b. The Contracting Officer will establish the frequency of the meetings, which is expected to increase as the project completion draws nearer. At the beginning, Red Zone meetings may be every two weeks then increase to weekly towards the final month of the project.
- c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.
- d. During the Red Zone Meetings discuss with the COTR any upcoming activities that require Government involvement.
- e. Maintain the Red Zone Checklist by documenting the actual completion dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

#### 1.9 PARTNERING

To most effectively accomplish this Contract, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the

strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget, and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, PWD, FEAD/ROICC, Contractor, key subcontractors and the Designer of Record are required to participate in the Partnering process.

1.9.1 Team-Led (Informal) Partnering

- a. The Contracting Officer will coordinate the initial Team-Led (Informal) Partnering Session with key personnel of the project team, including Contractor and Government personnel. The Partnering Session will be co-led by the Government Construction Manager and Contractor's Project Manager.
- b. The Initial Team-led Partnering session may be held concurrently with the Pre-Construction meeting. Partnering sessions will be held at a location mutually agreed to by the Contracting Officer and the Contractor, typically at a conference room on-base or at the Contractor's temporary trailer.
- c. The Initial Team-Led Partnering Session will be conducted and facilitated using electronic media (a video and accompanying forms) provided by Contracting Officer.
- d. The Partners will determine the frequency of the follow-on sessions.
- e. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 31 23.13 20

ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM  
05/17, CHG 7: 11/21

PART 1 GENERAL

1.1 CONTRACT ADMINISTRATION

Utilize the Naval Facilities Engineering Command's (NAVFAC's) Electronic Construction and Facility Support Contract Management System (eCMS) for the transfer, sharing, and management of electronic technical submittals and documents. The web-based eCMS is the designated means of transferring technical documents between the Contractor and the Government. Paper media or e-mail submission, including originals or copies, of the documents identified in Table 1 are not permitted, except where eCMS is unavailable, non-functional, or specifically requested in addition to electronic submission.

1.1.1 Format Naming Convention for Files Uploaded Into eCMS

Include the identification number of the document, the type of document, the name/subject or title, and for daily reports, the date (day of work) with format YYYY/MM/DD in the filename. For example, for RFI's, 0011\_RFI\_Roof\_Leaking.doc; for submittals, 0032a\_Submittals\_Light\_Fixture.pdf; for Daily Reports, 0132\_Daily\_Report\_20190504.xls. Contact the Contracting Officer's Representative (COR) regarding availability of eCMS training and reference materials.

1.1.2 Uploading Documents Processed Outside of eCMS

When specifically requested to provide documents outside of eCMS, upload all final project documentation (e.g., documents that are signed and/or adjudicated by the Government) mentioned in Table 1 into eCMS by creating a record in the module associated with that document type and uploading the document(s). Subject/title of the record should include the type of record i.e., RFI/Submittal/Other, the identification number(s), and the statement "Processed Outside of eCMS". For example, "RFI 001-012 Processed Outside of eCMS".

1.2 USER PRIVILEGES

The Contractor will be provided access to eCMS. All technical submittals and documents must be transmitted to the Government via the COR. Project roles and system roles will be established to control each user's menu, application, and software privileges, including the ability to create, edit, or delete objects.

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contractor's Personnel



#### 1.4 SYSTEM REQUIREMENTS AND CONNECTIVITY

##### 1.4.1 General

The eCMS requires a web-browser (platform-neutral) and Internet connection. Obtain from an approved vendor an External Certification Authority (ECA), Primary Key Infrastructure (PKI) certificate, or other similar digital identification to support two-factor authentication and access to eCMS. Provide and maintain computer hardware and software for the eCMS access throughout the duration of the contract for all Contractor-designated users. Provide connectivity, speed, bandwidth, and access to the Internet to ensure adequate functionality. 70 mbps download speed recommended, 40 mbps minimum for loading large files. Neither upgrading of the Contractor's computer system nor delays associated from the usage of the eCMS will be justification or grounds for a time extension or cost adjustment to the Contract.

##### 1.4.2 Contractor Personnel List

Within 20 calendar days of contract award, provide to the Contracting Officer a list of Contractor's personnel who will have the responsibility for the transfer, sharing and management of electronic technical submittals and documents and will require access to the eCMS. Project personnel roles to be filled in the eCMS include the Contractor's Project Manager, Superintendent, Quality Control (QC) Manager, and Site Safety and Health Officer (SSHO). Personnel must be capable of electronic document management. Notify the COR immediately of any personnel changes to the project. The Contracting Officer reserves the right to perform a security check on all potential users. Provide the following information:

- First Name
- Last Name
- E-mail Address
- Office Address
- Project Role (e.g. Project Manager, QC Manager, Superintendent)

#### 1.5 SECURITY CLASSIFICATION

In accordance with Department of Navy guidance, all military construction contract data are unclassified, unless specified otherwise by a properly designated Original Classification Authority (OCA) and in accordance with an established Security Classification Guide (SCG). Refer to the project's OCA when questions arise about the proper classification of information.

The eCMS and tablet computer must only be used for the transaction of unclassified information associated with construction projects. In conformance with the Freedom of Information Act (FOIA), DoD INSTRUCTION 5200.48 CONTROLLED UNCLASSIFIED INFORMATION (CUI), and DoD requirements, any unclassified project documentation uploaded into the eCMS must be designated either "U - UNCLASSIFIED" (U) or "CUI - CONTROLLED UNCLASSIFIED INFORMATION" (CUI).

#### 1.6 ECMS UTILIZATION

Establish, maintain, and update data and documentation in the eCMS throughout the duration of the contract.

Personally Identifiable Information (PII) transmittal is not permitted in the eCMS.

## 1.6.1 Information Security Classification/Identification

The eCMS must be used for the transmittal of the following documents. This requirement supersedes conflicting requirements in other sections, however, submittal review times in Section 01 33 00 SUBMITTAL PROCEDURES remain applicable. Table 1 - Project Documentation Types provides the appropriate U and CUI designations for various types of project documents. Construction documents requiring CUI status must be marked accordingly. Apply the appropriate markings before any document is uploaded into eCMS. Markings are not required on U documents.

Table 1 also identifies which eCMS application is to be used in the transmittal of data (these are subject to change based on the latest software configuration). If a designated application is not functional within 4 hours of initial attempt, defer to the Submittal application and submit the required data as an uploaded portable document (e.g. PDF), word processor, spreadsheet, drawing, or other appropriate format. Hard copy or e-mail submission of these items is acceptable only if eCMS is documented to be not available or not functional or specifically requested in addition to electronic submission. After uploading documents to the Submittal application, transmit the submittals and attachments to the COR via the Transmittal application. For Submittals, select the following:

Preparation by = Contractor personnel assigned to prepare the submittal

Approval by = Contracting Officer Representative (COR)

Returned by = Design Lead/Manager

Forwarded to = Contractor project manager

Table 1 - Project Documentation Types

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
As-Built Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Building Information Modeling (BIM)	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Construction Permits	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Construction Schedules (Activities and Milestones)	U	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App
Construction Schedules (Cost-Loaded)	CUI	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App
Construction Schedules (3-Week Lookahead)	U	Import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Scheduling App
DD 1354 Transfer of Real Property	U		Submittals and Transmittals
Daily Production Reports	CUI	Provide weather conditions, crew size, man-hours, equipment, and materials information	Daily Report
Daily Quality Control (QC) Reports	CUI	Provide QC Phase, Definable Features of Work Identify visitors	Daily Report
Designs and Specifications	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Environmental Notice of Violation (NOV), Corrective Action Plan	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Environmental Protection Plan (EPP)	CUI		Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Invoice (Supporting Documentation)	CUI	Applies to supporting documentation only. Invoices are submitted in Wide-Area Workflow (WAWF)	Submittals and Transmittals
Jobsite Documentation, Bulletin Board, Labor Laws, SDS	U		Submittals and Transmittals
Meeting Minutes	CUI		Meeting Minutes
Modification Documents	CUI	Provide final modification documents for the project. Upload into "Modifications - RFPs"	Document Management
Operations & Maintenance Support Information (OMSI/eOMSI), Facility Data Worksheet	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Photographs	U	Subject to base/installation restrictions	Submittals and Transmittals
QCM Initial Phase Checklists	CUI		Checklists (Site Management)
QCM Preparatory Phase Checklists	CUI		Checklists (Site Management)
Quality Control Plans	CUI		Submittals and Transmittals
QC Certifications	U		Submittals and Transmittals
QC Punch List	U		Punch Lists (Testing Logs)
Red-Zone Checklist	U		Checklists (Site Management)
Rework Items List	CUI		Punch Lists (Testing Logs)

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Request for Information (RFI) Post-Award	CUI		RFIs
Safety Plan	CUI		Daily Report
Safety - Activity Hazard Analyses (AHA)	CUI		Daily Report
Safety - Mishap Reports	CUI		Daily Report
SCIF/SAPF Accreditation Support Documents	CUI	Note: Some Construction Security plans may be classified as Secret. Classified information must not be uploaded into eCMS. Refer to the Site Security Manager, as applicable.	Submittals and Transmittals
Shop Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Storm Water Pollution Prevention (Notice of Intent - Notice of Termination)	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Submittals and Submittal Log	U		Submittals and Transmittals
Testing Plans, Logs, and Reports	CUI		Submittals and Transmittals
Training/Reference Materials	U		Submittals and Transmittals
Training Records (Personnel)	CUI		Submittals and Transmittals
Utility Outage/Tie-In Request/Approval	CUI		Submittals and Transmittals
Warranties/BOD Letter	CUI		Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Quality Assurance Reports	CUI		Checklists (Government initiated)
Non-Compliance Notices	CUI		Non-Compliance Notices (Government initiated)
Other Government-prepared documents	CUI		GOV ONLY
All Other Documents	CUI	Refer to FOIA guidelines and contact the FOIA official to determine whether exemptions exist	As applicable

#### 1.6.2 Markings on CUI documents

- a. Only CUI documents being electronically uploaded into the eCMS (.docx, .xlsx, .pptx, and others as appropriate), and associated paper documents described in the paragraph CONTRACT ADMINISTRATION require CUI markings as indicated in the subparagraphs below.
- b. CUI documents that are originally created within the eCMS application using the web-based forms (RFIs, Daily Reports, and others as appropriate) will be automatically watermarked by the eCMS software, and these do not require additional markings.
- c. CUI documents must be marked "CONTROLLED UNCLASSIFIED INFORMATION" at the bottom of the outside of the front cover (if there is one), the title page, the first page, and the outside of the back cover (if there is one).
- d. CUI documents must be marked on the internal pages of the document as "CONTROLLED UNCLASSIFIED INFORMATION" at top and bottom.
- e. Where Installations require digital photographs to be designated CUI, place the markings on the face of the photograph.
- f. For visual documentation, other than photographs and audio documentation, mark with either visual or audio statements as appropriate at both the beginning and end of the file.

#### 1.7 QUALITY ASSURANCE

Requested Government response dates on Transmittals and Submittals must be in accordance with the terms and conditions of the Contract. Requesting response dates earlier than the required review and response time, without concurrence by the Government COR, may be cause for rejection.

Incomplete submittals will be rejected without further review and must be resubmitted. Required Government response dates for resubmittals must reflect the date of resubmittal, not the original submittal date.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 32 16.00 20

SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES

08/18, CHG 1: 08/20

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Baseline Construction Schedule

SD-07 Certificates

Monthly Updates

1.2 PRE-CONSTRUCTION SCHEDULE REQUIREMENT

Prior to the start of work, prepare and submit to the Contracting Officer a Baseline Construction Schedule in the form of a Bar Chart Schedule in accordance with the terms in Contract Clause FAR 52.236-15 Schedules for Construction Contracts, except as modified in this contract. The approval of a Baseline Construction Schedule is a condition precedent to:

- a. The Contractor starting demolition work or construction stage(s) of the contract.
- b. Processing Contractor's invoice(s) for construction activities/items of work.
- c. Review of any schedule updates.

Submittal of the Baseline Construction Schedule, and subsequent schedule updates, is understood to be the Contractor's certification that the submitted schedule meets the requirements of the Contract Documents, represents the Contractor's plan on how the work will be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

1.3 SCHEDULE FORMAT

1.3.1 Bar Chart Schedule

The Bar Chart must, as a minimum, show work activities, submittals, Government review periods, material/equipment delivery, utility outages, on-site construction, inspection, testing, and closeout activities. The Bar Chart must be time scaled and generated using an electronic spreadsheet program.

1.3.2 Schedule Submittals and Procedures

Submit Schedules and updates on electronic media that is acceptable to the Contracting Officer. Submit an electronic back-up of the project schedule in an import format compatible with the Government's scheduling program.



#### 1.4 SCHEDULE MONTHLY UPDATES

Update the Construction Schedule at monthly intervals or when the schedule has been revised. Keep the updated schedule current, reflecting actual activity progress and plan for completing the remaining work. Submit copies of purchase orders and confirmation of delivery dates as directed by the Contracting Officer.

a. Narrative Report: Identify and justify the following:

- (1) Progress made in each area of the project;
- (2) Longest Path: Include printed copy on 11 by 17 inch paper, landscape setting;
- (3) Date/time constraint(s), other than those required by the contract;
- (4) Listing of changes made between the previous schedule and current updated schedule including: added or removed activities, original and remaining durations for activities that have not started, logic (sequence, constraint, lag/lead), milestones, planned sequence of operations, longest path, calendars or calendar assignments, and cost loading.
- (5) Any decrease in previously reported activity Earned Amount;
- (6) Pending items and status thereof, including permits, change orders, and time extensions;
- (7) Status of Contract Completion Date and interim milestones;
- (8) Current and anticipated delays (describe cause of delay and corrective actions(s) and mitigation measures to minimize);
- (9) Description of current and future schedule problem areas.

For each entry in the narrative report, cite the respective Activity ID and Activity Name, the date and reason for the change, and description of the change.

#### 1.5 3-WEEK LOOK AHEAD SCHEDULE

Prepare and issue a 3-Week Look Ahead Schedule to provide a more detailed day-to-day plan of upcoming work identified on the Construction Schedule. Key the work plans to activity numbers when a NAS is required and update each week to show the planned work for the current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Construction Schedule on an electronic spreadsheet program as directed by the Contracting Officer. Activities must not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work. Deliver an electronic file of the 3-Week Look Ahead Schedule to the Contracting Officer no later than 8 a.m. each Monday, and review during the weekly CQC Coordination or Production Meeting.

1.6 CORRESPONDENCE AND TEST REPORTS:

Correspondence (e.g., letters, Requests for Information (RFIs), e-mails, meeting minute items, Production and QC Daily Reports, material delivery tickets, photographs) must reference Schedule Activities that are being addressed. Test reports (e.g., concrete, soil compaction, weld, pressure) must reference Schedule Activities that are being addressed.

1.7 ADDITIONAL SCHEDULING REQUIREMENTS

Any references to additional scheduling requirements, including systems to be inspected, tested and commissioned, that are located throughout the remainder of the Contract Documents, are subject to all requirements of this section.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

08/18, CHG 4: 02/21

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or commencing with the start of work on site.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance  
Surety Bonds  
List Of Proposed Subcontractors  
List Of Proposed Products  
Baseline Construction Schedule  
Submittal Register  
Schedule Of Prices  
Accident Prevention Plan  
Work Plan  
Quality Control (QC) plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

#### SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

#### SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports  
Daily logs and checklists  
Final acceptance test and operational test procedure

#### SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits  
Text of posted operating instructions

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS) concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

#### SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

##### 1.1.2 Approving Authority

Office or designated person authorized to approve the submittal.

##### 1.1.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

#### 1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register

1.3 SUBMITTAL CLASSIFICATION

1.3.1 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

As soon as practicable after award of contract, and before procurement or fabrication, forward to the Architect-Engineer: NRW Engineering, 748 Lord Dunmore Drive, Suite 101, Virginia Beach, VA 23464, submittals required in the technical sections of this specification, including shop drawings, product data and samples. In addition, forward a copy of the submittals to the Contracting Officer at Commander, NAVFAC Mid-Atlantic, FEAD Cherry Point (Construction Branch), PSC Box 8006, Building 87, Cherry Point, North Carolina, 28533-0006.

Forward to the Commander, NAVFAC Mid-Atlantic, FEAD Cherry Point (Construction Branch), PSC Box 8006, Building 87, Cherry Point, North Carolina, 28533-0006, submittals required in the General Requirements sections of this specification.

1.4.1 O&M Data

Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the items to which such O&M data apply.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to the office of the approving authority using the transmittal form prescribed by the Contracting Officer. Include all information prescribed by the transmittal form and required in paragraph IDENTIFYING SUBMITTALS. Use the submittal transmittal forms to record actions regarding samples.

1.5.2 Identifying Submittals

The Contractor's Quality Control Manager must prepare, review and stamp submittals, including those provided by a subcontractor, before submittal to the Government.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location
- b. Construction contract number

- c. Dates of the drawings and revisions
- d. Name, address, and telephone number of Subcontractor, supplier, manufacturer, and any other Subcontractor associated with the submittal.
- e. Section number of the specification by which submittal is required
- f. Submittal description (SD) number of each component of submittal
- g. For a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission
- h. Product identification and location in project.

#### 1.5.3 Submittal Format

##### 1.5.3.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's certification stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

##### 1.5.3.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

- a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.
- b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Submit an electronic copy of drawings in PDF format.

##### 1.5.3.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than four inches on the right-hand side of each sheet for the Government disposition stamp.

#### 1.5.3.3 Format of SD-03 Product Data

Present product data submittals for each section. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

##### 1.5.3.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

##### 1.5.3.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

##### 1.5.3.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

#### 1.5.3.4 Format of SD-04 Samples

##### 1.5.3.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by



11 inches and adequate to indicate color, texture, and material variations.

- d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet.
- h. Sample Installation: 100 square feet.

#### 1.5.3.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

#### 1.5.3.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.5.3.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper.

#### 1.5.3.6 Format of SD-06 Test Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.5.3.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper.

#### 1.5.3.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section. Include the manufacturer's name, trade name, place of manufacture, and catalog

model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

#### 1.5.3.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.5.3.9 Format of SD-09 Manufacturer's Field Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.5.3.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

#### 1.5.3.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's certification stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

#### 1.5.4 Source Drawings for Shop Drawings

##### 1.5.4.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

##### 1.5.4.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection

with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

#### 1.5.5 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DoD SAFE Web Application located at the following website: <https://safe.apps.mil/>.

#### 1.6 QUANTITY OF SUBMITTALS

##### 1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit three sets of administrative submittals.

##### 1.6.2 Number of SD-04 Samples

- a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

- b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of nonsolid materials.

#### 1.7 INFORMATION ONLY SUBMITTALS

Submittals not requiring approval by the Government must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

#### 1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided at the end of this section.

##### 1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on

which submittals are received by and returned by the Government.

#### 1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

#### 1.8.3 Contractor Use of Submittal Register

Update the following fields with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

#### 1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

#### 1.8.5 Action Codes

##### 1.8.5.1 Government Review Action Codes

"A" - "Approved as submitted"

"AN" - "Approved as noted"

"RR" - "Disapproved as submitted"; "Completed"

"NR" - "Not Reviewed"

"RA" - "Receipt Acknowledged"

#### 1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

#### 1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

##### 1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

##### 1.9.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Contracting Officer, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

The Contracting Officer will indicate an approval or disapproval of the variation request; and if not approved as submitted, will indicate the Government's reasons therefore. Any work done before such approval is received is performed at the Contractor's risk.

##### 1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

##### 1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 10 working days will be allowed for the Government to consider submittals with variations.

#### 1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time

extensions will be allowed for time lost in late submittals. .

- a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.
- b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
- c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 20 working days after the date of submission.

- d. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 20 working days for submittals where the Contracting Officer is the approving authority. The period of review for submittals with Contracting Officer approval begins when the Government receives the submittal from the QC organization.

#### 1.10.1 Reviewing, Certifying, and Approving Authority

The QC Manager is responsible for reviewing all submittals and certifying that they are in compliance with contract requirements. The approving authority on submittals is the Contracting Officer unless otherwise specified.

#### 1.10.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of the work. At the same time, submit components of definable features that are interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, the submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of the assembly in which the item functions.

#### 1.10.3 QC Organization Responsibilities

- a. Review submittals for conformance with project design concepts and compliance with contract documents.

- b. Process submittals based on the approving authority indicated in the submittal register.

- (1) When the Contracting Officer is the approving authority or when variation has been proposed, forward the submittal to the Government, along with a certifying statement, or return the submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of the submittal determines the appropriate action.

- c. Ensure that material is clearly legible.

- d. Stamp each sheet of each submittal with a QC certifying statement, except that data submitted in a bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

- (1) When the approving authority is the Contracting Officer, the QC organization will certify submittals forwarded to the Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with Contract Number (\_\_\_\_) is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer \_\_\_\_\_, Date \_\_\_\_\_  
(Signature when applicable)

Certified by QC Manager \_\_\_\_\_, Date \_\_\_\_\_"  
(Signature)

- e. Sign the certifying statement. The QC organization member designated in the approved QC plan is the person signing certifying statements.
- f. Update the submittal register as submittal actions occur, and maintain the submittal register at the project site until final acceptance of all work by the Contracting Officer.
- g. Retain a copy of approved submittals and approved samples at the project site.

#### 1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

- a. Note the date on which the submittal was received from the QC manager.
- b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval,



stamp and date submittals. Three copies of the submittal will be retained by the Contracting Officer and four copies of the submittal will be returned to the Contractor.

#### 1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.
- b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required", authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.
- c. Submittals marked "not approved", "disapproved", or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.
- d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and certified by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.
- e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

#### 1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

#### 1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring

information contained within each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

#### 1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not to be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --

For use of this form, see ER 415-1-10; the proponent agency is CEMP-CE.  
(Read instructions on the reverse side prior to initiating this form)

For use of this form, see ER 415-1-10; the proponent agency is CEMP-CE.  
(Read instructions on the reverse side prior to initiating this form)

1. DATE (YYYYMMDD)

## 2. TRANSMITTAL NUMBER

**SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS** *(This section will be initiated by the contractor)*

1. TO	2. FROM	3. CONTRACT NUMBER	4. MARK (X) ONE <input type="checkbox"/> a. THIS IS A NEW TRANSMITTAL <input type="checkbox"/> b. THIS IS A RESUBMITTAL OF TRANSMITTAL				
5. SPECIFICATION SECTION NUMBER (Cover only one section with each transmittal)		6. PROJECT TITLE AND LOCATION					
8.	a.	b.	c.	d.	e.	f.	9.
ITEM NO.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number / etc.,)	MFG. OR CONTR. CAT. CURVE DRAWING OR BROCHURE NO. (See instruction no. 8)	NO. OF COPIES	CONTRACT REFERENCE DOCUMENT (1) SPEC. PARA. NO. (2) DRAWING SHEET. NO.	FOR CONTRACTOR USE CODE	VARIATION (See instruction No. 6)	FOR CE USE CODE
9. REMARKS		10. I CERTIFY THAT THE ABOVE SUBMITTED ITEMS HAVE BEEN REVIEWED IN DETAIL AND ARE CORRECT AND IN STRICT CONFORMANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS EXCEPT AS OTHERWISE NOTED.					
		a. CONTRACTOR NAME		b. CONTRACTOR SIGNATURE			
SECTION II - APPROVAL ACTION							
1. ENCLOSURES RETURNED (List by item number)		2a. NAME (Last, First MI) / TITLE OF APPROVING AUTHORITY		b. DATE (YYYYMMDD)		c. SIGNATURE OF APPROVING AUTHORITY	

### INSTRUCTIONS

1. SECTION I WILL BE INITIATED BY THE CONTRACTOR IN THE REQUIRED NUMBER OF COPIES
2. EACH TRANSMITTAL SHALL BE NUMBERED CONSECUTIVELY IN THE SPACE PROVIDED FOR "TRANSMITTAL NO." THIS NUMBER, IN ADDITION TO THE CONTRACT NUMBER, WILL FORM A SERIAL NUMBER FOR IDENTIFYING EACH SUBMITTAL. FOR NEW SUBMITTALS OR RESUBMITTALS MARK THE APPROPRIATE BOX; ON RESUBMITTALS, INSERT TRANSMITTAL NUMBER OF LAST SUBMISSION AS WELL AS THE NEW SUBMITTAL NUMBER.
3. THE "ITEM NO." WILL BE THE SAME "ITEM NO." AS INDICATED ON ENG FORM 4288-R FOR EACH ENTRY ON THIS FORM.
4. SUBMITTALS REQUIRING EXPENDITIOUS HANDLING WILL BE SUBMITTED ON A SEPARATE FORM.
5. SEPARATE TRANSMITTAL FORM WILL BE USED FOR SUBMITTALS UNDER SEPARATE SECTIONS OF THE SPECIFICATION IS.
6. A CHECK SHALL BE PLACED IN THE "VARIATION" COLUMN WHEN A SUBMITTAL IS NOT IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS - ALSO, A WRITTEN STATEMENT TO THAT EFFECT SHALL BE INCLUDED IN THE SPACE PROVIDED FOR "REMARKS".
7. FORM IS SELF TRANSMITTAL, LETTER OF TRANSMITTAL IS NOT REQUIRED.
8. WHEN A SAMPLE OF MATERIAL OR MANUFACTURER'S CERTIFICATE OF COMPLIANCE IS TRANSMITTED, INDICATE "SAMPLE" OR "CERTIFICATE" IN COLUMN c, SECTION I.
9. U.S. ARMY CORPS OF ENGINEERS APPROVING AUTHORITY WILL ASSIGN ACTION CODES AS INDICATED BELOW IN SPACE PROVIDED IN SECTION I, COLUMN I TO EACH ITEM SUBMITTED. IN ADDITION THEY WILL ENSURE ENCLOSURES ARE INDICATED AND ATTACHED TO THE FORM PRIOR TO RETURN TO THE CONTRACTOR. THE CONTRACTOR WILL ASSIGN ACTION CODES AS INDICATED BELOW IN SECTION I, COLUMN g, TO EACH ITEM SUBMITTED.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- A - APPROVED AS SUBMITTED.
  - B - APPROVED, EXCEPT AS NOTED ON DRAWINGS.
  - C - APPROVED, EXCEPT AS NOTED ON DRAWINGS, REFER TO ATTACHED SHEET RESUBMISSION REQUIRED.
  - D - WILL BE RETURNED BY SEPARATE CORRESPONDENCE.
  - E - DISAPPROVED (See attached)
  - F - RECEIPT ACKNOWLEDGEED.
  - FX - RECEIPT ACKNOWLEDGED, DOES NOT COMPLY AS NOTED WITH CONTRACT REQUIREMENTS.
  - G - OTHER (Specify)
10. APPROVAL OF ITEMS DOES NOT RELIEVE THE CONTRACTOR FROM COMPLYING WITH ALL REQUIREMENTS OF THE CONTRACT PLANS AND SPECIFICATIONS.

# SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION		CONTRACTOR																
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P		S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E C L A S S I F I C A T I O N R E V	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
A C T I V I T Y N O	T R A N S M I T T A L N O					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	
		01 11 00	SD-01 Preconstruction Submittals															
			Salvage Plan	1.5														
		01 14 00	SD-01 Preconstruction Submittals															
			List of Contact Personnel	1.3.1.1														
		01 20 00	SD-01 Preconstruction Submittals															
			Schedule of Prices	1.3														
		01 30 00	SD-01 Preconstruction Submittals															
			View Location Map	1.3														
			Progress and Completion	1.4														
			Pictures															
		01 31 23.13 20	SD-01 Preconstruction Submittals															
			List of Contractor's Personnel	1.4.2														
		01 32 16.00 20	SD-01 Preconstruction Submittals															
			Baseline Construction Schedule	1.2														
			SD-07 Certificates															
			Monthly Updates	1.4														
		01 33 00	SD-01 Preconstruction Submittals															
			Submittal Register	1.8														
		01 35 26	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.8														
			SD-06 Test Reports															
			Monthly Exposure Reports	1.4														
			Notifications and Reports	1.13														
			Accident Reports	1.13.2														
			LHE Inspection Reports	1.13.3														
			SD-07 Certificates															

# SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION																		CONTRACTOR																	
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																																			
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS																		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		(m)	(n)	(o)	(p)																				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)																		
		01 35 26	Contractor Safety Self-Evaluation Checklist	1.5																															
			Crane Operators/Riggers	1.7.1.4																															
			Standard Lift Plan	1.8.3.2																															
			Critical Lift Plan	1.8.3.3																															
			Activity Hazard Analysis (AHA)	1.9																															
			Confined Space Entry Permit	1.10.1																															
			Hot Work Permit	1.10.1																															
			Certificate of Compliance	1.13.4																															
			License Certificates	1.15																															
			Radiography Operation Planning	1.15.1																															
			Work Sheet																																
			Portable Gauge Operations	1.15.1																															
			Planning Worksheet																																
		01 45 00.00 20	SD-01 Preconstruction Submittals																																
			Construction Quality Control (QC) Plan	1.6.1																															
			SD-01 Preconstruction Submittals																																
		01 50 00	Construction Site Plan	1.3																															
			Traffic Control Plan	3.3.1																															
			Contractor Computer	1.6.1.4																															
			Cybersecurity Compliance																																
			Statements																																
			Contractor Temporary Network	1.6.6																															
			Cybersecurity Compliance																																
			Statements																																

# SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION					CONTRACTOR																	
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P					G O V T O R A / E C L A S S I F I C A T I O N R E V	P A R A G R A P H	DESCRIPTION ITEM SUBMITTED	(c)	(b)	(a)	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FROM APPR AUTH	REMARKS
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	(g)	(h)							(i)	(j)	(k)	(l)	(m)		(n)	(o)	(p)	(q)		
				01 50 00			SD-06 Test Reports															
							Backflow Preventer Tests	3.4														
							SD-07 Certificates															
							Backflow Tester	1.4.1														
							Backflow Preventers	1.4														
				01 57 19			SD-01 Preconstruction Submittals															
							Preconstruction Survey	1.5.1														
							Solid Waste Management Permit	1.9														
							Regulatory Notifications	1.5.2														
							Environmental Protection Plan	1.6														
							Stormwater Pollution Prevention Plan	3.2.1.1														
							Stormwater Notice of Intent	3.2.1.2														
							Dirt and Dust Control Plan	1.6.7.1														
							Employee Training Records	1.5.5														
							Environmental Manager	1.5.4														
							Qualifications															
							SD-06 Test Reports															
							Laboratory Analysis	3.6.1.1.2														
							Inspection Reports	3.2.1.3														
							Monthly Solid Waste Disposal Report	1.9.1														
							SD-07 Certificates															
							Employee Training Records	1.5.5														
							Erosion and Sediment Control Inspector	1.5.5														

SUBMITTAL REGISTER										CONTRACT NO. (CP2304M)							
TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P										CONTRACTOR							
TRANSMITTAL ACTIVITY NO	SPEC SECTION NO	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVERNOR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	01 57 19		SD-11 Closeout Submittals														
			Stormwater Pollution Prevention	3.2.1.4													
			Plan Compliance Notebook														
			Stormwater Notice of Termination	3.2.1.5													
			Waste Determination	3.6.1													
			Documentation														
			Disposal Documentation for	3.6.3.6													
			Hazardous and Regulated Waste														
			Assembled Employee Training	1.5.5													
			Records														
			Solid Waste Management Permit	1.9													
			Project Solid Waste Disposal	3.6.2.1													
			Documentation Report														
			Hazardous Waste/Debris	3.6.3.1													
			Management														
			Regulatory Notifications	1.5.2													
			Sales Documentation	3.6.2.1													
			Contractor Certification	3.6.2.1													
	01 78 00		SD-03 Product Data														
			Warranty Management Plan	1.3.1													
			SD-08 Manufacturer's Instructions														
			Instructions	1.3.1													
			SD-11 Closeout Submittals														
			As-Built Drawings	3.1													
			As-Built Record of Equipment	1.3.1													
			and Materials														



SUBMITTAL REGISTER										CONTRACT NO. (CP2304M)							
TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P										CONTRACTOR							
ACTIVITY NO	TRANSMITTAL NO	SPECIES	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT OR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	01 78 23		SD-10 Operation and Maintenance														
			Data														
			O&M Database	1.4													
			Training Plan	3.1.1													
			Training Outline	3.1.3													
			Training Content	3.1.2													
			SD-11 Closeout Submittals														
			Training Video Recording	3.1.4													
			Validation of Training Completion	3.1.6													
	02 41 00		SD-01 Preconstruction Submittals														
			Demolition Plan	1.2.2													
			Existing Conditions	1.9													
			SD-07 Certificates														
			Notification	1.6													
	02 83 00		SD-01 Preconstruction Submittals														
			Competent Person	1.5.1.1	G												
			Training Certification	1.5.1.2	G												
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			Medical Examinations	1.5.2.4	G												
			Lead Waste Management Plan	1.5.2.8	G												
			Licenses, Permits and Notifications	1.5.3	G												
			Lead Compliance Plan	1.5.2.2	G												
			Written Evidence of TSD	3.5.2.1	G												
			Approval														

SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P		CONTRACTOR															
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E R E V I W R C L A S S I F I C A T I O N	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	02 83 00		SD-03 Product Data														
			Respirators	1.6.1	G												
			Vacuum Filters	1.6.4	G												
			Materials and Equipment	2.1	G												
			Expendable Supplies	2.1.1	G												
			SD-06 Test Reports														
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			Sampling Results	1.5.2.3	G												
			SD-07 Certificates														
			Testing Laboratory	1.5.1.3	G												
			Third Party Consultant	1.5.1.4	G												
			Qualifications														
			Clearance Certification	3.5.1.1	G												
			North Carolina Lead Firm	1.2.4	G												
			Certification														
			SD-11 Closeout Submittals														
			Hazardous Waste Manifest	3.5.2.1	G												
			Turn-In Documents or Weight Tickets	3.5.2.1	G												
	03 30 00		SD-01 Preconstruction Submittals														
			Quality Control Plan	1.6.4													
			Quality Control Personnel	1.6.5													
			Certifications														
			Quality Control Organizational Chart	1.6.5													

# SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION		CONTRACTOR															
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	03 30 00		Laboratory Accreditation	1.6.7													
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1													
			SD-03 Product Data														
			Cementitious Materials	2.3.1													
			Concrete Curing Materials	2.4.1													
			Reinforcement	2.6													
			Admixtures	2.3.4													
			Local/Regional Materials	1.7.1													
			Nonshrink Grout	2.4.2													
			SD-05 Design Data														
			Concrete Mix Design	1.6.1.1													
			SD-06 Test Reports														
			Concrete Mix Design	1.6.1.1													
			Fly Ash	1.6.3.1													
			Pozzolan	1.6.3.1													
			Slag Cement	1.6.3.2													
			Aggregates	1.6.3.3													
			Compressive Strength Tests	3.11.3.3													
			Air Content	3.11.3.4													
			Slump Tests	3.11.3.1													
			Water	2.3.2													
			SD-07 Certificates														
			Reinforcing Bars	2.6.1													
			Field Testing Technician and	1.6.5.2													
			Testing Agency														



SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION		CONTRACTOR															
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT OR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	09 96 00		SD-01 Preconstruction Submittals	1.3													
			Equipment List														
			SD-03 Product Data														
			Coating System for Ductile or Cast Iron	2.2.2													
			Coating System For Carbon Steel	2.2.1													
			Coating System For Concrete Surfaces	2.2.3													
			SD-04 Samples														
			Color Chips	1.3													
			SD-07 Certificates														
			Coating System for Carbon Steel	2.2.1													
			Coating System for Ductile or Cast Iron	2.2.2													
			Coating System for Concrete Surfaces	2.2.3													
			Manufacturer's Printed Instructions	3.1.11													
	11 11 11		SD-02 Shop Drawings														
			Stainless Steel Slide Gates	2.2													
			SD-03 Product Data														
			Stainless Steel Slide Gates	2.2													
			SD-05 Design Data														
			Slide Gate Components	2.1													
			SD-10 Operation and Maintenance														
			Data														

SUBMITTAL REGISTER

CONTRACT NO.  
(CP2304M)

TITLE AND LOCATION		CONTRACTOR															
TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVERNOR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION			DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	11 11 11		Stainless Steel Slide Gates	2.2													
	22 07 19.00		SD-02 Shop Drawings	3.1													
			Installation Drawings														
			SD-03 Product Data														
			Insulation Materials	2.3													
			Jacketing	2.3													
			Tape	2.3													
			SD-08 Manufacturer's Instructions														
			Installation Manual	3.1													
			SD-11 Closeout Submittals														
			Record Drawings	3.3													
	22 13 29		SD-02 Shop Drawings														
			Equipment Installation	3.2													
			SD-03 Product Data														
			Materials and Equipment	2.1													
			Framed Instructions	3.4													
			Spare Parts	1.4													
			SD-06 Test Reports														
			Field Testing and Adjusting	3.5													
			Equipment														
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.7													
			Manuals														
	25 05 11		SD-01 Preconstruction Submittals														

SUBMITTAL REGISTER										CONTRACT NO. (CP2304M)							
TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P										CONTRACTOR							
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT OR A/E REVIEW CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	25 05 11		Multiple Ethernet Connection	3.2.2.2													
			Device Request														
			Contractor Computer	1.8.1.6													
			Cybersecurity Compliance Statements														
			Contractor Temporary Network	1.8.5													
			Cybersecurity Compliance Statements														
			Cybersecurity Interconnection Schedule	1.6.2													
			Proposed STIG and SRG	1.6.1													
			Applicability Report														
			SD-02 Shop Drawings														
			Network Communication Report	1.6.3													
			Cybersecurity Riser Diagram	1.6.6													
			SD-03 Product Data														
			Control System Cybersecurity Documentation	1.6.8													
			SD-06 Test Reports														
			Control System Cybersecurity Testing Procedures	3.12.1													
			Control System Cybersecurity Testing Report	3.12.3													
			SD-07 Certificates														
			Software Licenses	1.7													
			SD-11 Closeout Submittals														

SUBMITTAL REGISTER										CONTRACT NO. (CP2304M)							
TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P										CONTRACTOR							
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT OR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	25 05 11		Confidential Password Report	3.4.5.5													
			Enclosure Keys	3.3.5													
			Software and Configuration Backups	1.6.5													
			Auditing Front End Software	3.5.3													
			Device Audit Record Upload	3.5.4.1													
			Software														
			System Maintenance Tool	3.9													
			Software														
			Control System Scanning Tools	3.11.2													
			STIG, SRG and Vendor Guide	1.6.7													
			Compliance Result Report														
			Control System Inventory Report	1.6.4													
	26 20 00		SD-02 Shop Drawings														
			Panelboards	2.9													
			Wireways	2.17													
			Marking Strips	3.1.7.1													
			SD-03 Product Data														
			Receptacles	2.8													
			Circuit Breakers	2.9.3													
			Switches	2.7													
			Enclosed Circuit Breakers	2.10													
			Motor Controllers	2.13													
			Manual Motor Starters	2.14													
			Surge Protective Devices	2.19													
			SD-06 Test Reports														



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TITLE AND LOCATION		CONTRACTOR															
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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	26 20 00		600-volt Wiring Test	3.5.2													
			Grounding System Test	3.5.5													
			Transformer Tests	3.5.3													
			Ground-fault Receptacle Test	3.5.4													
			SD-09 Manufacturer's Field Reports														
			Transformer Factory Tests	2.21.1													
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.5.1													
			Metering	2.18													
	26 29 01.00		SD-02 Shop Drawings														
			Motors	2.2													
			SD-03 Product Data														
			Insulated Windings	2.2.5													
			Duty Cycle	2.2.2.4													
			Motors	2.2													
			Government Study	1.4.2													
			Spare Parts	1.2													
			SD-06 Test Reports														
			Starting Capabilities	2.2.2.3													
			Factory Tests	2.6													
			SD-07 Certificates														
			Power Factor and Efficiency	2.2.2.7													
			Factory Tests	2.6													

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TITLE AND LOCATION		CONTRACTOR															
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P		S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E R E V C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
A C T I V I T Y N O	T R A N S M I T T A L N O					SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION		(m)	(n)	(o)			(p)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	26 29 01.00		SD-10 Operation and Maintenance														
			Data														
			Instructions	1.2													
	27 21 10.00		SD-02 Shop Drawings														
			Installation	3.1													
			SD-03 Product Data														
			Spare Parts	1.3.1													
			Enclosures	2.2.1													
			SD-06 Test Reports														
			Test Procedures and Reports	3.3.1.3													
			Power Attenuation Test	3.2.2.2													
			Optical Time Domain	3.2.2.1													
			Reflectometer Tests														
			SD-07 Certificates														
			Optic Cable Assemblies	2.5.1													
			Labeling Format	3.1.6													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	3.1													
			Manufacturer's	3.1													
			Recommendations														
			SD-10 Operation and Maintenance														
			Data														
			Operating Instructions	3.3.2.1													
	31 23 00.00 20		SD-01 Preconstruction Submittals														
			Shoring and Sheeting Plan	1.9.1													
			Dewatering work plan	1.9.2													

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TITLE AND LOCATION		CONTRACTOR															
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E R E V I W R C L A S S I F I C A T I O N	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	31	23	00.00	20	SD-06 Test Reports												
					Testing												
					1.6												
					Select material												
					3.13.2.1												
					Density tests												
					3.13.2.2												
					Moisture Content Tests												
					3.13.2.3												
	32	31	13		SD-02 Shop Drawings												
					Location of Gate, Corner, End, and Pull Posts												
					3.2.2.1												
					Gate Assembly												
					2.1												
					Gate Hardware and Accessories												
					2.3.5												
					Erection/Installation Drawings Part 3												
					SD-03 Product Data												
					Gate Assembly												
					2.1												
					Gate Hardware and Accessories												
					2.3.5												
					Zinc Coating												
					2.4.1												
					Fabric												
					2.2.1												
					Stretcher Bars												
					2.2.6												
					Concrete												
					2.4.2												
					SD-04 Samples												
					Fabric												
					2.2.1												
					Posts												
					2.2.2												
					Braces												
					2.2.3												
					Line Posts												
					2.2.2.1.1												
					Sleeves												
					2.2.5												
					Top Rail												
					2.2.3.1												
					Tension Wire												
					2.2.8												

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TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P		CONTRACTOR															
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E R E V I O N C L A S S I F I C A T I O N	CONTRACTOR- SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	32 31 13		Stretcher Bars	2.2.6													
			Gate Posts	2.3.1													
			Gate Hardware and Accessories	2.3.5													
			Wire Ties	2.2.4													
			SD-07 Certificates														
			Certificates of Compliance	1.3.1													
			SD-08 Manufacturer's Instructions														
			Gate Assembly	2.1													
			Hardware Assembly	2.1													
			Accessories	2.1													
	32 92 19		SD-03 Product Data														
			Fertilizer	2.4													
			SD-06 Test Reports														
			Topsoil Composition Tests	2.2.3													
			SD-07 Certificates														
			Seed	2.1													
	32 92 23		SD-03 Product Data														
			Fertilizer	2.4													
			SD-06 Test Reports														
			Topsoil composition tests	2.2.3													
			SD-07 Certificates														
			sods	2.1													
	33 30 00		SD-02 Shop Drawings														
			Installation Drawings	3.1.1													
			SD-03 Product Data														
			Precast Concrete Manholes	2.2.4													

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CONTRACT NO.  
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TITLE AND LOCATION										CONTRACTOR													
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P										CONTRACTOR													
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVERNOR CLASSIFICATION	(f)	(e)	(d)	(c)	(b)	(a)	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
												SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		(m)	(n)	(o)	(p)		
												(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
										33 30 00													
								Frames, Covers, and Gratings															
								Gravity Pipe															
								Pressure Pipe															
								SD-06 Test Reports															
								Precast Concrete Sewer Manhole															
								Test															
								Hydrostatic Pressure Test															
								Infiltration Tests And Exfiltration															
								Tests															
								Negative Air Pressure Test															
								Low-Pressure Air Tests															
								SD-07 Certificates															
								Gaskets															
								SD-02 Shop Drawings															
								Precast Underground Structures															
								SD-03 Product Data															
								Medium Voltage Cable															
								Precast Concrete Structures															
								Sealing Material															
								Pulling-In Irons															
								Manhole Frames and Covers															
								Handhole Frames and Covers															
								Composite/Fiberglass Handholes															
								Cable Supports															
								SD-06 Test Reports															

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CONTRACT NO.  
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TITLE AND LOCATION		CONTRACTOR															
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR A/E REVIEW CLASSIFICATION	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
	33 71 02		Field Acceptance Checks and Tests	3.14.1													
			SD-07 Certificates														
			Cable Installer Qualifications	1.4.2													
	40 60 00		SD-02 Shop Drawings														
			Contractor Design Drawings	3.7.2													
			Draft As-Built Drawings	3.7.2.1													
			Draft As-Built Drawings	3.7.2.2													
			SD-03 Product Data														
			Control Drawings	3.7													
			Sensors and Meters	2.4.2													
			Performance Verification Test (PVT)	3.8.2													
			SD-06 Test Reports														
			Testing, Adjusting and Commissioning	3.8.1													
			Performance Verification Test(PVT)	3.8.2													
			Endurance Test	3.8.3													
			SD-07 Certificates														
			Control and Sensor Wiring	3.5.1.2													
			Ground Rods	3.8.1													
			Wiring	3.2.1													
			Installation	3.2.1													
			SD-10 Operation and Maintenance														
			Data														

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TITLE AND LOCATION																		CONTRACTOR									
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																		CONTRACTOR									
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT OR A/E REVIEW CLASSIFICATION	(f)	(e)	(d)	(c)	(b)	(a)	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS				
												SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		(m)	(n)	(o)	(p)						
												(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)				
	40 60 00		Training Manual	3.9																							
			Control System	2.1																							
			SD-11 Closeout Submittals																								
			Final As-Built Drawings																								
	40 96 00		SD-03 Product Data																								
			System Delivery Plan																								
			PLC Software Standards																								
			SCS Standards																								
			Applications Software Schedule																								
			of Values and Progress Schedule																								
			SD-05 Design Data																								
			Detailed Loop Specifications and P&ID																								
			Presoftware Developmen																								
			Software Design																								
			Milestone Breakdown																								
			System Delivery Plan																								
			SD-06 Test Reports																								
			Process Reports																								
			Test Procedures and Reports																								
			SD-09 Manufacturer's Field Reports																								
			Owner Training Plan																								
			SD-10 Operation and Maintenance Data																								
			PLC and SCS Software Licenses																								

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TITLE AND LOCATION WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P		CONTRACTOR															
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E R E V I O N C L A S S I F I C A T I O N	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	40 96 00		Operation and Maintenance Manual														
	46 30 00		SD-02 Shop Drawings														
			Detail Drawings	3.2													
			SD-03 Product Data														
			Chemical Feed System	2.1													
			Auxiliary Equipment and Spare Parts	1.3													
			SD-06 Test Reports														
			Factory Test Report														
			Operating Tests	3.3.1													
			Controlled Volume Pumps - Operational Tests	3.3.1.1													
			Controlled Volume Pumps - Time, Volume And Pumping Pressure Tests	3.3.1.2													
			Flow Tests	3.3.1.3													
			SD-07 Certificates														
			Safety Data Sheet														
			Supplied Chemical	2.3													
			Service Organization	2.2.1													
			Certificates	3.3.2													
			SD-10 Operation and Maintenance Data														
			Operating Instructions	3.4.2													
			Maintenance Instructions	3.4.3													



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CONTRACT NO.  
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TITLE AND LOCATION		CONTRACTOR															
WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R A / E C L A S S I F I C A T I O N R E V I E W	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	46 30 00		SD-11 Closeout Submittals														
			Extended Warranty	2.1.4													
	46 43 21		SD-02 Shop Drawings														
			Circular Clarifier System	Part 2													
			SD-10 Operation and Maintenance														
			Data														
			Circular Clarifier System	Part 2													
	46 44 20		SD-02 Shop Drawings														
			Screen Assembly	2.2													
			Rotating Brush Assembly	2.2													
	46 51 00.00		SD-02 Shop Drawings														
			Equipment Installation	3.2													
			SD-03 Product Data														
			Materials and Equipment	1.4.1													
			SD-06 Test Reports														
			Field Testing	3.3.1													
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.4.2													
			Manuals														
	46 61 00		SD-03 Product Data														
			Qualifications	1.2													
			Media	1.2.2													
			Spare Parts	1.4													
			Factory Tests	2.2.3													

## SECTION 01 35 26

## GOVERNMENTAL SAFETY REQUIREMENTS

**11/20, CHG 3: 02/22**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.5	(2021) Mobile and Locomotive Cranes
ASME B30.9	(2018) Slings
ASME B30.20	(2018) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.26	(2015; R 2020) Rigging Hardware

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ASSP A10.44	(2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSP Z244.1	(2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods
ASSP Z359.0	(2018) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSP Z359.1	(2020) The Fall Protection Code
ASSP Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ASSP Z359.3	(2019) Safety Requirements for Lanyards and Positioning Lanyards
ASSP Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ASSP Z359.6	(2016) Specifications and Design Requirements for Active Fall Protection Systems
ASSP Z359.7	(2019) Qualification and Verification

## Testing of Fall Protection Products

ASSP Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSP Z359.12	(2019) Connecting Components for Personal Fall Arrest Systems
ASSP Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSP Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSP Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ASSP Z359.16	(2016) Safety Requirements for Climbing Ladder Fall Arrest Systems
ASSP Z359.18	(2017) Safety Requirements for Anchorage Connectors for Active Fall Protection Systems

## ASTM INTERNATIONAL (ASTM)

ASTM F855	(2019) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment
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## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2016) Guide for Protective Grounding of Power Lines
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA Z535.2	(2011; R 2017) Environmental and Facility Safety Signs
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022) Standard for Portable Fire Extinguishers
NFPA 51B	(2019; TIA 20-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 70E (2021) Standard for Electrical Safety in the Workplace

NFPA 241 (2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20 Standards for Protection Against Radiation

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.146 Permit-required Confined Spaces

29 CFR 1910.147 The Control of Hazardous Energy (Lock Out/Tag Out)

29 CFR 1910.333 Selection and Use of Work Practices

29 CFR 1915 Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment

29 CFR 1915.89 Control of Hazardous Energy (Lockout/Tags-Plus)

29 CFR 1926 Safety and Health Regulations for Construction

29 CFR 1926.16 Rules of Construction

29 CFR 1926.450 Scaffolds

29 CFR 1926.500 Fall Protection

29 CFR 1926.1400 Cranes and Derricks in Construction

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

CPL 2.100 (1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

## 1.2 DEFINITIONS

### 1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

### 1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person requirements, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSP Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented including experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented

minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

#### 1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the training material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

#### 1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

#### 1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

#### 1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including cranes, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

#### 1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even when provided by a physician or registered personnel.

#### 1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

#### 1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or LHE. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e. ground or rail), the load's rigging path, the lift and rigging procedure.

#### 1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

#### 1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the definition requirements of EM 385-1-1 Appendix Q, and ASSP Z359.2 standard, having a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

#### 1.2.16 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

- a. Death, regardless of the time between the injury and death, or the length of the illness;
- b. Days away from work (any time lost after day of injury/illness onset);
- c. Restricted work;
- d. Transfer to another job;
- e. Medical treatment beyond first aid;
- f. Loss of consciousness; or
- g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above

#### 1.2.17 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap or accident using the NAVFAC prescribed Navy Crane Center (NCC) accident form.

#### 1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following

in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP)

SD-06 Test Reports

Monthly Exposure Reports  
Notifications and Reports  
Accident Reports  
LHE Inspection Reports

SD-07 Certificates

Contractor Safety Self-Evaluation Checklist  
Crane Operators/Riggers  
Standard Lift Plan  
Critical Lift Plan  
Activity Hazard Analysis (AHA)  
Confined Space Entry Permit  
Hot Work Permit  
Certificate of Compliance  
License Certificates  
Radiography Operation Planning Work Sheet  
Portable Gauge Operations Planning Worksheet

1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher.

1.5 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation Checklist" to the Contractor at the pre-construction meeting. Complete the checklist monthly and submit with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90 may result in retention of up to 10 percent of the voucher. The Contractor Safety Self-Evaluation Checklist can be found on the Whole Building Design Guide website at [www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-35-26](http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-35-26)

1.6 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with the most recent edition of USACE EM 385-1-1, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.



### 1.6.1 Subcontractor Safety Requirements

For this Contract, neither Contractor nor any subcontractor may enter into Contract with any subcontractor that fails to meet the following requirements. The term subcontractor in this and the following paragraphs means any entity holding a Contract with the Contractor or with a subcontractor at any tier.

#### 1.6.1.1 Experience Modification Rate (EMR)

Subcontractors on this Contract must have an effective EMR less than or equal to 1.10, as computed by the National Council on Compensation Insurance (NCCI) or if not available, as computed by the state agency's rating bureau in the state where the subcontractor is registered, when entering into a subcontract agreement with the Prime Contractor or a subcontractor at any tier. The Prime Contractor may submit a written request for additional consideration to the Contracting Officer where the specified acceptable EMR range cannot be achieved. Relaxation of the EMR range will only be considered for approval on a case-by-case basis for special conditions and must not be anticipated as tacit approval. Contractor's Site Safety and Health Officer (SSHO) must collect and maintain the certified EMR ratings for all subcontractors on the project and make them available to the Government at the Government's request.

#### 1.6.1.2 OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate

Subcontractors on this Contract must have a DART rate, calculated from the most recent, complete calendar year, less than or equal to 3.4 when entering into a subcontract agreement with the Prime Contractor or a subcontractor at any tier. The OSHA Dart Rate is calculated using the following formula:

$$(N/EH) \times 200,000$$

where:

N = number of injuries and illnesses with days away, restricted work, or job transfer

EH = total hours worked by all employees during most recent, complete calendar year

200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year)

The Prime Contractor may submit a written request for additional consideration to the Contracting Officer where the specified acceptable OSHA Dart rate range cannot be achieved for a particular subcontractor. Relaxation of the OSHA DART rate range will only be considered for approval on a case-by-case basis for special conditions and must not be anticipated as tacit approval. Contractor's SSHO must collect and maintain self-certified OSHA DART rates for all subcontractors on the project and make them available to the Government at the Government's request.

## 1.7 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

### 1.7.1 Personnel Qualifications

#### 1.7.1.1 Site Safety and Health Officer (SSHO)

Provide a SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one person at each project site to function as the SSHO. The SSHO, or an equally-qualified Alternate SSHO, must be at the work site at all times to implement and administer the Contractor's safety program and Government-accepted Accident Prevention Plan (APP). The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified Alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in the AHA may be used in lieu of an Alternate SSHO, and must be on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

##### 1.7.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

The SSHO may not serve as the Quality Control (QC) Manager. The SSHO may not serve as the Superintendent.

#### 1.7.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with EM 385-1-1, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e. competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted APP must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Contracting Officer for information in consultation with the Safety Office.

##### 1.7.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1, Section 34.

##### 1.7.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of EM 385-1-1, Section 22.B.02 and herein.

#### 1.7.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04, 21.B.03, and herein.

#### 1.7.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40 hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.450, Subpart L.

Instructors are required to:

- a. Prepare class presentations that cover construction-related safety requirements.
- b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least five years. This is a certification class and must be attended 100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.
- c. Update training course materials whenever an update of the EM 385-1-1 becomes available.
- d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.
- e. Request, review and incorporate student feedback into a continuous course improvement program.

#### 1.7.1.4 Crane Operators/Riggers

Provide Operators, Signal Persons, and Riggers meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators and Signal Persons. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a Government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

#### 1.7.2 Personnel Duties

##### 1.7.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports.

Report mishaps and near misses.

- c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction meeting, pre-work meetings including preparatory meetings, and periodic in-progress meetings.
- f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.
- i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

Superintendent, QC Manager, and SSHO are subject to dismissal if the above or any other required duties are not being effectively carried out. If either the Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

### 1.7.3 Meetings

#### 1.7.3.1 Preconstruction Meeting

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction meeting. This includes the project superintendent, SSHO, QC manager, or any other assigned safety and health professionals who participated in the development of the APP (including the AHAs and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the Contract. This list of proposed AHAs will be reviewed and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays.

- c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin until an APP is established that is acceptable to the Contracting Officer.

#### 1.7.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors at the project location. The SSHO, supervisors, or foremen must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

### 1.8 ACCIDENT PREVENTION PLAN (APP)

#### 1.8.1 APP - Construction

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor QC Manager, and any designated Certified Safety Professional (CSP) or Certified Health Physicist (CIH). The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer within 30 calendar days of Contract award and not less than 10 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has

been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and QC Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e. imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSP A10.34), and the environment.

#### 1.8.2 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

- a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated SSHO and other competent and qualified personnel to be used. Specify the duties of each position.
- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

#### 1.8.3 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

##### 1.8.3.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this Contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by Contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

##### 1.8.3.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made.

Maintain historical SLPs for a minimum of three months.

#### 1.8.3.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. In addition, Critical Lift Plans are required for the following:

- a. Lifts over 50 percent of the capacity of barge mounted mobile crane's hoist.
- b. When working around energized power lines where the work will get closer than the minimum clearance distance in EM 385-1-1 Table 16-1.
- c. For lifts with anticipated binding conditions.
- d. When erecting cranes.

##### 1.8.3.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

##### 1.8.3.3.2 Lifts of Personnel

In addition to the requirements of EM 385-1-1, Section 16.H.02, for lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

#### 1.8.3.4 Multi-Purpose Machines, Material Handling Equipment, and Construction Equipment Lift Plan

Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Written approval from a qualified registered professional engineer, after a safety analysis is performed, is allowed in lieu of the OEM's approval. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

#### 1.8.3.5 Fall Protection and Prevention (FP&P) Plan

The plan must be in accordance with the requirements of EM 385-1-1, Section 21.D and ASSP Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include FP&P systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Review and revise, as necessary, the FP&P Plan documentation as conditions change, but at a minimum every six months, for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted FP&P Plan documentation at the job site for the duration of the project.

Include the FP&P Plan documentation in the APP.

#### 1.8.3.6 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSP Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

#### 1.8.3.7 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12, 29 CFR 1910.147, 29 CFR 1910.333, 29 CFR 1915.89, ASSP Z244.1, and ASSP A10.44. Submit this HECP as part of the APP. Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

#### 1.8.3.8 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A.

### 1.9 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

#### 1.9.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

#### 1.9.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must



review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

#### 1.10 DISPLAY OF SAFETY INFORMATION

##### 1.10.1 Safety Bulletin Board

Prior to commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.07. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

##### 1.10.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

- a. Date deficiency identified;
- b. Description of deficiency;
- c. Name of person responsible for correcting deficiency;
- d. Projected resolution date;
- e. Date actually resolved.

#### 1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

#### 1.12 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. Government has no responsibility to provide emergency medical treatment.

#### 1.13 NOTIFICATIONS and REPORTS

##### 1.13.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, or any property damage. For LHE or rigging mishaps, notify the Contracting Officer as soon as practical but not more than four hours after mishap. The Contractor is responsible for obtaining

appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); LHE or rigging; fall from height (any level other than same surface). These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.

#### 1.13.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS). Complete and submit an accident investigation report in ESAMS within 5 days for mishaps defined in EM 385-1-1 01.D.03 and 10 days for accidents defined by EM 385-1-1 01.D.05. Complete an investigation report within 30 days for those mishaps defined by EM 385-1-1 01.D.04. Mishaps defined by EM 385-1-1 01.D.04 and 01.D.05 must include a written report submitted as an attachment in ESAMS using the following outline: (1) Mishap summary description to include process, findings and outcomes; (2) Root Cause; (3) Direct Factors; (4) Indirect and Contributing Factors; (5) Corrective Actions; and (6) Recommendations. The Contracting Officer will provide copies of any required or special forms.
- b. Near Misses: For Navy Projects, complete the applicable documentation in NAVFAC CIRS, and electronically submit via the NAVFAC ESAMS. Near miss reports are considered positive and proactive Contractor safety management actions.

#### 1.13.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

#### 1.13.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this Contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

## 1.14 HOT WORK

### 1.14.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e. welding or cutting) or operating other flame-producing/spark producing devices, from the MCAS Cherry Point Fire Department. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with NFPA 51B and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency phone number (911). REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE MCAS CHERRY POINT FIRE DEPARTMENT IMMEDIATELY.

### 1.14.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1, Section 06.H

## 1.15 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer and Radiation Safety Office (RSO), and Contracting Oversight Technician (COT) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on Government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

### 1.15.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead.

The Contracting Officer and COT will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

#### 1.15.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer and COT for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma radiography materials and equipment, a Government escort is required for any travels on the Installation. The Navy COT or Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Navy COT or Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records to the COT for radiological operations performed on the site.

#### 1.15.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

#### 1.15.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

#### 1.15.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

#### 1.15.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site RSO of any Radioactive Material use.

#### 1.15.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

#### 1.15.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

### 1.16 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with Section 34 of EM 385-1-1, OSHA 29 CFR 1926, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, and OSHA Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

#### 1.16.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

#### 1.16.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

#### 1.16.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

#### 1.16.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

### 1.17 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

- a. Secure outside equipment and materials and place materials that could be damaged in protected areas.
- b. Check surrounding area, including roof, for loose material, equipment,

debris, and other objects that could be blown away or against existing facilities.

- c. Ensure that temporary erosion controls are adequate.

## PART 2 PRODUCTS

### 2.1 CONFINED SPACE SIGNAGE

Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs for confined spaces must comply with NEMA Z535.2. Provide signs with wording:

"DANGER--PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" in bold letters a minimum of one inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" must be red and readable from 5 feet.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

- a. Hard Hat
- b. Long Pants
- c. Appropriate Safety Shoes
- d. Appropriate Class Reflective Vests

#### 3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. Develop an employee check-in/check-out communication procedure to ensure employee safety.

#### 3.1.2 Hazardous Material Use

Each hazardous material must receive approval from the Contracting Office or their designated representative prior to being brought onto the job site or prior to any other use in connection with this Contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

#### 3.1.3 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing

ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the RSO prior to excepted items of radioactive material and devices being brought on base.

#### 3.1.4 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If material(s) that may be hazardous to human health upon disturbance are encountered during construction operations, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4 Changes and FAR 52.236-2 Differing Site Conditions.

#### 3.2 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages at least 15 days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation). Some examples of energy isolation devices and procedures are highlighted in EM 385-1-1, Section 12.D. In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of HEC and HEC procedures, as well as applicable AHAs. In accordance with EM 385-1-1, Section 11.A.02 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

#### 3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1, Section 12.A. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Public Works representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with

HECP training in accordance with EM 385-1-1, Section 12.C. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

### 3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, ASSP A10.44, NFPA 70E, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

#### 3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1, Section 12.A.02. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

#### 3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1, Sections 05.I and 11.B. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1, Section 12.E.06.

#### 3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, Section 12.E.08, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

### 3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSP Z359.2 and EM 385-1-1, Sections 21.A and 21.D.



### 3.5.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards and using personal fall protection equipment. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and ASSP Z359.2 in the AHA.

### 3.5.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific FP&P Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I, 29 CFR 1926.500 Subpart M, ASSP Z359.0, ASSP Z359.1, ASSP Z359.2, ASSP Z359.3, ASSP Z359.4, ASSP Z359.6, ASSP Z359.7, ASSP Z359.11, ASSP Z359.12, ASSP Z359.13, ASSP Z359.14, ASSP Z359.15, ASSP Z359.16 and ASSP Z359.18.

#### 3.5.2.1 Additional Personal Fall Protection Measures

Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

#### 3.5.2.2 Personal Fall Protection Equipment

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

### 3.5.3 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured HLL must be designed, installed, certified and used, under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (

29 CFR 1926.500). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

#### 3.5.4 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

#### 3.5.5 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the AHA for the phase of work, in the FP&P Plan, and the APP. The plan must be in accordance with the requirements of EM 385-1-1, ASSP Z359.2, and ASSP Z359.4.

### 3.6 WORK PLATFORMS

#### 3.6.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

- a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.
- b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.
- c. An adequate gate is required.
- d. Employees performing scaffold erection and dismantling must be qualified.
- e. Scaffold must be capable of supporting at least four times the maximum intended load, and provide appropriate fall protection as delineated in the accepted FP&P plan.
- f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.
- g. Special care must be given to ensure scaffold systems are not overloaded.
- h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.

- i. Scaffolding other than suspended types must bear on base plates upon wood mudsills ( 2 in x 10 in x 8 in minimum) or other adequate firm foundation.
- j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 feet.
- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the FP&P Plan and AHA for the phase of work.

### 3.6.2 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

## 3.7 EQUIPMENT

### 3.7.1 Material Handling Equipment (MHE)

- a. Material Handling Equipment (MHE) such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. MHE fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. MHE Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N.
- c. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

### 3.7.2 Load Handling Equipment (LHE)

The following requirements apply. In exception, these requirements do not apply to commercial truck mounted and articulating boom cranes used solely to deliver material and supplies (not prefabricated components, structural steel, or components of a systems-engineered metal building) where the lift consists of moving materials and supplies from a truck or trailer to the ground; to cranes installed on mechanics trucks that are used solely in the repair of shore-based equipment; to crane that enter the activity but are not used for lifting; nor to other machines not used to lift loads suspended by rigging equipment. However, LHE accidents occurring during such operations must be reported.

- a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be provided at the Preconstruction Meeting. Contractor's operator must remain with the crane during the spot check. Rigging gear must be in accordance with OSHA and ASME B30.9 Standards.
- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.
- e. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11, and ASME B30.5 or ASME B30.22 as applicable.
- f. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.
- g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- h. All employees must keep clear of loads about to be lifted and of suspended loads, except for employees required to handle the load.
- i. Use cribbing when performing lifts on outriggers.
- j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- k. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.
- l. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.
- m. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.

- n. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
- o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.
- p. On mobile cranes, lifts where the load weight is greater than 90 percent of the equipment's capacity are prohibited.
- q. Follow FAA guidelines when required based on project location.

### 3.7.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment must be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

### 3.7.4 Use of Explosives

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

## 3.8 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

### 3.8.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

### 3.8.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within 3 feet of the underground system.

### 3.8.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever Contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

## 3.9 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Sections 11 and 12.

### 3.9.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

### 3.9.2 Qualifications

Electrical work must be performed by QP with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State and Local requirements applicable to where work is being performed.

### 3.9.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

### 3.9.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

### 3.9.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

02/19

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

444 North Capital Street, NW, Suite 249  
Washington, DC 20001  
Ph: 202-624-5800  
Fax: 202-624-5806  
E-Mail: [info@aaashto.org](mailto:info@aaashto.org)  
Internet: <https://www.transportation.org/>

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

330 N. Wabash Ave., Suite 2000  
Chicago, IL 60611  
Ph: 202-367-1155  
E-mail: [info@americanbearings.org](mailto:info@americanbearings.org)  
Internet: <https://www.americanbearings.org/>

AMERICAN CONCRETE INSTITUTE (ACI)

38800 Country Club Drive  
Farmington Hills, MI 48331-3439  
Ph: 248-848-3700  
Fax: 248-848-3701  
Internet: <https://www.concrete.org/>

AMERICAN HARDBOARD ASSOCIATION (AHA)

1210 West Northwest Highway  
Palatine, IL 60067  
Ph: 847-934-8800  
Fax: 847-934-8803  
E-mail: [aha@hardboard.org](mailto:aha@hardboard.org)  
Internet: <http://domensino.com/AHA/>



AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)  
130 East Randolph, Suite 2000  
Chicago, IL 60601  
Ph: 312-670-5444  
Fax: 312-670-5403  
Steel Solutions Center: 866-275-2472  
E-mail: [solutions@aisc.org](mailto:solutions@aisc.org)  
Internet: <https://www.aisc.org/>

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
1899 L Street, NW, 11th Floor  
Washington, DC 20036  
Ph: 202-293-8020  
Fax: 202-293-9287  
E-mail: [storemanager@ansi.org](mailto:storemanager@ansi.org)  
Internet: <https://www.ansi.org/>

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)  
Two Park Avenue  
New York, NY 10016-5990  
Ph: 800-843-2763  
Fax: 973-882-1717  
E-mail: [customercare@asme.org](mailto:customercare@asme.org)  
Internet: <https://www.asme.org/>

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)  
520 N. Northwest Highway  
Park Ridge, IL 60068  
Ph: 847-699-2929  
E-mail: [customerservice@assp.org](mailto:customerservice@assp.org)  
Internet: <https://www.assp.org/>

AMERICAN WATER WORKS ASSOCIATION (AWWA)  
6666 W. Quincy Avenue  
Denver, CO 80235 USA  
Ph: 303-794-7711 or 800-926-7337  
Fax: 303-347-0804  
Internet: <https://www.awwa.org/>

AMERICAN WELDING SOCIETY (AWS)  
8669 NW 36 Street, #130  
Miami, FL 33166-6672  
Ph: 800-443-9353  
Internet: <https://www.aws.org/>

ASTM INTERNATIONAL (ASTM)  
100 Barr Harbor Drive, P.O. Box C700  
West Conshohocken, PA 19428-2959  
Ph: 610-832-9500  
Fax: 610-832-9555  
E-mail: [service@astm.org](mailto:service@astm.org)  
Internet: <https://www.astm.org/>

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)  
933 North Plum Grove Road  
Schaumburg, IL 60173-4758  
Ph: 847-517-1200  
Fax: 847-517-1206

Internet: <http://www.crsi.org/>

ELECTRONIC INDUSTRIES ALLIANCE (EIA)  
EIA has become part of the ELECTRONIC COMPONENTS INDUSTRY  
ASSOCIATION (ECIA)

HYDRAULIC INSTITUTE (HI)  
6 Campus Drive, First Floor North  
Parsippany, NJ 07054-4405  
Ph: 973-267-9700  
Fax: 973-267-9055  
Internet: <http://www.pumps.org>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)  
445 and 501 Hoes Lane  
Piscataway, NJ 08854-4141  
Ph: 732-981-0060 or 800-701-4333  
Fax: 732-981-9667  
E-mail: [onlinesupport@ieee.org](mailto:onlinesupport@ieee.org)  
Internet: <https://www.ieee.org/>

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)  
3050 Old Centre Ave. Suite 101  
Portage, MI 49024  
Ph: 269-488-6382  
Fax: 269-488-6383  
Internet: <https://www.netaworld.org/>

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)  
3, rue de Varembe, 1st floor  
P.O. Box 131  
CH-1211 Geneva 20, Switzerland  
Ph: 41-22-919-02-11  
Fax: 41-22-919-03-00  
E-mail: [info@iec.ch](mailto:info@iec.ch)  
Internet: <https://www.iec.ch/>

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)  
127 Park Street, NE  
Vienna, VA 22180-4602  
Ph: 703-281-6613  
E-mail: [info@msshq.org](mailto:info@msshq.org)  
Internet: <http://msshq.org>

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)  
800 Roosevelt Road, Bldg C, Suite 312  
Glen Ellyn, IL 60137  
Ph: 630-942-6591  
Fax: 630-790-3095  
E-mail: [info@naamm.org](mailto:info@naamm.org)  
Internet: <http://www.naamm.org>

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)  
3 Bethesda Metro Center, Suite 1100  
Bethesda, MD 20814  
Ph: 301-657-3110  
Fax: 301-215-4500  
Internet: <https://www.necanet.org/>

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)  
1300 North 17th Street, Suite 900  
Arlington, VA 22209  
Ph: 703-841-3200  
Internet: <https://www.nema.org>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)  
1 Batterymarch Park  
Quincy, MA 02169-7471  
Ph: 800-344-3555  
Fax: 800-593-6372  
Internet: <https://www.nfpa.org>

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)  
100 Bureau Drive  
Gaithersburg, MD 20899  
Ph: 301-975-2000  
Internet: <https://www.nist.gov/>

PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION (PHCC)  
180 South Washington Street, Suite 100  
Falls Church, VA 22046  
Ph: 800-533-7694 or 703-237-8100  
Fax: 703-237-7442  
E-mail: [customercare@naphcc.org](mailto:customercare@naphcc.org)  
Internet: <https://www.phccweb.org/>

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)  
400 Commonwealth Drive  
Warrendale, PA 15096  
Ph: 877-606-7323 or 724-776-4841  
Fax: 724-776-0790  
E-mail: [customerservice@sae.org](mailto:customerservice@sae.org)  
Internet: <https://www.sae.org/>

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)  
140 Philips Road  
Exton, PA 19341-1318  
Ph: 800-542-5040 or 610-363-6888  
Fax: 610-884-7237  
E-Mail: [info@scte.org](mailto:info@scte.org)  
Internet: <https://www.scte.org/>

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)  
1320 North Courthouse Road, Suite 200  
Arlington, VA 22201  
Ph: 703-907-7700  
Fax: 703-907-7727  
E-mail: [marketing@tiaonline.org](mailto:marketing@tiaonline.org)  
Internet: <https://www.tiaonline.org/>

TURFGRASS PRODUCERS INTERNATIONAL (TPI)  
444 E. Roosevelt Road  
#346  
Lombard, IL 60148  
Ph: 800-405-8873 or 847-649-5555  
Fax: 847-649-5678

E-mail: [info@turfgrasssod.org](mailto:info@turfgrasssod.org)  
Internet: <http://www.turfgrasssod.org>

U.S. ARMY CORPS OF ENGINEERS (USACE)  
CRD-C DOCUMENTS available on Internet:  
<http://www.wbdg.org/ffc/army-coe/standards>  
Order Other Documents from:  
Official Publications of the Headquarters, USACE  
E-mail: [hqpublications@usace.army.mil](mailto:hqpublications@usace.army.mil)  
Internet: <http://www.publications.usace.army.mil/>  
or  
<https://www.hnc.usace.army.mil/Missions/Engineering-Directorate/TECHINFO/>

U.S. DEPARTMENT OF AGRICULTURE (USDA)  
Order AMS Publications from:  
AGRICULTURAL MARKETING SERVICE (AMS)  
Seed Regulatory and Testing Branch  
801 Summit Crossing Place, Suite C  
Gastonia, NC 28054-2193  
Ph: 704-810-8884  
E-mail: [PA@ams.usda.gov](mailto:PA@ams.usda.gov)  
Internet: <https://www.ams.usda.gov/>  
Order Other Publications from:  
USDA Rural Development  
Rural Utilities Service  
STOP 1510, Rm 5135  
1400 Independence Avenue SW  
Washington, DC 20250-1510  
Phone: (202) 720-9540  
Internet:  
<https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service>

U.S. DEPARTMENT OF DEFENSE (DOD)  
Order DOD Documents from:  
Room 3A750-The Pentagon  
1400 Defense Pentagon  
Washington, DC 20301-1400  
Ph: 703-571-3343  
Fax: 215-697-1462  
E-mail: [customerservice@ntis.gov](mailto:customerservice@ntis.gov)  
Internet: <https://www.ntis.gov/>  
Obtain Military Specifications, Standards and Related Publications  
from:  
Acquisition Streamlining and Standardization Information System  
(ASSIST)  
Department of Defense Single Stock Point (DODSSP)  
Document Automation and Production Service (DAPS)  
Building 4/D  
700 Robbins Avenue  
Philadelphia, PA 19111-5094  
Ph: 215-697-6396 - for account/password issues  
Internet: <https://assist.dla.mil/online/start/>; account  
registration required  
Obtain Unified Facilities Criteria (UFC) from:  
Whole Building Design Guide (WBDG)  
National Institute of Building Sciences (NIBS)  
1090 Vermont Avenue NW, Suite 700  
Washington, DC 20005  
Ph: 202-289-7800

WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P

Fax: 202-289-1092

Internet:

<https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc>

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD User

P.O. Box 23268

Washington, DC 20026-3268

Ph: 800-245-2691 or 202-708-3178

TDD: 800-927-7589

Fax: 202-708-9981

E-mail: [helpdesk@huduser.gov](mailto:helpdesk@huduser.gov)

Internet: <https://www.huduser.gov>

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

1200 Pennsylvania Avenue, N.W.

Washington, DC 20004

Ph: 202-564-4700

Internet: <https://www.epa.gov>

--- Some EPA documents are available only from:  
National Technical Information Service (NTIS)

5301 Shawnee Road

Alexandria, VA 22312

Ph: 703-605-6060 or 1-800-363-2068

Fax: 703-605-6880

TDD: 703-487-4639

E-mail: [info@ntis.gov](mailto:info@ntis.gov)

Internet: <https://www.ntis.gov/>

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

1200 New Jersey Ave., SE

Washington, DC 20590

Ph: 202-366-4000

E-mail: [ExecSecretariat.FHWA@dot.gov](mailto:ExecSecretariat.FHWA@dot.gov)

Internet: <https://www.fhwa.dot.gov/>

Order from:

Superintendent of Documents

U.S. Government Publishing Office (GPO)

732 N. Capitol Street, NW

Washington, DC 20401

Ph: 202-512-1800 or 866-512-1800

Bookstore: 202-512-0132

Internet: <https://www.gpo.gov/>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

General Services Administration

1800 F Street, NW

Washington, DC 20405

Ph: 1-844-472-4111

Internet: <https://www.gsaelibrary.gsa.gov/ElibMain/home.do>

Obtain documents from:

Acquisition Streamlining and Standardization Information System  
(ASSIST)

Internet: <https://assist.dla.mil/online/start/>; account  
registration required

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

8601 Adelphi Road

College Park, MD 20740-6001

Ph: 866-272-6272

Internet: <https://www.archives.gov/>

Order documents from:

Superintendent of Documents

U.S. Government Publishing Office (GPO)

732 N. Capitol Street, NW

Washington, DC 20401

Ph: 202-512-1800 or 866-512-1800

Bookstore: 202-512-0132

Internet: <https://www.gpo.gov/>

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

1322 Patterson Ave. SE, Suite 1000

Washington Navy Yard, DC 20374-5065

Ph: 202-685-9387

Internet: <http://www.navfac.navy.mil>

UNDERWRITERS LABORATORIES (UL)

2600 N.W. Lake Road

Camas, WA 98607-8542

Ph: 877-854-3577 or 360-817-5500

E-mail: [CustomerExperienceCenter@ul.com](mailto:CustomerExperienceCenter@ul.com)

Internet: <https://www.ul.com/>

UL Directories available through IHS at <https://ihsmarkit.com/>

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

Corporate Headquarters

2711 LBJ Freeway, Suite 1000

Dallas, TX 75234

Ph: 972-243-3902

Fax: 972-243-3907

E-mail: [info@uni-bell.org](mailto:info@uni-bell.org)

Internet: <https://www.uni-bell.org/>

## PART 2 PRODUCTS

Not used

## PART 3 EXECUTION

Not used

-- End of Section --

## SECTION 01 45 00.00 20

QUALITY CONTROL  
11/11, CHG 8: 02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements  
Manual

## 1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

SD-01 Preconstruction Submittals

Construction Quality Control (QC) Plan

## 1.3 INFORMATION FOR THE CONTRACTING OFFICER

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the Contracting Officer. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, CQC Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log.

Deliver the following to the Contracting Officer during Construction:

- a. CQC Report: Submit the report electronically by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.
- b. Contractor Production Report: Submit the report electronically by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.
- c. Preparatory Phase Checklist: Submit the report electronically in the same manner as the CQC Report for each Preparatory Phase held.
- d. Initial Phase Checklist: Submit the report electronically in the same manner as the CQC Report for each Initial Phase held.
- e. QC Specialist Reports: Submit the report electronically by 10:00 AM the next working day after each day that work is performed.
- f. Field Test Reports: Within two working days after the test is

performed, submit the report as an electronic attachment to the CQC Report.

- g. Monthly Summary Report of Tests: Submit the report as an electronic attachment to the CQC Report at the end of each month.
- h. Testing Plan and Log: Submit the report as an electronic attachment to the CQC Report, at the end of each month. Provide a copy of the final Testing Plan and Log to the preparer of the Operation & Maintenance (O&M) documentation.
- i. Rework Items List: Submit lists containing new entries daily, in the same manner as the CQC Report.
- j. CQC Meeting Minutes: Within two working days after the meeting is held, submit the report as an electronic attachment to the CQC Report.
- k. QC Certifications: As required by the paragraph QC CERTIFICATIONS.

#### 1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting the objectives of NAVFAC Commissioning. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and certification, testing, completion inspections, QC certifications, and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program must cover on-site and off-site work and be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

##### 1.4.1 Acceptance of the Construction Quality Control (QC) Plan

Acceptance of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

##### 1.4.2 Preliminary Construction Work Authorized Prior to Acceptance

The only construction work that is authorized to proceed prior to the acceptance of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying.

##### 1.4.3 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the



QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 1.5 QC ORGANIZATION

### 1.5.1 QC Manager

#### 1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. A different person must serve as the Site Safety and Health Officer (SSHO) as detailed in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager is required to attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control except for those phases of control designated to be performed by QC Specialists, perform submittal review and certification, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

#### 1.5.1.2 Qualifications

An individual with a minimum of 5 years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have at least two years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability.

### 1.5.2 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager must have completed the course entitled "Construction Quality Management (CQM) for Contractors". If the QC Manager does not have a current certification, they must obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

### 1.5.3 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager must be the same as for the QC Manager.

## 1.6 QUALITY CONTROL (QC) PLAN

### 1.6.1 Construction Quality Control (QC) Plan

Submit a Construction QC Plan within 30 calendar days of Contract Award. The Accepted QC plan is required prior to start of construction.

#### 1.6.1.1 Requirements

Provide a Construction QC Plan, prior to start of construction, that includes a table of contents, with major sections identified, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing quality control during the construction of the project:

- a. QC ORGANIZATION: A chart showing the QC organizational structure.
- b. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, for each person in the QC organization. Include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs CONSTRUCTION QUALITY MANAGEMENT TRAINING and ALTERNATE QC MANAGER DUTIES AND QUALIFICATIONS.
- c. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.
- d. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.
- e. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. Letters of direction are to be issued by the QC Manager to all other QC Specialists outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.
- f. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, certifying, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to submitting for approval. Provide the initial submittal of the Submittal Register as specified in Section 01 33 00 SUBMITTAL PROCEDURES.
- g. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs ACCREDITATION REQUIREMENTS, as applicable.
- h. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
- i. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, and complete rework items.

- j. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines and is an item or activity on the construction schedule. Include in the list of DFOWs, but not be limited to, all critical path activities on the construction schedule. Include all activities for which this specification requires QC Specialists or specialty inspection personnel. Provide separate DFOWs in the construction schedule for each submittal package.
- k. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each DFOW, a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.
- l. PERSONNEL MATRIX: Not Applicable
- m. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.
- n. TRAINING PROCEDURES AND TRAINING LOG: Not Applicable
- o. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

#### 1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, and prior to Government approval and the start of construction, the QC Manager will meet with the Contracting Officer to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting must be repeated.

##### 1.7.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

- a. Waste Management Plan.
- c. Procedures for noise and acoustics management.
- d. Environmental Protection Plan.
- e. Environmental regulatory requirements.

### 1.7.2 Coordination of Activities

Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation.

### 1.7.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities must have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Contracting Officer. Provide a copy of the signed minutes to all attendees and include in the QC Plan.

## 1.8 QC MEETINGS

After the start of construction, conduct weekly QC meetings by the QC Manager at the work site with the Project Superintendent, and the foremen who are performing the work of the DFOWs. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within two working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

- a. Review the minutes of the previous meeting.
- b. Review the schedule and the status of work and rework.
- c. Review the status of submittals.
- d. Review the work to be accomplished in the next two weeks and documentation required.
- e. Resolve QC and production problems (RFI, etc.).
- f. Address items that may require revising the QC Plan.
- g. Review Accident Prevention Plan (APP).
- h. Review environmental requirements and procedures.
- i. Review Waste Management Plan.
- k. Review Environmental Management Plan.
- l. Review the status of training completion.

## 1.9 THREE PHASES OF CONTROL

Adequately cover both on-site and off-site work with the Three Phases of Control and include the following for each DFOW.

### 1.9.1 Preparatory Phase

Notify the Contracting Officer at least two work days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the Project Superintendent, and the foreman responsible for the DFO. When the DFO will be accomplished by a subcontractor, that subcontractor's foreman must attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFO:

- a. Review each paragraph of the applicable specification sections.
- b. Review the Contract drawings.
- c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order to minimize waste due to excessive materials.
- d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
- e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.
- g. Examine the work area to ensure that the required preliminary work has been completed.
- h. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- i. Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible.
- j. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data and are properly stored.
- k. Discuss specific controls used and construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFO.
- l. Review the APP and appropriate AHA to ensure that applicable safety requirements are met, and that required Safety Data Sheets (SDS) are submitted.

### 1.9.2 Initial Phase

Notify the Contracting Officer at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFO, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFO. Observe the initial segment of the DFO to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met.

Perform the following for each DFOW:

- a. Establish level of workmanship and verify that it meets the minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- b. Resolve any workmanship issues.
- c. Ensure that testing is performed by the approved laboratory.
- d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.
- e. Review project specific work plans (i.e. Cx, HAZMAT Abatement, Stormwater Management) to ensure all preparatory work items have been completed and documented.

#### 1.9.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

- a. Ensure the work is in compliance with Contract requirements.
- b. Maintain the quality of workmanship required.
- c. Ensure that testing is performed by the approved laboratory.
- d. Ensure that rework items are being corrected.
- e. Assure manufacturers representatives have performed necessary inspections if required and perform safety inspections.

#### 1.9.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

#### 1.9.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

#### 1.10 SUBMITTAL REVIEW AND CERTIFICATION

Procedures for submission, review and certification of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES.

#### 1.11 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

#### 1.11.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing must meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

#### 1.11.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at <https://www.nist.gov/nvlap>, the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program at <http://www.aashtoresource.org/aap/overview>, International Accreditation Services, Inc. (IAS) at <http://www.iasonline.org>, U.S. Army Corps of Engineers Materials Testing Center (MTC) at <http://www.erdc.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Article/476661/materials-testing-center.aspx>, and the American Association for Laboratory Accreditation (A2LA) program at <http://www.a2la.org/>.

#### 1.11.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

#### 1.11.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results must be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month, in accordance with paragraph INFORMATION FOR THE CONTRACTING OFFICER.

#### 1.11.5 Test Reports and Monthly Summary Report of Tests

Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily CQC Report of each month. Provide a copy of the signed test reports and certifications to the OMSI preparer for inclusion into the OMSI documentation, in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

## 1.12 QC CERTIFICATIONS

### 1.12.1 CQC Report Certification

Contain the following statement within the CQC Report: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

### 1.12.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current, coordinated and attesting that the work for which payment is requested, including stored material, is in compliance with Contract requirements.

### 1.12.3 Completion Certification

Upon completion of work under this Contract, the QC Manager must furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the preparer of the Operation & Maintenance (O&M) documentation.

## 1.13 COMPLETION INSPECTIONS

### 1.13.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work", or stated elsewhere in the specifications, the QC Manager must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications and Contract. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer. The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

### 1.13.2 Pre-Final Inspection

The Government and QC Manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" will be documented by the QC Manager as a result of this inspection. The QC Manager will ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection must be corrected in a timely manner and be accomplished before the contract completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

### 1.13.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that



all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent and others deemed necessary. Attendees for the Government will include the Contracting Officer, other FEAD personnel, and personnel representing the Client. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

#### 1.14 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

##### 1.14.1 Construction Documentation

Reports are required for each day that work is performed and must be attached to the CQC Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER" will be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work must be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, QC problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

##### 1.14.2 Quality Control Validation

Establish and maintain the following in an electronic folder. Divide folder into a series of tabbed sections as shown below. Ensure folder is updated at each required progress meeting.

- a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.
- b. All milestone inspections, arranged by Activity Number.
- c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
- e. An up-to-date copy of the Rework Items List.
- f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the

Government.

#### 1.14.3 Testing Plan and Log

As tests are performed, the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month, per the paragraph "INFORMATION FOR THE CONTRACTING OFFICER". Provide a copy of the final "Testing Plan and Log" to the preparer of the Operation & Maintenance (O&M) documentation.

#### 1.14.4 Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last daily CQC Report of each month. The Contractor is responsible for including those items identified by the Contracting Officer.

#### 1.14.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager or QC Specialist assigned to an area of responsibility must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

#### 1.15 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, is deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time for excess costs or damages by the Contractor.

### PART 2 PRODUCTS

Not Used

### PART 3 EXECUTION

#### 3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss

from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

11/20, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (2017) Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 241 (2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2009; Rev 2012) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan  
Traffic Control Plan  
Contractor Computer Cybersecurity Compliance Statements  
Contractor Temporary Network Cybersecurity Compliance Statements

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 BACKFLOW PREVENTERS CERTIFICATE

1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (58 mph) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted APP, EM 385-1-1 Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

- a. Condition FOUR (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site, including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 3.3 feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.
- b. Condition THREE (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all

gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

- c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.
- d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

#### 1.6 CYBERSECURITY DURING CONSTRUCTION

Meet the following requirements throughout the construction process.

##### 1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

###### 1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

###### 1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

###### 1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

###### 1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company.

##### 1.6.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must

meet the following requirements:

#### 1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

#### 1.6.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

#### 1.6.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

#### 1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

#### 1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

## PART 2 PRODUCTS

### 2.1 TEMPORARY SIGNAGE

#### 2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

#### 2.1.2 Warning Signs

Post temporary signs, tags, and labels to give workers and the public

adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry designating the construction site as a hard hat area.

## 2.2 TEMPORARY TRAFFIC CONTROL

### 2.2.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

## 2.3 FENCING

Provide fencing at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

### 2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

## 2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

## 2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements of AWWA C511. Provide backflow preventers complete with bronze or brass gate valve and strainer, and stainless steel or bronze internal parts.

## PART 3 EXECUTION

### 3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not



interfere with existing and established parking requirements of the Government installation.

### 3.2 AVAILABILITY AND USE OF UTILITY SERVICES

#### 3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

#### 3.2.2 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

#### 3.2.3 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1 Section 02. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

#### 3.2.4 Telephone

Make arrangements and pay all costs for telephone facilities desired. Contact Century Link to arrange telephone service if desired. The Station Telephone Officer, located in Building 4397, may need to be contacted if excess phone lines are not available in the area.

#### 3.2.5 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

### 3.3 TRAFFIC PROVISIONS

#### 3.3.1 Maintenance of Traffic

- a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic

movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

- b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.
- c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.
- d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

### 3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

### 3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations for MCAS Cherry Point without notification to and approval by the Contracting Officer.

### 3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

### 3.4 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of

the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and quarterly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

### 3.5 CONTRACTOR'S TEMPORARY FACILITIES

Temporary facilities must meet requirements as identified in EM 385-1-1 Section 04.

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1 Section 04. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

#### 3.5.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

In the event a new building is constructed for the temporary project field office, it must be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery-operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, provide air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

#### 3.5.2 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in

support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, must be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

### 3.5.3 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

### 3.5.4 Appearance of Trailers

- a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.
- b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

### 3.5.5 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

### 3.5.6 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

#### 3.5.6.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property.

Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

### 3.6 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

### 3.7 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

11/15, CHG 5: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846 (Third Edition; Update IV) Test Methods  
for Evaluating Solid Waste:  
Physical/Chemical Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.1053	Respirable Crystalline Silica
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261.7	Residues of Hazardous Waste in Empty

Containers

40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.31	Standards Applicable to Generators of Hazardous Waste-Labeling
40 CFR 262.34	Standards Applicable to Generators of Hazardous Waste-Accumulation Time
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response

Information, and Training Requirements

49 CFR 172.101	Hazardous Material Regulation-Purpose and Use of Hazardous Material Table
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous



waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

#### 1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

#### 1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

#### 1.2.9 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

#### 1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by installations to obtain NPDES permit coverage for their stormwater discharges.

#### 1.2.11 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

#### 1.2.12 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

#### 1.2.13 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

#### 1.2.14 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

#### 1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

##### 1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

##### 1.2.15.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

##### 1.2.15.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil

exploration or production.

#### 1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

#### 1.2.15.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may be included as recyclable if sold to a scrap metal company. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

#### 1.2.15.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

#### 1.2.15.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

#### 1.2.15.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, and hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

#### 1.2.16 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, creeks or "waters of the United States". Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

#### 1.2.17 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

1.2.17.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.18 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

1.2.19 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.2.20 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

- Preconstruction Survey
- Solid Waste Management Permit
- Regulatory Notifications
- Environmental Protection Plan
- Stormwater Pollution Prevention Plan (SWPPP)
- Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities)
- Dirt and Dust Control Plan
- Employee Training Records
- Environmental Manager Qualifications

SD-06 Test Reports

- Laboratory Analysis
- Inspection Reports
- Monthly Solid Waste Disposal Report

SD-07 Certificates

- Employee Training Records

Erosion and Sediment Control Inspector Qualifications

SD-11 Closeout Submittals

Stormwater Pollution Prevention Plan Compliance Notebook  
Stormwater Notice of Termination (for NPDES coverage under the  
general permit for construction activities)  
Waste Determination Documentation  
Disposal Documentation for Hazardous and Regulated Waste  
Assembled Employee Training Records  
Solid Waste Management Permit  
Project Solid Waste Disposal Documentation Report

Hazardous Waste/Debris Management  
Regulatory Notifications  
Sales Documentation  
Contractor Certification

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

1.4.1 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental

Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

### 1.5.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 15 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

### 1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

### 1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor compliance with federal, state, local, and installation requirements. The

Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

#### 1.5.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with federal, state and local regulatory requirements for RCRA Large Quantity Generator. Provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet EPA and state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Contact additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Certification as required by the State of North Carolina.

#### 1.5.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or

interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

#### 1.6 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

##### 1.6.1 General Overview and Purpose

###### 1.6.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, traffic control plan, Hazardous, Toxic and Radioactive Waste (HTRW) Plan, Non-Hazardous Solid Waste Disposal Plan, and borrowing material plan.

###### 1.6.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

###### 1.6.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

###### 1.6.1.4 Communications

Communication and training procedures that will be used to convey



environmental management requirements to Contractor employees and subcontractors.

1.6.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.6.2 General Site Information

1.6.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.6.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

1.6.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.6.3 Stormwater Management and Control

- a. Ground cover
- b. Erodible soils
- c. Temporary measures
  - (1) Structural Practices
  - (2) Temporary and permanent stabilization
- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

1.6.4 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of hazardous waste.

This item consists of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated

- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
- g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar
- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

#### 1.6.5 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

#### 1.6.6 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

#### 1.6.7 Clean Air Act Compliance

##### 1.6.7.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

##### 1.6.7.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

#### 1.6.7.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

#### 1.6.7.4 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

#### 1.6.7.5 Compliant Materials

Provide the Government a list of SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

### 1.7 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

### 1.8 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

### 1.9 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

#### 1.9.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

#### 1.10 FACILITY HAZARDOUS WASTE GENERATOR STATUS

MCAS Cherry Point is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

##### 3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

##### 3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

###### 3.2.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 or the State of North Carolina General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

###### 3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the North Carolina State General Permit for stormwater discharges from construction sites.

Include the following:

- a. Comply with terms of the state general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with state requirements. Use the EPA guide Developing your Stormwater Pollution Prevention Plan located at <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp> to prepare the SWPPP.
- b. Select applicable BMPs from EPA Fact Sheets located at <https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#constr> or in accordance with applicable state or local requirements.
- c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

#### 3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review and approval.

Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

#### 3.2.1.3 Inspection Reports

Submit "Inspection Reports" to the Contracting Officer in accordance with the State of North Carolina Construction General Permit.

#### 3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the North Carolina State Permitting Agency, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

#### 3.2.1.5 Stormwater Notice of Termination for Construction Activities

Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency.

#### 3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

#### 3.2.2.1 Erosion Control

Prevent erosion by mulching. Stabilize slopes by sodding. Use of hay bales is prohibited.

Provide sodding in accordance with Section 32 92 23 SODDING.

#### 3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Location and details of installation and construction are indicated on the drawings.

#### 3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

#### 3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

#### 3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

### 3.3 SURFACE AND GROUNDWATER

#### 3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of North Carolina water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

### 3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States, except as authorized herein. The protection of waters of the United States shown on the drawings in accordance with paragraph LICENSES AND PERMITS is the Contractor's responsibility. Authorization to enter specific waters of the United States identified does not relieve the Contractor from any obligation to protect other waters of the United States within, adjacent to, or in the vicinity of the construction site and associated boundaries.

### 3.4 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

#### 3.4.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

#### 3.4.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

#### 3.4.3 Burning

Burning is prohibited on the Government premises.

#### 3.4.4 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the appropriate location for turn in of all reclaimed refrigerant.

#### 3.4.5 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported

immediately to the Contracting Officer.

#### 3.4.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

#### 3.4.7 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

##### 3.4.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

##### 3.4.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

#### 3.4.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.



### 3.5 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

#### 3.5.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

#### 3.5.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	(____) cubic yards or tons, as appropriate
C&D Debris Recycled	(____) cubic yards or tons, as appropriate
C&D Debris Composted	(____) cubic yards or tons, as appropriate
Total C&D Debris Generated	(____) cubic yards or tons, as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	(____) cubic yards or tons, as appropriate

### 3.6 WASTE MANAGEMENT AND DISPOSAL

#### 3.6.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 261 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex-based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

##### 3.6.1.1 Sampling and Analysis of Waste

###### 3.6.1.1.1 Waste Sampling

Sample waste in accordance with EPA SW-846. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

###### 3.6.1.1.2 Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. Provide analytical results and reports performed to the Contracting Officer.

###### 3.6.1.1.3 Analysis Type

Identify hazardous waste by analyzing for the following characteristics: ignitability, corrosivity, reactivity, toxicity based on TCLP results.

### 3.6.2 Solid Waste Management

#### 3.6.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The Contractor certification must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

#### 3.6.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

#### 3.6.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

##### 3.6.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by

personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

### 3.6.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262.34 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or 1 quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90 day accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan to the Request):

Contract Number	(_____)
Contractor	(_____)
Haz/Waste or Regulated Waste POC	(_____)
Phone Number	(_____)
Type of Waste	(_____)
Source of Waste	(_____)
Emergency POC	(_____)
Phone Number	(_____)
Location of the Site	(_____)

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

### 3.6.3.3 Hazardous Waste Disposal

#### 3.6.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

#### 3.6.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services

include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

#### 3.6.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

#### 3.6.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

#### 3.6.3.3.1.4 Labeling

Determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

#### 3.6.3.3.2 Contractor Disposal Turn-In Requirements

Hazardous waste generated must be disposed of in accordance with the following conditions to meet installation requirements:

- a. Drums must be compatible with waste contents and drums must meet DOT requirements for 49 CFR 173 for transportation of materials.
- b. Band drums to wooden pallets.
- c. No more than three 55 gallon drums or two 85 gallon over packs are to be banded to a pallet.
- d. Band using 1-1/4 inch minimum band on upper third of drum.
- e. Provide label in accordance with 49 CFR 172.101.
- f. Leave 3 to 5 inches of empty space above volume of material.

#### 3.6.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

- a. Batteries as described in 40 CFR 273.2
- b. Lamps as described in 40 CFR 273.5
- c. Mercury-containing equipment as described in 40 CFR 273.4

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for

disposal as directed.

#### 3.6.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such as computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

#### 3.6.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office.

#### 3.6.4 Releases/Spills of Oil and Hazardous Substances

##### 3.6.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

##### 3.6.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

#### 3.6.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the

satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

### 3.6.6 Wastewater

#### 3.6.6.1 Disposal of Wastewater

Disposal of wastewater must be as specified below.

##### 3.6.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction-related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

##### 3.6.6.1.2 Surface Discharge

For discharge of ground water, obtain a state or federal permit specific for pumping and discharging ground water prior to surface discharging.

### 3.7 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have NFPA labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

### 3.8 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

### 3.9 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and

regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

#### 3.9.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

#### 3.9.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

#### 3.10 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

#### 3.11 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause:



"Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

05/19, CHG 1: 08/21

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings.

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Management Plan

SD-08 Manufacturer's Instructions

Posted Instructions

SD-11 Closeout Submittals

As-Built Drawings

As-Built Record of Equipment and Materials

1.3 WARRANTY MANAGEMENT

1.3.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the

Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Conduct a joint 4 month and 9 month warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

- a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.
- b. For each warranty, the name, address, telephone number, and e-mail of each of the guarantor's representatives nearest to the project location.
- c. A list and status of delivery of Certificates of Warranty for extended warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.
- d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:
  - (1) Name of item.
  - (2) Model and serial numbers.
  - (3) Location where installed.
  - (4) Name and phone numbers of manufacturers or suppliers.
  - (5) Names, addresses and telephone numbers of sources of spare parts.
  - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have warranties longer than one year must be indicated with separate warranty expiration dates.
  - (7) Cross-reference to warranty certificates as applicable.
  - (8) Starting point and duration of warranty period.
  - (9) Summary of maintenance procedures required to continue the warranty in force.
  - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (11) Organization, names and phone numbers of persons to call for warranty service.
  - (12) Typical response time and repair time expected for various warranted equipment.
- e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of equipment covered by warranties longer than one year.
- g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

#### 1.3.2 Performance Bond

The Performance Bond must remain effective throughout the construction and warranty period.

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.
- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty. In connection with these requirements and at the time of the Contractor's QC completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

## PART 2 PRODUCTS

## PART 3 EXECUTION

### 3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site and/or red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

#### 3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

- a. Use base colors of red, green, and blue. Color code for changes as follows:
  - (1) Special (Blue) - Items requiring special information,

coordination, or special detailing or detailing notes.

(2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

(3) Additions (Green) - Added items, lettering in notes and leaders.

- b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.
- c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.
- d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.
- e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.
- f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.
- g. For deletions, cross out all features, data and captions that relate to that revision.
- h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.
- i. Indicate one of the following when attaching a print or sketch to a markup print:
  - 1) Add an entire drawing to contract drawings
  - 2) Change the contract drawing to show
  - 3) Provided for reference only to further detail the initial design.
- j. Incorporate all shop and fabrication drawings into the markup drawings.

### 3.1.2 As-Built Drawings Content

Show on the as-built drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.
- b. Layout and schematic drawings of electrical circuits and piping.
- c. Correct grade, elevations, cross section, or alignment of roads,

earthwork, structures or utilities if any changes were made from contract plans.

- d. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.
- e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- f. Changes or Revisions which result from the final inspection.
- g. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.
- i. Modifications.
- j. Actual location of anchors, construction and control joints, etc., in concrete.
- k. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

### 3.2 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site..

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

08/15, CHG 2: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971 (2005; R 2011) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database  
Training Plan  
Training Outline  
Training Content

SD-11 Closeout Submittals

Training Video Recording  
Validation of Training Completion

1.3 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.3.1 Package Quality

Documents must be fully legible. O&M data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.3.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package

requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows.

#### 1.3.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

#### 1.4 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the O&M Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

#### 1.5 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic O&M Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked O&M directory.

##### 1.5.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI MasterFormat numbering system, and arrange submittals using the specification sections as a structure. Use CSI MasterFormat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

##### 1.5.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

- a. Building Number
- b. Project Title
- c. Activity and Location
- d. Construction Contract Number
- e. Prepared For: (Contracting Agency)
- f. Prepared By: (Name, title, phone number and email address)
- g. Include the disk content on the disk label
- h. Date
- i. Virus scanning program used

#### 1.6 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.



#### 1.6.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

##### 1.6.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the AHA provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

##### 1.6.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

##### 1.6.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

##### 1.6.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

##### 1.6.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

##### 1.6.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

##### 1.6.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

##### 1.6.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

#### 1.6.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance

to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

#### 1.6.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.6.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

#### 1.6.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

#### 1.6.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

#### 1.6.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

#### 1.6.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

#### 1.6.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

#### 1.6.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

#### 1.6.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

#### 1.6.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

#### 1.6.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

##### 1.6.4.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

##### 1.6.4.2 Certificates

Provide a copy of SD-07 Certificates submittals documented with the required approval.

#### 1.6.4.3 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

#### 1.6.4.4 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

#### 1.6.4.5 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

#### 1.6.4.6 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.4.7 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.4.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.6.4.9 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.4.10 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.4.11 Field Test Reports and Manufacturer's Field Reports

Provide a copy of Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals documented with the required approval.

1.6.4.12 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name, address, and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

1.7.1 Data Package 1

- a. Safety precautions and hazards
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Extended warranty information
- f. Contractor information
- g. Spare parts and supply list

1.7.2 Data Package 2

- a. Safety precautions and hazards
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan, schedule, and procedures
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Extended warranty information
- m. Contractor information

1.7.3 Data Package 3

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations

- f. Environmental conditions
- g. Operating log
- h. Lubrication data
- i. Preventive maintenance plan, schedule, and procedures
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Product submittal data
- q. O&M submittal data
- r. Parts identification
- s. Warranty information
- t. Extended warranty information
- u. Testing equipment and special tool information
- v. Testing and performance data
- w. Contractor information
- x. Field test reports

1.7.4 Data Package 4

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Operating log
- i. Lubrication data
- j. Preventive maintenance plan, schedule, and procedures
- k. Cleaning recommendations
- l. Troubleshooting guides and diagnostic techniques
- m. Wiring diagrams and control diagrams
- n. Repair procedures
- o. Removal and replacement instructions
- p. Spare parts and supply list
- q. Repair work-hours
- r. Product submittal data
- s. O&M submittal data
- t. Parts identification
- u. Warranty information
- v. Extended warranty information
- w. Personnel training requirements
- x. Testing equipment and special tool information
- y. Testing and performance data
- z. Contractor information
- aa. Field test reports

1.7.5 Data Package 5

- a. Safety precautions and hazards
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan, schedule, and procedures
- g. Troubleshooting guides and diagnostic techniques

- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Extended warranty information
- s. Testing and performance data
- t. Contractor information
- u. Field test reports

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the Facilities Management Specialist, building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the O&M Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

#### 3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the QC Manager prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and QC Manager. Include within the plan the following elements:

- a. Equipment included in training
- b. Intended audience
- c. Location of training
- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)

- i. Instructor names and instructor qualifications for each subject
- j. List of texts and other materials to be furnished by the Contractor that are required to support training
- k. Description of proposed software to be used for video recording of training sessions.

#### 3.1.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the O&M information. The QC Manager is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

#### 3.1.1.3 Training Outline

Provide the O&M Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

#### 3.1.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

#### 3.1.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees



that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

#### 3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the O&M Manual Preparer for inclusion into the Manual's documentation.

#### 3.1.7 Quality Control Coordination

Coordinate this training with the QC Manager in accordance with Section 01 45 00.00 20 QUALITY CONTROL.

-- End of Section --

SECTION 01 80 00

REPORTS

04/15

PART 1 GENERAL

1.1 REPORTS INCLUDED

1.1.1 Asbestos and Lead Paint Inspection Report

Asbestos-Containing Building Materials Survey and Limited Lead-Containing Paint Screening Report, May 5, 2022, CLES Project No. 21-108  
Cape Lookout Environmental Services, PLLC.

1.2 USE OF INFORMATION

1.2.1 Warranty

The information disclosed in the referenced reports is based on data obtained in specific locations and is assumed to be representative of conditions throughout the site. This information is furnished without warranty and is only for general information to be used by the contractor in the preparation of his bid and work schedule. It is not intended as a replacement for personal investigation and judgment, or interpretation of the information furnished, as required of the contractor in the performance of this contract.

1.2.2 Site Visit

Bidders should visit the site and acquaint themselves with all existing conditions prior to preparing their bid. This will include a review of the conditions contained in the enclosed report as they relate to the site. The contractor is responsible for including in his bid and work schedule, procedures for handling existing site conditions delineated in the included reports in accord with applicable laws and regulations as those conditions may affect the work.

1.2.3 Application of Information

Recommendations contained in the reports are to be used by the contractor only to the extent that these recommendations comply with applicable laws, regulations, and other sections of the these specifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 VARYING CONDITIONS

If during the course of the work, conditions are encountered which are not covered in the included reports or are different from conditions that would be reasonably anticipated from the included reports, the contractor shall immediately notify the Contracting Officer. If such conditions are hazardous or the continuation of work would cause a hazardous condition to develop, he shall stop work and proceed as directed by the Contracting

Officer as directed by provisions contained in other sections of this specification. This may include modifications to, or the development of a new, Health and Safety Plan for this project, and alternate or additional appropriate abatement procedures.

### 3.2 CHANGES TO THE CONTRACT

Any changes to the contract made as a result of site conditions which differ from those delineated in the report may result in an adjustment of the contract amount. The adjustment will be an increase or decrease depending on the scope and nature of the change and will be in accord with other provisions of these specifications.

-- End of Section --



May 5, 2022

NRW Engineering, PC  
748 Lord Dunmore Drive  
Suite 101  
Virginia Beach, Virginia 23464-2664

**Attention:** Mr. Kevin Roomsburg, PE, Vice President

**Reference:** **Asbestos-Containing Building Materials Survey and Limited Lead-Containing Paint Screening Report**  
WO7080863 Repairs to Wastewater Treatment Plant CP2304M Project  
Marine Corps Air Station Cherry Point  
Cherry Point, North Carolina  
CLES Project No. 21-108

Dear Mr. Roomsburg:

Cape Lookout Environmental Sciences, PLLC (CLES), appreciates the opportunity to perform an Asbestos-Containing Building Materials Survey and Limited Lead-Containing Paint Screening of the structures and system components that will be impacted by the proposed project located at Marine Corps Air Station (MCAS) Cherry Point. Our services were performed in general accordance with CLES Proposal P160-21, dated October 19, 2021.

## **PROJECT BACKGROUND**

We understand that NRW Engineering, PC (NRW), and Dewberry Engineers, Inc. (Dewberry), are developing plans and specifications for repairs and improvements to the wastewater treatment plant (WWTP) at MCAS Cherry Point. CLES prepared a proposal based on a request for services and information provided in an email correspondence from Mr. Steven Harvey with Dewberry to Mr. Chris Hamblet with CLES on October 18, 2021. On the behalf of NRW, Mr. Harvey requested that CLES provide a proposal to perform a screening for lead-containing paints (LCP) of the structures and the system components that will be impacted by the above-referenced project. On March 30, 2022, Mr. Harvey stated that the primary sludge pump station (B4410) was going to be demolished and requested that CLES add the collection and analysis of samples of suspect asbestos-containing building materials (ACM) for this structure.

## **PROJECT DESCRIPTION**

Dewberry requested that CLES perform an asbestos-containing building materials survey of B4410 and a limited lead-containing paints screening of the structures that will be impacted by the above-referenced project. Dewberry provided drawings of the structures in electronic

format. Mr. Harvey did not request that CLES perform a visual inventory of any other typical hazardous building materials.

## **PROCEDURE**

On April 8, 2022, Mr. Chris Hamblet of CLES visited the project site to perform the ACM survey and limited LCP screening. The limited survey included a visual assessment for suspect:

- Asbestos-containing building materials
- Lead-containing paints

Mr. Hamblet is accredited in North Carolina as an Asbestos Inspector (NC Accreditation No. 11679). The wastewater treatment plant components were in operation with energized systems at the time of the site visit and portions of the proposed work area were not readily accessible or were not accessed, including the below ground portions of the structures and components that were located under water or beneath concrete slab floors. CLES personnel did not dismantle or open any plumbing, electrical or mechanical equipment associated with the buildings to observe or sample the interior surfaces.

Some of the piping gasket materials were enclosed within metal flanges, limiting our ability to observe the underlying materials. Only the exposed and readily accessible gasket materials were evaluated. The observed, accessible gaskets were made of soft, non-reinforced rubber, which is not a suspect ACM. Suspect ACM gaskets, gasket sealants and any other suspect ACM, if identified, that were not sampled during our asbestos survey should be classified as Presumed ACM until sampled and proven otherwise.

### **Asbestos Containing Building Materials Survey**

The ACM survey of B4410 consisted of the following:

1. Collection of representative samples of readily accessible suspect asbestos-containing materials. The number of samples collected for each material was in accordance with the sampling schedule described in the EPA AHERA rule (40 CFR § 763.86),
2. Determination of EPA Category as described in the EPA NESHAP rule (40 CFR § 61.141), approximate location, current condition and approximate quantity of the materials that are confirmed to be ACM, and;
3. Submission of suspect ACM samples to a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory for analysis using polarized light microscopy with dispersion staining in accordance with the EPA 600/R-93/116 Method.

### **Limited Lead-Containing Paint Screening**

CLES also performed a limited screening of the building materials and accessible areas of the facility's equipment for the presence of lead-containing paints. Our lead-containing paint screening included:

1. A visual survey of the building materials to prepare a list of the prevalent types of painted surfaces, including a description of the color, approximate location, building component type and substrate material.

2. Collection of representative paint chip samples of each of the prevalent types of paint.
3. Submission of the paint chip samples for laboratory analysis using Flame Atomic Absorption Spectroscopy in accordance with Method SW 846 3050B/7000B.

CLES did not perform observations to inventory, assess or sample other types of typical hazardous building materials and components, such as PCBs, mercury, and CFC refrigerants.

## **FINDINGS**

### **Asbestos Containing Building Materials Survey Findings**

During our ACM survey, Mr. Hamblet collected a total of 12 samples of suspect ACM representing six types of building materials from B4410. One additional type of suspect ACM was identified in the other areas of the WWTP that will be impacted. Two samples of the suspect ACM exterior caulk on the pipe insulation jacket located at the Primary Clarifier were also collected. The samples were submitted to EMSL's asbestos laboratory located in Morrisville, North Carolina (NVLAP ID 102104-0).

The approximate sample locations for both asbestos and lead paint samples are shown on **Figure 1** and **Figure 2**. Please see the **Asbestos Survey Data Table** in **Appendix I** and the **Asbestos Analytical Report** in **Appendix II** for additional details regarding the condition and location of the ACM present in the structures. The table also contains information about the other suspect ACM that were sampled where no asbestos was detected, which are classified as non-ACM. The area of ACM provided on the **Asbestos Survey Data Table** was based on a general visual estimate and the quantity of ACM should be confirmed by the abatement contractors for bidding purposes.

### **Asbestos Containing Materials**

Any material type with at least one sample that is found to contain greater than 1% asbestos when analyzed using the EPA Polarized Light Microscopy Method specified in 40 CFR 763, Subpart F, Appendix A, is classified as an ACM. None of 14 samples that were collected and analyzed from the seven homogeneous areas of suspect ACM were found to contain asbestos, so no confirmed ACMs were identified.

### **Non-Asbestos Containing Materials**

No asbestos was detected the 14 building material samples that were tested, so they are classified as non-ACM. The observed exposed portions of piping gasket materials that were readily accessible were non-reinforced rubber gaskets that are non-ACM. If other types of suspect ACM non-rubber gaskets, non-silicone gasket sealants, non-fiberglass TSI or any other suspect ACMs are found to be present in areas that were not accessible and sampled during the current survey, they should be classified as presumed ACM (PACM) until proven otherwise through appropriate sampling and analysis. Please see the **Asbestos Survey Data Table** for additional details regarding the materials that were found to be non-ACM.

### **Limited Lead-Containing Paint Screening Findings**

CLES collected a total of 13 paint chip samples from accessible interior and exterior painted surfaces on the structures. The paint chip samples were submitted to EMSL's lead laboratory located in Kernersville, North Carolina, for analysis by Flame Atomic Absorption Spectroscopy (AAS), Method SW 846 3050B/7000B. The minimum reporting limit for this testing method is 0.010 % by weight (% wt) based on the minimum sample weight in their Standard Operating

Procedures. The minimum reporting limit is higher if the submitted sample weight is less than the minimum sample weight. In any LCP survey, it is possible to fail to detect some paints or types of substrates, especially when lead-containing paint is hidden by an outer paint layer.

### Lead-Containing Paints

Only one of the 13 paint chip samples were found to contain lead at a concentration exceeding the laboratory's detection limit. Other types of coatings that are present in areas that were not accessible during the current survey should be presumed to contain lead until proven otherwise through sampling and analysis.

**Table 2. Lead-Containing Paints**

Sample ID	Area ID	Paint Color	Substrate	Area Location	Sample Location	Result (% wt)
08L-04	D	Gray	Metal	B4410 – piping & fittings	E gate valve	0.96

None of the other samples were found to contain lead at a concentration exceeding the laboratory's detection limit.

A more detailed description of the coatings that were sampled and analyzed where no lead was detected may be found in the **Lead-Containing Paint Screening Results Table** located in **Appendix III**. The **Lead Analytical Report** is included in **Appendix IV**.

## RECOMMENDATIONS

### Limited Asbestos Containing Building Materials Survey Recommendations

None of the suspect ACMs that were identified and sampled were found to contain asbestos, so no confirmed ACMs were identified in the materials that will be impacted by the proposed project. If any additional suspect ACMs are identified that were not sampled during our survey, such as non-rubber gaskets, they should be presumed to be ACM until they have been sampled and proven to be non-ACM.

If confirmed ACMs are found to be present, ACM is required to be removed if the material is friable prior to building demolition, or if the material is currently non-friable and the demolition operations may render the material to be friable and, therefore, be classified as a "Regulated Asbestos-Containing Material (RACM)". According to the NESHAP, RACM is (a) friable ACM, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting or abrading, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material during demolition or asbestos abatement operations. If non-friable ACM is left in the building, and it is demolished in a manner that does not render it friable, then all of the associated demolition debris would be considered an asbestos-containing waste, and would need to be contained, transported, and disposed of accordingly. Typically, it is more cost effective to remove all of the ACM prior to demolition.

Activities involving the removal of ACM must be performed in accordance with the NESHAP and other regulations prior to building demolition. The North Carolina Department of Health and Human Services, Health Hazards Control Unit, requires the submittal of an *Asbestos Permit Application and Notification for Demolition/Renovation* by the owner or operator at least ten working days prior to the removal start date if more than 160 square feet, 260 linear feet or 35

cubic feet or greater of RACM are to be removed. Even if no RACM is scheduled for removal, the notification for the demolition activity is still required at least ten working days prior to the start of demolition activities.

Asbestos exposure to construction workers is regulated by the OSHA Standard 29 CFR 1926.1101. Workers participating in demolition activities are required to be trained in the hazards of asbestos and in the requirements of the OSHA Standard. This training includes, but is not limited to, a detailed description of the health effects of asbestos, relationship between smoking and asbestos relating to lung cancer, appropriate work practices, waste disposal and the importance of personal hygiene. Training for workers is also required according to 29 CFR 1910.1200 (Hazard Communication). All personnel working with asbestos are to be medically qualified as required by 29 CFR 1926.1101, having completed and passed the physical examination specified therein.

OSHA also requires employers to perform an initial exposure assessment of their workers to assess their exposure to asbestos. Workers are to be protected during the exposure assessment period, and, if levels of airborne asbestos exceed the regulatory limits, they must continue to wear personal protective equipment and use engineering controls to reduce the airborne asbestos levels. The employer must demonstrate that worker exposure is below the 0.1 asbestos fiber per cubic centimeter of air (f/cc) as an eight-hour Time Weighted Average Permissible Exposure Limit (TWA-PEL) to suspend further exposure assessment for each specific task.

After the WWTP equipment has been taken off-line, de-energized and drained for the proposed demolition activities, areas including the below ground portions of the structures and the internal components of the plumbing, electrical and mechanical systems, should be inspected by a North Carolina accredited Asbestos Inspector for additional suspect ACM. If suspect ACM is identified that has not been tested and is to be disturbed, such as non-rubber gaskets or non-silicone caulks, these materials should be tested or presumed to contain asbestos and handled accordingly.

#### **Lead-Containing Paint Recommendations**

For building renovation, the State of North Carolina and the EPA will allow building components to be removed intact without removing the LCP from the surface. It is considered a type of component removal since the lead paint and its substrate typically remain intact. The advantages of removing the component are lower exposure to lead-containing dust and the ability to dispose of the components at most sanitary landfills. However, Craven County and the landfill where the building debris is to be disposed should be contacted to see if they have any additional regulations or policies concerning LCP.

CLES performed a limited screening for LCP, which only included identifying and sampling the most prevalent types of exposed paints that were observed. Several other types of paints are present that were not sampled and are not listed on the **Lead-Containing Paint Screening Results Table**. Any types of coatings in the areas that were not sampled during the current survey that were not sampled in other locations should be presumed to contain lead until proven otherwise, including the internal components of equipment, the below water portions of the structures, and materials that were not readily and/or safely accessible. The contractor should take appropriate measures to ensure that workers are not exposed to lead or other contaminants during any surface preparation activities, and manage any wastes generated from surface preparation activities in accordance with applicable State and federal regulations.



In cases where the paint is to be removed from the substrate or otherwise disturbed, it is recommended that any renovation activities be treated as a LCP abatement project, using necessary engineering controls to protect the workers and the public. Also, the contractor is required to comply with applicable OSHA regulations, including 29 CFR 1926.62 concerning lead exposure to its workers during activities that cause the disturbance of LCP. In addition, other potential contaminants may be present in coatings, such as cadmium and chromium, that should be considered related to worker exposure and waste characterization. **Under no condition should unprotected workers perform sanding, cutting or welding activities on any surface coated with LCP.**

Lead exposure to construction workers is regulated by the OSHA Standard 29 CFR 1926.62. OSHA considers paint a *potential* hazard if it contains any amount of lead by dry weight when analyzed using ASTM D335-85A "Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectroscopy (AAS)". This standard applies to areas that may be disturbed during renovation or demolition activities. Other factors, such as the location and condition of the paint, work to be done around the paint, and whether the paint is accessible by children determine if there is a lead hazard and what actions need to be taken.

OSHA considers any amount of lead a potential exposure hazard and does not provide a specific action level for the concentration of lead in a coating. Note that, although those surfaces where lead was not detected are less likely to present a significant risk of lead exposure in excess of the OSHA standard than those where lead was detected, anyone who disturbs painted surfaces should perform an exposure assessment in compliance with OSHA regulations.

If workers are to disturb LCP, they need to be trained in the hazards of lead, in the requirements of 29 CFR 1926.62, and in the requirements of HUD Guidelines<sup>1</sup>. This training includes a detailed description of the hazards to the developing fetus in pregnant women exposed to lead and the importance of personal hygiene, including decontamination procedures for controlling the spread of the lead hazard. The workers are also required to be trained according to 29 CFR 1910.1200 (Hazard Communication). All personnel working with lead are to be medically qualified as required by 29 CFR 1926.62, having completed and passed the physical examination specified therein.

OSHA also requires an initial exposure assessment of workers to assess their exposure for tasks that may disturb painted surfaces. Workers are to be protected during the exposure assessment and, if high levels of lead are found in the air, they must continue to wear personal protective equipment and use engineering controls to reduce the airborne lead levels<sup>2</sup>. The employer must demonstrate that worker exposure is below the 30  $\mu\text{g}/\text{m}^3$  eight-hour time weighted average OSHA action level to be able to eliminate further exposure assessment of a specific task<sup>3</sup>.

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<sup>1</sup>- The HUD guidelines do not apply to renovation or other non-target housing or non-child occupied facilities.

<sup>2</sup>- Protection is not required for mechanical demolition during the assessment period unless there is reason to expect lead exposures.

<sup>3</sup>- 30 Micrograms per cubic meter (30  $\mu\text{g}/\text{m}^3$ ).

## LIMITATIONS

Suspected types of ACM that were identified within the structures during this survey were sampled and tested for asbestos content. The survey did **not** include evaluation of suspect hazardous building materials that were not readily and safely accessible, below water, or located within confined spaces. Materials located inside of equipment and below the concrete slab were excluded from the assessment.

As is the case with any asbestos inspection, lead-containing paint screening, or other hazardous materials assessment, materials that were not readily apparent or were located in concealed locations, such as beneath a concrete slab or inside a wall may not have been identified. CLES personnel visually observed the exterior of the plumbing, mechanical and electrical equipment, but did not disassemble any of these systems or collect samples from inside these systems for laboratory analysis. If any material that is suspected to contain asbestos or lead is discovered and was not included in this report as a material that was tested, it should be presumed to be positive and managed accordingly or evaluated for asbestos or lead content before it is disturbed.

Although Polarized Light Microscopy (PLM) / Dispersion Staining (Method EPA 600/R-93/116) is the specified method for analysis of bulk material samples for asbestos under the EPA Asbestos Hazard Emergency Response Act, there have been reports that this method may not identify asbestos when fiber sizes are extremely small or if they are bound in a resinous material. EPA recommends analyzing such materials (floor tiles, mastics and asphaltic roofing) using Transmission Electron Microscopy (TEM) when PLM analysis does not detect asbestos in quantities greater than 1%. Current EPA regulations do not require this additional analysis and the decision to do so is left to the client.

This report is not intended for use as an ACM or LCP material removal specification. It is not within the scope of these services to describe all appropriate precautions, safeguards and regulations relating to asbestos or lead.

CLES' *Asbestos Survey and Limited Lead-Containing Paint Screening* was limited to only those materials that were visible and readily accessible. There is the potential that additional hazardous materials may be present below the concrete floor slab or beneath paint coatings, within wall cavities or other areas that were not identified during the visual survey. Also, the WWTP is currently in use, so suspect ACM such as gaskets, packings, insulation and wire coverings, or other suspect ACM or LCP that may be located behind metal, wood, plastic or other coverings, inside electrical equipment or other system components, were not sampled unless they could be safely and readily accessed and without potentially jeopardizing the integrity of the materials. If suspect ACM or LCP is identified and cannot be sampled, these materials should be presumed to be positive until proven otherwise by applicable laboratory analysis. If suspect hazardous materials are encountered during repair or demolition activities that were not identified during the visual survey, they should be evaluated, handled and disposed of properly.

Without attempting to be a complete list or description of all services or potential services excluded from this project and not performed by CLES, the following services were specifically excluded:

- Entering confined spaces and evaluating materials that are below water or underground.

- Evaluation of equipment that may contain hazardous materials but would require de-energizing, dismantling or other disassembly to access it, unless such equipment is identified, de-energized and disassembled by the client.
- Asbestos, lead paint, or other hazardous material abatement design or air monitoring services during abatement.
- Evaluation of any areas of the facility for the presence of other types of hazardous materials or wastes.
- Lead-Based Paint Inspection or Risk Assessment meeting HUD protocols.
- Lead-Based Paint or asbestos clearance testing after a renovation, interim control procedure or abatement.
- Identification, sampling or assessment of other hazardous materials not specifically included herein.
- Evaluation of exposures to chemical or biological contaminants not specifically included herein.
- Handling or disposal of hazardous building materials and/or wastes.
- Performing or supervising confined space entry.
- Collecting samples of suspect materials located within confined spaces.

CLES is available to perform many of these services upon request and under a change order proposal. If any of the above excluded services are required, please contact us so that we can provide a change order proposal with an estimated additional budget for these services.

## CLOSING

CLES appreciates the opportunity to assist you with your environmental and industrial hygiene consulting needs. Please contact us at 919-757-7901 or 919-880-6801 if you have any questions or comments regarding this report. We look forward to working with you again soon.

Sincerely,

Cape Lookout Environmental Sciences, PLLC



Christopher L. Hamblet, CHMM  
Senior Environmental Scientist



David B. Wells, PG  
Senior Geologist

## Figures:

Figure 1 – Sample Location Map

Figure 2 – B4410 Sample Location Map

## Appendices:

Appendix I – Asbestos Survey Data Table

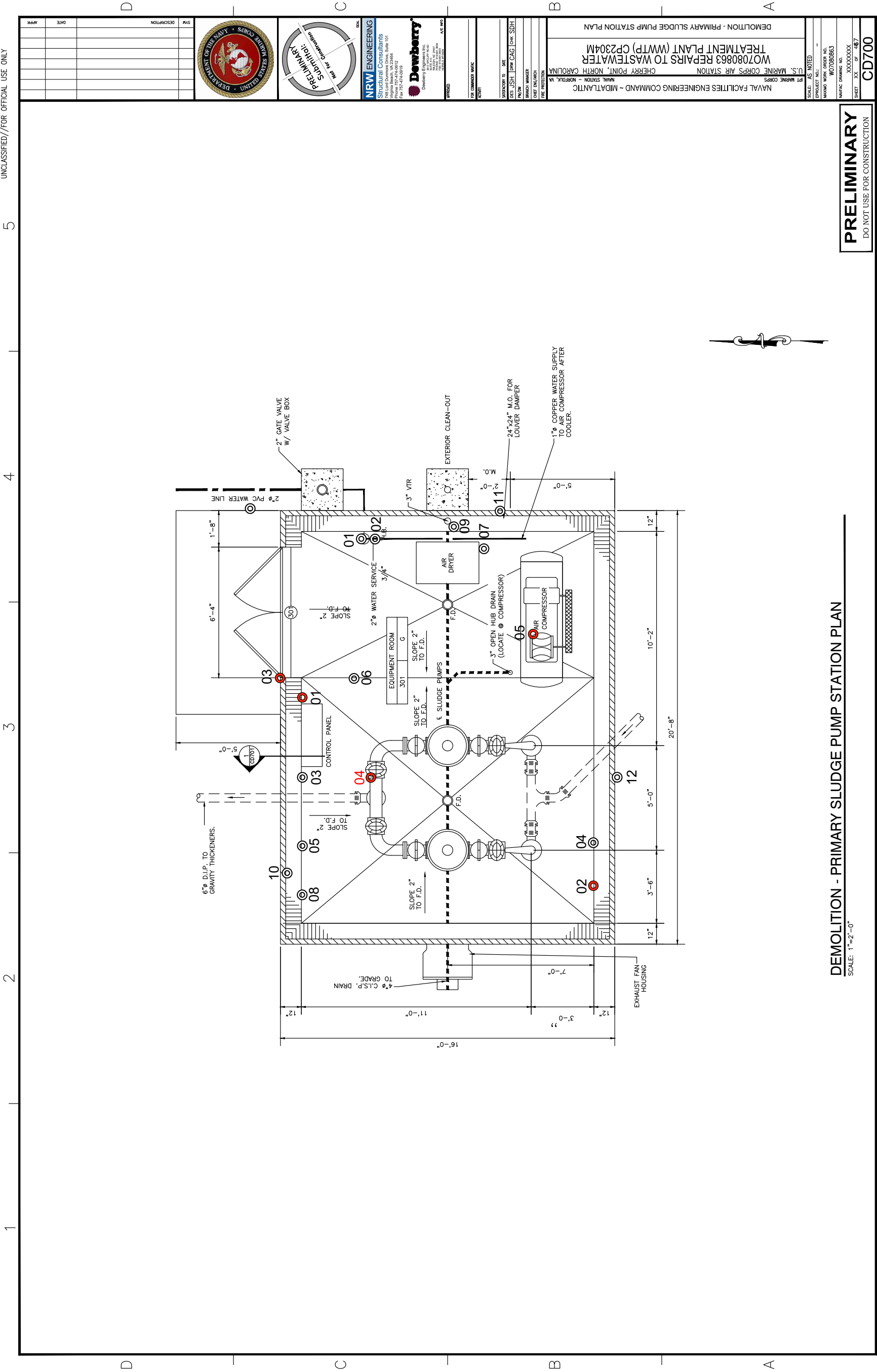
Appendix II – Asbestos Analytical Report

Appendix III – Lead-Containing Paint Screening Data Table

Appendix IV – Lead Analytical Report



UNCLASSIFIED//FOR OFFICIAL USE ONLY



DEMOLITION - PRIMARY SLUDGE PUMP STATION PLAN  
SCALE: 1"=2'-0"

Legend: 01 = 08-XX Asbestos Sample Location  
02 = 08L-XX Lead Paint Sample Location, XX = Lead Detected in Sample

PRELIMINARY  
DO NOT USE FOR CONSTRUCTION

UNCLASSIFIED//FOR OFFICIAL USE ONLY

UNCLASSIFIED//FOR OFFICIAL USE ONLY

Legend: 01 = 08-XX Asbestos Sample Location

02 = 08L-XX Lead Paint Sample Location, XX = Lead Detected in Sample

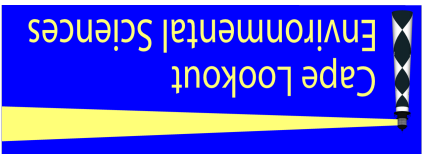
FIGURE NO.

2

B4410 Sample Location Map

B4410 ACM Survey and LCP Screening  
W07080863 Repairs to Wastewater Treatment Plant

Roosevelt Avenue  
MCAS Cherry Point, North Carolina



SCALE:  
As Shown  
PROJECT NUMBER:  
21-108  
DRAWING NUMBER:  
2

DATE:  
05/05/2022  
DRAWN BY:  
CLH  
CHECKED BY:  
DBW

## **Appendix I – Asbestos Survey Data Table**



## ASBESTOS SURVEY DATA TABLE

<b>Project Number:</b>	21-108	<b>Inspection Date:</b>	4-8-22	<b>Inspector 1: Accreditation No:</b>	Chris Hamblet NC 11679
<b>Project Name &amp; Address:</b>	WWTP B4410 Primary Sludge Pump Station Roosevelt Avenue, MCAS Cherry Point, North Carolina			<b>Inspector 2: Accreditation No:</b>	NA
<b>Description of Structure(s) Inspected:</b> Approximately 16' by 20' concrete masonry unit structure with brick veneer, precast concrete panel roof and slab on grade floor. Materials located inside of equipment and below the concrete slab were excluded from the assessment. The evaluation of gasket materials was limited to those that were visible and readily accessible. Observed gaskets were made of non-suspect rubber materials.					

### HOMOGENEOUS AREA:

Form 3585-03-01								
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<sup>1</sup>Category: F=Friable; I=Non-Friable (ACM packing, gaskets, resilient floor coverings & asphalt roofing); II=Category II, Non-Friable (misc. ACM)

<sup>2</sup>Condition: PD=Potential for Damage; PSD=Potential for Significant Damage; D=Damaged; SD=Significantly Damaged

ND = none detected; NA = not analyzed, positive stop; SF = square feet; LF = linear feet

## **Appendix II – Asbestos Analytical Report**





# EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560

Tel/Fax: (919) 465-3900 / (919) 465-3950

<http://www.EMSL.com> / [raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 292202962

Customer ID: CAPE42

Customer PO:

Project ID:

Attention: Chris Hamblet

Cape Lookout Environmental Sciences

8005 Clear Brook Drive

Raleigh, NC 27615

Phone: (919) 757-7901

Fax:

Received Date: 04/11/2022 5:30 PM

Analysis Date: 04/12/2022

Collected Date:

Project: 21-108 MCAS Cherry Point WWTP

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
08-01 292202962-0001	B4410 - 1" Water Line Tee - Fiberglass Insulation Mastic	White Fibrous Homogeneous	2% Min. Wool 3% Wollastonite 2% Fibrous (Other)	10% Ca Carbonate 83% Non-fibrous (Other)	None Detected
08-02 292202962-0002	B4410 - 1" Water Line Tee - Fiberglass Insulation Mastic	White Fibrous Homogeneous	5% Wollastonite 2% Fibrous (Other)	15% Ca Carbonate 78% Non-fibrous (Other)	None Detected
08-03 292202962-0003	B4410 - N Floor - Expansion Joint	Brown/Black Fibrous Homogeneous	85% Cellulose	15% Non-fibrous (Other)	None Detected
08-04 292202962-0004	B4410 - S Floor - Expansion Joint	Brown/Black Fibrous Homogeneous	85% Cellulose	15% Non-fibrous (Other)	None Detected
08-05 292202962-0005	B4410 - N Ceiling - Interior Caulk	White Non-Fibrous Homogeneous		10% Ca Carbonate 90% Non-fibrous (Other)	None Detected
08-06 292202962-0006	B4410 - N Ceiling - Interior Caulk	White Non-Fibrous Homogeneous		10% Ca Carbonate 90% Non-fibrous (Other)	None Detected
08-07-Roofing 1 292202962-0007	B4410 - E Roof - Rolled Asphalt Roofing	Black Fibrous Homogeneous	5% Cellulose 2% Glass	5% Ca Carbonate 88% Non-fibrous (Other)	None Detected
08-07-Roofing 2 292202962-0007A	B4410 - E Roof - Rolled Asphalt Roofing	Brown Fibrous Homogeneous	75% Cellulose	15% Perlite 10% Non-fibrous (Other)	None Detected
08-08-Roofing 1 292202962-0008	B4410 - N Roof - Rolled Asphalt Roofing	Black Fibrous Homogeneous	5% Cellulose 2% Glass	10% Ca Carbonate 83% Non-fibrous (Other)	None Detected
08-08-Roofing 2 292202962-0008A	B4410 - N Roof - Rolled Asphalt Roofing	Brown/Gray Fibrous Homogeneous	60% Cellulose	20% Perlite 20% Non-fibrous (Other)	None Detected
08-09 292202962-0009	B4410 - E Pipe Penetration - Roof Flashing	Gray/Black Fibrous Homogeneous	10% Cellulose	5% Ca Carbonate 85% Non-fibrous (Other)	None Detected
08-10 292202962-0010	B4410 - N Edge - Roof Flashing	Various/Black Fibrous Homogeneous	10% Glass	10% Ca Carbonate 80% Non-fibrous (Other)	None Detected
08-11 292202962-0011	B4410 - E Wall Vent - Exterior Caulk	Beige Non-Fibrous Homogeneous	<1% Cellulose <1% Wollastonite	15% Ca Carbonate 85% Non-fibrous (Other)	None Detected
08-12 292202962-0012	B4410 - S Wall Vent - Exterior Caulk	White/Beige Non-Fibrous Homogeneous		10% Ca Carbonate 90% Non-fibrous (Other)	None Detected
08-13-Caulk 1 292202962-0013	Primary Clarifier - 1 1/2" Pipe Jacket - Exterior Caulk	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08-13-Caulk 2 292202962-0013A	Primary Clarifier - 1 1/2" Pipe Jacket - Exterior Caulk	Gray Non-Fibrous Homogeneous		10% Ca Carbonate 90% Non-fibrous (Other)	None Detected

Initial report from: 04/12/2022 15:38:10



# EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560

Tel/Fax: (919) 465-3900 / (919) 465-3950

<http://www.EMSL.com> / [raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 292202962

Customer ID: CAPE42

Customer PO:

Project ID:

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
08-14-Caulk 1 292202962-0014	Primary Clarifier - 1 1/2" Pipe Jacket - Exterior Caulk				Layer Not Present
08-14-Caulk 2 292202962-0014A	Primary Clarifier - 1 1/2" Pipe Jacket - Exterior Caulk	Gray Non-Fibrous Homogeneous		10% Ca Carbonate 90% Non-fibrous (Other)	None Detected

Analyst(s)

Joshua Moorman (9)

Roxsee Stover (8)

Billy Barnes, Asbestos Lab Manager  
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from: 04/12/2022 15:38:10


**EMSL ANALYTICAL**  
 LABORATORY PRODUCTS
**Cape Lookout Environmental Sciences**

21-108 MCAS Cherry Point WWTP

4/11/2022 17:30

PLM

TAT: 24 Hour

Bulk

Order ID: 292202962

No Samples: 14

Due: 04/12 5:30 PM

Fax:

re Boulevard, Suite 1

0

00

.nsl.com

<b>Customer Information</b>	Customer ID:		Billing ID:																																														
	Company Name: Cape Lookout Environmental Sciences		Company Name: Cape Lookout Environmental Sciences																																														
	Contact Name: Christopher Hamblet		Billing Contact: Christopher Hamblet																																														
	Street Address: 8005 Clear Brook Drive		Street Address: 8005 Clear Brook Drive																																														
	City, State, Zip: Raleigh NC 27615 Country: US		City, State, Zip: Raleigh NC Country: US																																														
	Phone: 9197577901		Phone: 9197577901																																														
Email(s) for Report: ChrisHamblet@CapeLookoutEnv.com		Email(s) for Invoice:																																															
<b>Project Information</b>																																																	
Project Name/No: 21-108 MCAS Cherry Point WWTP				Purchase Order:																																													
EMSL LIMS Project ID: (If applicable, EMSL will provide)				US State where samples collected: NC																																													
				State of Connecticut (CT) must select project location: <input type="checkbox"/> Commercial (Taxable) <input type="checkbox"/> Residential (Non-Taxable)																																													
Sampled By Name: Chris Hamblet		Sampled By Signature: <i>Chris Hamblet</i>		Date Sampled:																																													
				No. of Samples in Shipment																																													
<b>Turn-Around-Time (TAT)</b> <input type="checkbox"/> 3 Hour <input type="checkbox"/> 6 Hour <input checked="" type="checkbox"/> 24 Hour <input type="checkbox"/> 32 Hour <input type="checkbox"/> 48 Hour <input type="checkbox"/> 72 Hour <input type="checkbox"/> 96 Hour <input type="checkbox"/> 1 Week <input type="checkbox"/> 2 Week <small>Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.</small>																																																	
<b>Test Selection</b>																																																	
<b>PLM - Bulk (reporting limit)</b> <input checked="" type="checkbox"/> PLM EPA 600/R-93/116 (<1%) <input type="checkbox"/> PLM EPA NOB (<1%) <input type="checkbox"/> POINT COUNT <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1,000 (<0.1%) <input type="checkbox"/> POINT COUNT w/ GRAVIMETRIC <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1,000 (<0.1%) <input type="checkbox"/> NIOSH 9002 (<1%) <input type="checkbox"/> NYS 198.1 (Friable - NY) <input type="checkbox"/> NYS 198.6 NOB (Non-Friable - NY) <input type="checkbox"/> NYS 198.8 (Vermiculite SM-V)			<b>TEM - Bulk</b> <input type="checkbox"/> TEM EPA NOB <input type="checkbox"/> NYS NOB 198.4 (Non-Friable - NY) <input type="checkbox"/> TEM EPA 600/R-93/116 w Milling Prep (0.1%)  <b>Other Tests (please specify)</b>  <input type="checkbox"/> Positive Stop - Clearly Identified Homogeneous Areas (HA)																																														
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:15%;">Sample Number</th> <th style="width:10%;">HA Number</th> <th style="width:40%;">Sample Location</th> <th style="width:35%;">Material Description</th> </tr> </thead> <tbody> <tr> <td>08-01</td> <td>A</td> <td>B4410-1" water line tee</td> <td>Fiberglass insulation mastic</td> </tr> <tr> <td>02</td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> <tr> <td>03</td> <td>B</td> <td>- N Floor</td> <td>Expansion joint</td> </tr> <tr> <td>04</td> <td>↓</td> <td>- S Floor</td> <td>↓</td> </tr> <tr> <td>05</td> <td>C</td> <td>- N ceiling</td> <td>Interior caulk</td> </tr> <tr> <td>06</td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> <tr> <td>07</td> <td>D</td> <td>- E roof</td> <td>Roller asphalt roofing</td> </tr> <tr> <td>08</td> <td>↓</td> <td>- N roof</td> <td>↓</td> </tr> <tr> <td>09</td> <td>E</td> <td>- E pipe penetration</td> <td>Roof Flashing</td> </tr> <tr> <td>10</td> <td>↓</td> <td>- N edge</td> <td>↓</td> </tr> </tbody> </table>						Sample Number	HA Number	Sample Location	Material Description	08-01	A	B4410-1" water line tee	Fiberglass insulation mastic	02	↓	↓	↓	03	B	- N Floor	Expansion joint	04	↓	- S Floor	↓	05	C	- N ceiling	Interior caulk	06	↓	↓	↓	07	D	- E roof	Roller asphalt roofing	08	↓	- N roof	↓	09	E	- E pipe penetration	Roof Flashing	10	↓	- N edge	↓
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<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2">Method of Shipment:</td> <td colspan="2">Sample Condition Upon Receipt</td> </tr> <tr> <td>Relinquished by: <i>Chris Hamblet</i></td> <td>Date/Time: 4/11/22 1715</td> <td>Received by: <i>[Signature]</i></td> <td>Date/Time: 4/11/22 5:30pm</td> </tr> <tr> <td>Relinquished by:</td> <td>Date/Time:</td> <td>Received by:</td> <td>Date/Time:</td> </tr> </table>						Method of Shipment:		Sample Condition Upon Receipt		Relinquished by: <i>Chris Hamblet</i>	Date/Time: 4/11/22 1715	Received by: <i>[Signature]</i>	Date/Time: 4/11/22 5:30pm	Relinquished by:	Date/Time:	Received by:	Date/Time:																																
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Controlled Document - Asbestos Bulk R7 9/14/2021



AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

## Cape Lookout Environmental Sciences

21-108 MCAS Cherry Point WWTP

4/11/2022 17:30

PLM

**TAT: 24 Hour**

## Bulk

**Order ID:** 292202962

**No Samples: 14**

**Due:** 04/12 5:30 PM

**Fax:**

City Centre Boulevard, Suite 1

IC 27560

) 465-3900

**.ghlab@emsl.com**

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

[illegible]

Method of Shipment:

Sample Condition Upon Receipt:
--------------------------------

Relinquished by:

Chris Hamblet

Date/Time: 4/11/22

Received by:

Date/Time	Location	Activity	Remarks
10/10/2023 10:00	Room 101	Meeting with Mr. Smith	Discussed project progress
10/10/2023 14:30	Room 202	Training session	Completed module 3
10/10/2023 18:00	Room 101	Dinner with team	Relaxed and informal
10/11/2023 09:00	Room 101	Meeting with Mr. Jones	Discussed budget concerns
10/11/2023 13:00	Room 202	Training session	Completed module 4
10/11/2023 17:00	Room 101	Meeting with Mr. Brown	Discussed client feedback
10/12/2023 08:00	Room 101	Meeting with Mr. Green	Discussed project timeline
10/12/2023 12:00	Room 202	Training session	Completed module 5
10/12/2023 16:00	Room 101	Meeting with Mr. White	Discussed project risks
10/13/2023 09:00	Room 101	Meeting with Mr. Black	Discussed project status
10/13/2023 13:00	Room 202	Training session	Completed module 6
10/13/2023 17:00	Room 101	Meeting with Mr. Grey	Discussed project outcomes
10/14/2023 08:00	Room 101	Meeting with Mr. Blue	Discussed project results
10/14/2023 12:00	Room 202	Training session	Completed module 7
10/14/2023 16:00	Room 101	Meeting with Mr. Yellow	Discussed project impact
10/15/2023 09:00	Room 101	Meeting with Mr. Purple	Discussed project lessons
10/15/2023 13:00	Room 202	Training session	Completed module 8
10/15/2023 17:00	Room 101	Meeting with Mr. Pink	Discussed project future
10/16/2023 08:00	Room 101	Meeting with Mr. Brown	Discussed project closure
10/16/2023 12:00	Room 202	Training session	Completed module 9
10/16/2023 16:00	Room 101	Meeting with Mr. Green	Discussed project evaluation
10/17/2023 09:00	Room 101	Meeting with Mr. White	Discussed project feedback
10/17/2023 13:00	Room 202	Training session	Completed module 10
10/17/2023 17:00	Room 101	Meeting with Mr. Black	Discussed project conclusion
10/18/2023 08:00	Room 101	Meeting with Mr. Grey	Discussed project final report
10/18/2023 12:00	Room 202	Training session	Completed module 11
10/18/2023 16:00	Room 101	Meeting with Mr. Blue	Discussed project final review
10/19/2023 09:00	Room 101	Meeting with Mr. Yellow	Discussed project final presentation
10/19/2023 13:00	Room 202	Training session	Completed module 12
10/19/2023 17:00	Room 101	Meeting with Mr. Purple	Discussed project final outcome
10/20/2023 08:00	Room 101	Meeting with Mr. Pink	Discussed project final report
10/20/2023 12:00	Room 202	Training session	Completed module 13
10/20/2023 16:00	Room 101	Meeting with Mr. Brown	Discussed project final review
10/21/2023 09:00	Room 101	Meeting with Mr. Green	Discussed project final presentation
10/21/2023 13:00	Room 202	Training session	Completed module 14
10/21/2023 17:00	Room 101	Meeting with Mr. White	Discussed project final outcome
10/22/2023 08:00	Room 101	Meeting with Mr. Black	Discussed project final report
10/22/2023 12:00	Room 202	Training session	Completed module 15
10/22/2023 16:00	Room 101	Meeting with Mr. Grey	Discussed project final review
10/23/2023 09:00	Room 101	Meeting with Mr. Blue	Discussed project final presentation
10/23/2023 13:00	Room 202	Training session	Completed module 16
10/23/2023 17:00	Room 101	Meeting with Mr. Yellow	Discussed project final outcome
10/24/2023 08:00	Room 101	Meeting with Mr. Purple	Discussed project final report
10/24/2023 12:00	Room 202	Training session	Completed module 17
10/24/2023 16:00	Room 101	Meeting with Mr. Pink	Discussed project final review
10/25/2023 09:00	Room 101	Meeting with Mr. Brown	Discussed project final presentation
10/25/2023 13:00	Room 202	Training session	Completed module 18
10/25/2023 17:00	Room 101	Meeting with Mr. Green	Discussed project final outcome
10/26/2023 08:00	Room 101	Meeting with Mr. White	Discussed project final report
10/26/2023 12:00	Room 202	Training session	Completed module 19
10/26/2023 16:00	Room 101	Meeting with Mr. Black	Discussed project final review
10/27/2023 09:00	Room 101	Meeting with Mr. Grey	Discussed project final presentation
10/27/2023 13:00	Room 202	Training session	Completed module 20
10/27/2023 17:00	Room 101	Meeting with Mr. Blue	Discussed project final outcome
10/28/2023 08:00	Room 101	Meeting with Mr. Yellow	Discussed project final report
10/28/2023 12:00	Room 202	Training session	Completed module 21
10/28/2023 16:00	Room 101	Meeting with Mr. Purple	Discussed project final review
10/29/2023 09:00	Room 101	Meeting with Mr. Pink	Discussed project final presentation
10/29/2023 13:00	Room 202	Training session	Completed module 22
10/29/2023 17:00	Room 101	Meeting with Mr. Brown	Discussed project final outcome
10/30/2023 08:00	Room 101	Meeting with Mr. Green	Discussed project final report
10/30/2023 12:00	Room 202	Training session	Completed module 23
10/30/2023 16:00	Room 101	Meeting with Mr. White	Discussed project final review
10/31/2023 09:00	Room 101	Meeting with Mr. Black	Discussed project final presentation
10/31/2023 13:00	Room 202	Training session	Completed module 24
10/31/2023 17:00	Room 101	Meeting with Mr. Grey	Discussed project final outcome
11/01/2023 08:00	Room 101	Meeting with Mr. Blue	

Relinquished by.

Date/Time.	Location.	Activity.	Remarks.
11/11/2019	11/11/2019	11/11/2019	11/11/2019

Received by:

Date/Time
-----------

Controlled Document - Asbestos Bulk R7 09/14/2021

☐ **AGREE TO ELECTRONIC SIGNATURE** (By checking, I consent to signing this Chain of Custody document by electronic signature.)

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## **Appendix III – Lead Containing Paint Data Table**

### Lead-Containing Paint Screening Data Table

Site: WO7080863 MCAS Cherry Point WWTP	CLES Project No.: 21-108
Address: Roosevelt Blvd	Inspector: Chris Hamblet
City, State: Cherry Point, North Carolina	Inspection Date: 04-08-2022

[illegible]

## **Appendix IV – Lead Analytical Report**

**EMSL Analytical, Inc.**

706 Gralin Street, Kernersville, NC 27284

Phone/Fax: (336) 992-1025 / (336) 992-4175

<http://www.EMSL.com>[greensborolab@emsl.com](mailto:greensborolab@emsl.com)

EMSL Order: 022202745

CustomerID: CAPE42

CustomerPO:

ProjectID:

Attn: **Chris Hamblet**  
**Cape Lookout Environmental Sciences**  
**8005 Clear Brook Drive**  
**Raleigh, NC 27615**

Phone: (919) 757-7901  
Fax:  
Received: 4/13/2022 09:15 AM  
Collected: 4/8/2022

Project: **21-108 MCAS Cherry Point WWTP****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\***

Client Sample Description	Lab ID	Collected	Analyzed	Weight	Lead
					Concentration
08L-01	022202745-0001	4/8/2022	4/13/2022	.2292 g	<0.0087 % wt
08L-02	022202745-0002	4/8/2022	4/13/2022	.0917 g	<0.022 % wt
08L-03	022202745-0003	4/8/2022	4/13/2022	.2578 g	<0.0080 % wt
08L-04	022202745-0004	4/8/2022	4/13/2022	.1745 g	0.96 % wt
08L-05	022202745-0005	4/8/2022	4/13/2022	.154 g	<0.013 % wt
08L-06	022202745-0006	4/8/2022	4/13/2022	.2469 g	<0.0081 % wt
08L-07	022202745-0007	4/8/2022	4/13/2022	.2647 g	<0.0080 % wt
08L-08	022202745-0008	4/8/2022	4/13/2022	.033 g	<0.061 % wt
08L-09	022202745-0009	4/8/2022	4/13/2022	.0283 g	<0.071 % wt
08L-10	022202745-0010	4/8/2022	4/13/2022	.0233 g	<0.086 % wt
08L-11	022202745-0011	4/8/2022	4/13/2022	.0317 g	<0.063 % wt
08L-12	022202745-0012	4/8/2022	4/13/2022	.0463 g	<0.043 % wt
08L-13	022202745-0013	4/8/2022	4/13/2022	.0782 g	<0.026 % wt

James Cole, Laboratory Manager  
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.

\* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Kernersville, NC EMSL Lab ID 102564 is accredited by the AIHA Laboratory Accreditation Program (AIHA-LAP), LLC in the Environmental Lead accreditation program for Lead in Paint Chips.

Initial report from 04/14/2022 08:23:53





**EMSL ANALYTICAL, INC.**  
**LARGE-STORY, PRODUCTS-TRAINING**

## Lead Chain of Custody

EMSL Order Number / Lab Use Only

ΕΠΙΣΤΗΜΟΝΙΚΟ ΕΡΓΑΣΙΟ, ΠΡΩΤΗ

706 Gralin Street

Kernersville, NC 27284

PHONE: (336) 992-1025

EMAIL: greensborolab@emsl.com

2745

Customer Information	Customer ID:			
	Company Name: Cape Lookout Environmental Sciences			
	Contact Name: Christopher Hamblet			
	Street Address: 8005 Clear Brook Drive			
	City, State, Zip: Raleigh NC 27615		Country: US	
	Phone: 9197577901			
Email(s) for Report: ChrisHamblet@CapeLookoutEnv.com				
Billing Information	Billing ID:			
	Company Name: Cape Lookout Environmental Sciences			
	Billing Contact: Christopher Hamblet			
	Street Address: 8005 Clear Brook Drive			
	City, State, Zip: Raleigh NC 27615		Country: US	
	Phone: 9197577901			
Email(s) for Invoice:				

### Project Information

Project Name/No: 21-108 MCAS Cherry Point WWTP		Purchase Order:	
EMSL LIMS Project ID: (If applicable, EMSL will provide)	US State where samples collected: NC	State of <input type="checkbox"/> Connecticut (CT) must select project location: Commercial (Taxable) <input type="checkbox"/> Residential (Non-Taxable)	
Sampled By Name: Chris Hamblet	Sampled By Signature: Chris Hamblet	No. of Samples in Shipment	13

**Turn-Around-Time (TAT)**

☐ 3 Hour ☐ 6 Hour ☒ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

Please call ahead for large projects and/or turnaround times 6 Hours or Less. \*32 Hour TAT available for select tests only; samples must be submitted by 11:30am

MATRIX	METHOD	INSTRUMENT	REPORTING LIMIT	SELECTION
CHIPS <input checked="" type="checkbox"/> % by wt. <input type="checkbox"/> ppm (mg/kg) <input type="checkbox"/> mg/cm <sup>2</sup>	SW 846-7000B	Flame Atomic Absorption	0.008% (80ppm)	<input type="checkbox"/>
*Reporting Limit based on a minimum 0.25g sample weight	SW 846-6010D*	ICP-OES	0.0004% (4ppm)	<input type="checkbox"/>
AIR	NIOSH 7082	Flame Atomic Absorption	4µg/filter	<input type="checkbox"/>
	NIOSH 7300M / NIOSH 7303M	ICP-OES	0.5µg/filter	<input type="checkbox"/>
	NIOSH 7300M / NIOSH 7303M	ICP-MS	0.05µg/filter	<input type="checkbox"/>
WIPE <input type="checkbox"/> ASTM <input type="checkbox"/> NON-ASTM	SW 846-7000B	Flame Atomic Absorption	10µg/wipe	<input type="checkbox"/>
*If no box is checked, non-ASTM Wipe is assumed	SW 846-6010D*	ICP-OES	1.0µg/wipe	<input type="checkbox"/>
TCLP	SW 846-1311 / 7000B / SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
	SW 846-1311 / SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	<input type="checkbox"/>
SPLP	SW 846-1312 / 7000B / SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
	SW 846-1312 / SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	<input type="checkbox"/>
TTLC	22 CCR App. II, 7000B	Flame Atomic Absorption	40mg/kg (ppm)	<input type="checkbox"/>
	22 CCR App. II, SW 846-6010D*	ICP-OES	2mg/kg (ppm)	<input type="checkbox"/>
STLC	22 CCR App. II, 7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
	22 CCR App. II, SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	<input type="checkbox"/>
Soil	SW 846-7000B	Flame Atomic Absorption	40mg/kg (ppm)	<input type="checkbox"/>
	SW 846-6010D*	ICP-OES	2mg/kg (ppm)	<input type="checkbox"/>
Wastewater	SM 3111B / SW 846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
Unpreserved <input type="checkbox"/>				
Preserved with HNO <sub>3</sub> <input type="checkbox"/> PH<2	EPA 200.7	ICP-OES	0.020 mg/L (ppm)	<input type="checkbox"/>
Drinking Water				
Unpreserved <input type="checkbox"/>	EPA 200.5	ICP-OES	0.003 mg/L (ppm)	<input type="checkbox"/>
Preserved with HNO <sub>3</sub> <input type="checkbox"/> PH<2	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	<input type="checkbox"/>
TSP/SPM Filter	40 CFR Part 50	ICP-OES	12 µg/filter	<input type="checkbox"/>
Other: <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sample Number	Sample Location	Volume / Area	Date / Time Sampled
08L-01	B4410-ceiling	NA	4/18/22
↓ 02	↓ - S wall	↓	↓
03	- door		
04	- piping		
↓ 05	↓ - compressor	↓	↓

Method of Shipment: <b>RTU 55959-8002</b>		Sample Condition Upon Receipt:	
Relinquished by: <b>Chris Hamblet</b>	Date/Time: <b>7/11/22 1715</b>	Received by: <b>[Signature]</b>	Date/Time: <b>4/11/22 5:30pm</b>
Relinquished by:	Date/Time:	Received by: <b>NSD</b>	Date/Time: <b>4/13/22 9:15</b>

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Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: <i>Chris Hamblet</i>	Date/Time:	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Page 2 of 2

SECTION 02 41 00

DEMOLITION

05/10, CHG 2: 02/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 145 (1991; R 2012) Standard Specification for  
Classification of Soils and Soil-Aggregate  
Mixtures for Highway Construction Purposes

AASHTO T 180 (2017) Standard Method of Test for  
Moisture-Density Relations of Soils Using  
a 4.54-kg (10-lb) Rammer and a 457-mm  
(18-in.) Drop

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6 (2006) Safety & Health Program  
Requirements for Demolition Operations -  
American National Standard for  
Construction and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements  
Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61 National Emission Standards for Hazardous  
Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of wrecking or taking out any load-supporting structural member of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

#### 1.2.2 Demolition Plan

Prepare a Demolition Plan and submit proposed demolition and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

#### 1.2.3 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the station daily; do not allow accumulations. The work includes demolition of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

#### 1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

##### 1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

##### 1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

##### 1.3.3 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from

the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

#### 1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations.

#### 1.3.5 Facilities

Protect electrical and mechanical services and utilities. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

#### 1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

#### 1.5 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Demolition Plan;  
Existing Conditions

##### SD-07 Certificates

Notification;

#### 1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

##### 1.6.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris.

## 1.7 PROTECTION

### 1.7.1 Traffic Control Signs

- a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

### 1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

## 1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

## 1.9 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

## PART 2 PRODUCTS

### 2.1 FILL MATERIAL

- a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.
- b. Fill material shall conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.
- c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D

### PART 3 EXECUTION

#### 3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

##### 3.1.1 Structures

- a. Remove existing structures indicated to be removed in their entirety.
- b. Demolish structures in a systematic manner from the top of the structure to the ground.

##### 3.1.2 Utilities and Related Equipment

###### 3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

###### 3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

#### 3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

#### 3.3 DISPOSITION OF MATERIAL

##### 3.3.1 Title to Materials

All materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government

property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

### 3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

### 3.5 DISPOSAL OF REMOVED MATERIALS

#### 3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified off the installation.

#### 3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

#### 3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --



SECTION 02 83 00

LEAD REMEDIATION

11/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for  
Flame Propagation of Textiles and Films

STATE OF NORTH CAROLINA ADMINISTRATIVE CODE (NCAC)

130A NCAC 453 Lead-Based Paint Hazard Managment Program

10A NCAC 41C .0800 Lead-Based Paint Hazard Managment Program  
Rules

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements  
Manual

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997)  
Guidelines for the Evaluation and Control  
of Lead-Based Paint Hazards in Housing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.21 Safety Training and Education

29 CFR 1926.33 Access to Employee Exposure and Medical  
Records

29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists

29 CFR 1926.59 Hazard Communication

29 CFR 1926.62 Lead

29 CFR 1926.65 Hazardous Waste Operations and Emergency  
Response

40 CFR 260 Hazardous Waste Management System: General

40 CFR 261 Identification and Listing of Hazardous  
Waste

40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual
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UNDERWRITERS LABORATORIES (UL)

UL 586	(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units
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## 1.2 DEFINITIONS

### 1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period.

### 1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

### 1.2.3 Certified Industrial Hygienist (CIH)

As used in this section refers to a person retained by the Contractor who is certified as an industrial hygienist and who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. CIH must be certified for comprehensive practice by the American Board of Industrial Hygiene. The Certified Industrial Hygienist must be independent of the Contractor and must have no employee or employer relationship which could constitute a conflict of

interest.

#### 1.2.4 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. The Contractor may provide more than one CP as required to supervise and monitor the work. The CP must be a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals and a licensed lead-based paint abatement Supervisor/Project Designer in the State of North Carolina. Provide proof of north carolina lead firm certification

#### 1.2.5 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

#### 1.2.6 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

#### 1.2.7 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or to plan such activities in commercial buildings, bridges or other structures.

#### 1.2.8 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62.

#### 1.2.9 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

#### 1.2.10 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

#### 1.2.11 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

#### 1.2.12 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor

or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

#### 1.2.13 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

#### 1.2.14 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

#### 1.2.15 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

#### 1.2.16 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

### 1.3 DESCRIPTION

Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition or removal of material containing lead in fair condition, located on the sludge piping and fittings located in the Primary Sludge Pump Station (B4410) as listed below and as indicated on the drawings.

An Asbestos-Containing Building Materials Survey and Limited Lead-Containing Paint Screening Report was prepared by Cape Lookout Environmental Sciences, PLLC (CLES), dated May 5, 2022, to evaluate the materials that will be disturbed by the WO7080863 Repairs to Wastewater Treatment Plant (WWTP) CP2304M Project. Thirteen paint chip samples were collected from the prevalent types of painted surfaces in the proposed work areas at the WWTP and submitted for lead analysis. One of the 13 samples that were tested was found to contain lead at a concentration exceeding the laboratory's detection limit and is classified as PWL and is also classified as LBP. Additional details and limitations regarding the lead-containing paint screening, including the types of paint that were sampled and lead was not detected, are provided in the above-referenced report.

Sample ID	Area	Paint Color	Substrate	Area Location	Sample Location	Result (%)
08L-04	D	Gray	Metal	B4410-piping & fittings	E Gate Valve	0.96

None of the 12 other samples were found to contain lead at a concentration exceeding the laboratory's detection limit.

The WWTP was in operation and had energized systems at the time of the site visit for the Limited Lead-Containing Paint Screening, and portions of the proposed work area were either not safely or readily accessible. These areas included the below ground and below water portions of the structures and piping and the inside of walls, piping and equipment. CLES personnel did not dismantle or open any plumbing, electrical or mechanical equipment to observe or sample the interior surfaces. The coatings in these areas that have not been tested should be presumed to contain lead and managed accordingly until sampled and proven otherwise. The identified PWL may also be present in other areas, including the below ground portions of the sludge piping.

No assessment of either cadmium or chromium in coatings was requested or performed. Therefore, all coatings within the proposed project area should be presumed to contain cadmium and chromium and managed accordingly until proven otherwise.

The work covered by this section includes work tasks and the precautions specified in this section for the protection of building occupants and the environment during and after the performance of the hazard abatement activities.

#### 1.3.1 Protection of Existing Areas To Remain

Project work including, but not limited to, lead hazard abatement work, storage, transportation, and disposal must be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

#### 1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead Compliance Plan and describe how the Contractor will prevent lead and other potential exposures to other contractors and Government personnel performing work unrelated to lead activities.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Competent Person Qualifications; G

Training Certification; G

Occupational and Environmental Assessment Data Report (if

objective data is used to justify excluding the initial occupational exposure assessment); G

Medical Examinations; G

Lead Waste Management Plan; G

Licenses, Permits and Notifications; G

Lead Compliance Plan; G

Written Evidence of TSD Approval; G

#### SD-03 Product Data

Respirators; G

Vacuum Filters; G

Materials and Equipment; G

Expendable Supplies; G

#### SD-06 Test Reports

Occupational and Environmental Assessment Data Report; G

Sampling Results; G

#### SD-07 Certificates

Testing Laboratory; G

Third Party Consultant Qualifications; G

Clearance Certification; G

North Carolina Lead Firm Certification; G

#### SD-11 Closeout Submittals

Hazardous Waste Manifest, if applicable; G

Waste Turn-In Documents or Weight Tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition debris landfills; G

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Qualifications

##### 1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), which shows ability to assess occupational and environmental exposure to lead; experience with the use of respirators,

personal protective equipment and other exposure reduction methods to protect employee health. Demonstrate a minimum of 3 years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62). Submit proper documentation that the CP is trained and certified in accordance with federal, State of North Carolina and local laws. The competent person must be a licensed lead-based paint abatement Supervisor/Project Designer in the State of North Carolina.

#### 1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62 and is certified to perform or supervise deleading, lead removal or demolition activities in the State of North Carolina, and works for a North Carolina-certified Lead Abatement Firm as required by NCGS 130A NCAC 453.

#### 1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis must be OSHA approved.

#### 1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

### 1.5.2 Requirements

#### 1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect LBP/PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

- g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.

#### 1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, LBP/PWL or MCL. Include in the plan a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan must be developed and signed by a certified Lead Project Designer in the State of North Carolina. The plan must include the name and certification number of the person signing the plan.

#### 1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62 the Contractor must provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

- a. The initial monitoring must represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data must represent the worker's regular daily exposure to lead for stated work.
- b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.



- c. The initial assessment must determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead, cadmium, chromium compliance plan per 29 CFR 1926.62.

#### 1.5.2.4 Medical Examinations

Submit pre-work blood lead levels and post-work blood lead levels for all workers performing lead activities during the execution of the work. Initial medical surveillance as required by 29 CFR 1926.62 must be made available to all employees exposed to lead at any time (one day) above the action level. Full medical surveillance must be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records must show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead, cadmium, chromium as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

#### 1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62 and State and local regulations where appropriate.

#### 1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
- b. Establish and implement a respiratory protection program as required by 29 CFR 1926.103, 29 CFR 1926.62 and 29 CFR 1926.55.

#### 1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

#### 1.5.2.8 Lead Waste Management

The Lead Waste Management Plan must comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA and State of North Carolina hazardous waste permits, manifests and USEPA Identification numbers.
- d. Names and qualifications (experience and training) of personnel who

will be working on-site with hazardous wastes.

- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Clean up and containerize wastes daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

#### 1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead, asbestos, and other potential contaminants associated with the WWTP structures and equipment as well as other project site hazards. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, EM 385-1-1, ND OPNAVINST 5100.23. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply. The following State laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead -contaminated materials apply:

- a. N.C. General Statute 130A 453.01 - 453.11 Lead-Based Paint Hazard Management Program.
- b. N.C. General Statute 10A NCAC 41C-0800 - Lead-Based Paint Hazard Management Program Rules.

Licensing and certification in the state of North Carolina is required.

#### 1.5.3 Licenses, Permits and Notifications

Certify and submit in writing to the North Carolina Department of Health and Human Services, Health Hazards Control Unit, and the Contracting Officer at least 10 days prior to the commencement of work that applicable licenses, permits and notifications have been obtained. All associated fees or costs incurred in obtaining the licenses, permits and notifications are included in the contract price.

#### 1.5.4 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

## 1.6 EQUIPMENT

### 1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators must comply with the requirements of 29 CFR 1926.62.

### 1.6.2 Special Protective Clothing

Personnel exposed to lead contaminated dust must wear proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

### 1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

### 1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

### 1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment must include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE remains the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

### 1.6.6 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

### 1.6.7 Vacuum Systems

Vacuum systems must be suitably sized for the project, and filters must be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers (mean aerodynamic diameter) at a minimum efficiency of 99.97 percent. Properly dispose of used filters that are being replaced.

### 1.6.8 Heat Blower Guns

Heat blower guns must be flameless, electrical, paint-softener type with controls to limit temperature to 1,100 degrees F. Heat blower must be (grounded) 120 volts ac, and must be equipped with cone, fan, glass protector and spoon reflector nozzles.

## 1.7 PROJECT/SITE CONDITIONS

### 1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Keep materials and equipment needed to complete the project available and on the site. Submit a description of the materials and equipment required; including Safety Data Sheets (SDSs) for material brought onsite to perform the work.

#### 2.1.1 Expendable Supplies

Submit a description of the expendable supplies required.

##### 2.1.1.1 Polyethylene Bags

Disposable bags must be polyethylene plastic and be a minimum of 6 mils thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

##### 2.1.1.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead contaminated debris must be polyethylene plastic that is a minimum of 6 mils thick or any other thick plastic material shown to demonstrate at least equivalent performance.

##### 2.1.1.3 Polyethylene Sheeting

Sheeting must be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, provide flame-resistant polyethylene sheets which conform to the requirements of NFPA 701.

##### 2.1.1.4 Tape and Adhesive Spray

Tape and adhesive must be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive must retain adhesion when exposed to wet conditions, including amended water. Tape must be minimum 2 inches wide, industrial strength.

##### 2.1.1.5 Containers

When used, containers must be leak-tight and be labeled in accordance with EPA, DOT and OSHA standards.

#### 2.1.1.6 Chemical Paint Strippers

Chemical paint strippers must not contain methylene chloride and be formulated to prevent stain, discoloration, or raising of the substrate materials.

#### 2.1.1.7 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers must be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

#### 2.1.1.8 Detergents and Cleaners

Detergents or cleaning agents must not contain trisodium phosphate and have demonstrated effectiveness in lead control work using cleaning techniques specified by HUD 6780 guidelines.

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Protection

##### 3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead work.

##### 3.1.1.2 Lead Control Area

- a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead area. Prohibit the general public from accessing the lead control areas.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

##### 3.1.1.3 Furnishings

Furniture and equipment will remain in the building. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the Contracting Officer.

##### 3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

##### 3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

#### 3.1.1.6 Eye Wash Station

Provide suitable facilities within the work area for quick drenching or flushing of the eyes where eyes may be exposed to injurious corrosive materials.

#### 3.1.1.7 Mechanical Ventilation System

- a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Evaluate and maintain local exhaust ventilation systems in accordance with 29 CFR 1926.62.
- b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
- c. Use locally exhausted, power actuated tools or manual hand tools.

#### 3.1.1.8 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

### 3.2 ERECTION

#### 3.2.1 Lead Control Area Requirements

Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

### 3.3 APPLICATION

#### 3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

#### 3.3.2 Paint with Lead or Material Containing Lead Removal

Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead contaminated dust or other lead contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

Avoid deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 96 00 HIGH-PERFORMANCE COATINGS, if applicable.

Provide methodology for lead, LBP/PWL removal and processes to minimize contamination of work areas outside the control area with lead contaminated dust or other lead contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this lead, LBP/PWL removal/control process in the Lead Compliance Plan.

#### 3.3.2.1 Paint with Lead or Material Containing Lead - Indoor Removal

Perform removal in the lead control areas using enclosures, barriers or containments. Collect residue and debris for disposal in accordance with federal, State, and local requirements.

#### 3.3.2.2 Paint with Lead or Material Containing Lead - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) must be job dependent and presented in the Lead Compliance Plan.

#### 3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead controlled area, they must perform the following procedures and must not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.
- d. Change to clean clothes prior to leaving the clean clothes storage area.

#### 3.4 FIELD QUALITY CONTROL

##### 3.4.1 Tests

##### 3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling must be directed or performed by the CP.

- a. The CP must be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work

shift.

- c. Submit results of air samples, signed by the CP, within 72-hours after the air samples are taken.
- d. Conduct area air sampling daily, on each shift in which lead and lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above 30 micrograms of lead per cubic meter of air. If 30 micrograms of lead per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Resume removal work only after the CP and the Contracting Officer give approval.

#### 3.4.1.2 Sampling After Removal

After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust in micrograms per square meter foot of surface area.

### 3.5 CLEANING AND DISPOSAL

#### 3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of all visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP must then certify in writing that the area has been cleaned of lead contamination before clearance testing.

##### 3.5.1.1 Clearance Certification

The CP must certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms of lead per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

Clear the lead control area in industrial facilities of all visible dust and debris.

#### 3.5.2 Disposal

- a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result



of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

- b. Contractor is responsible for segregation of waste. Collect lead contaminated waste, scrap, debris, bags, containers, equipment, and lead contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261, 40 CFR 262 and corresponding state regulations.
- c. Dispose of lead contaminated material classified as hazardous waste at an EPA approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Accumulate waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with 40 CFR 262 and corresponding state regulations during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for accumulation of waste containers. Coordinate authorized accumulation volumes and time limits with the host installation environmental function.
- e. Handle, store, transport, and dispose lead or lead contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- f. All lead waste generation, management, and disposal will be coordinated with the host installation environmental function.

#### 3.5.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead waste with the host installation environmental function. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. If applicable, submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

#### 3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility is received and approved by the Contracting Officer. The manifest must detail and certify the amount of lead containing materials or non-hazardous waste delivered to the treatment or disposal facility.

-- End of Section --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

02/19, CHG 3: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard
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ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
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ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A955/A955M	(2020c) Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2021a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2021) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2018) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans

	for Use in Portland-Cement Concrete
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2021) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C845/C845M	(2018) Standard Specification for Expansive Hydraulic Cement
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1012/C1012M	(2018b) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1157/C1157M	(2020a) Standard Performance Specification for Hydraulic Cement
ASTM C1218/C1218M	(2020c) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1240	(2020) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2021) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1567	(2021) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate

(Accelerated Mortar-Bar Method)

ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2016) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D3042	(2017) Standard Test Method for Insoluble Residue in Carbonate Aggregates
ASTM D5759	(2012; R 2020) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM E329	(2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2018) Manual of Standard Practice
CRSI RB4.1	(2016) Supports for Reinforcement Used in Concrete

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1	(2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood
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U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
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1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, and slag cement.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design

criteria.

- f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.
- g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.
- j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

### 1.3 SUBMITTALS

Government approval is required for all submittals. for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Quality Control Plan;  
Quality Control Personnel Certifications;  
Quality Control Organizational Chart  
Laboratory Accreditation;

#### SD-02 Shop Drawings

Reinforcing Steel;

#### SD-03 Product Data

Cementitious Materials;  
Concrete Curing Materials  
Reinforcement;  
Admixtures  
Local/Regional Materials;

Nonshrink Grout

SD-05 Design Data

Concrete Mix Design;

SD-06 Test Reports

Concrete Mix Design;

Fly Ash

Pozzolan

Slag Cement

Aggregates

Compressive Strength Tests;

Air Content

Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Curing Compound

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from

contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Design Data

#### 1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

### 1.6.2 Shop Drawings

#### 1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

### 1.6.3 Test Reports

#### 1.6.3.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

#### 1.6.3.2 Slag Cement

Submit test results in accordance with ASTM C989/C989M for slag cement. Submit test results performed within 6 months of submittal date.

#### 1.6.3.3 Aggregates

Submit test results in accordance with ASTM C33/C33M, or ASTM C330/C330M for lightweight aggregate, and ASTM C1293 or ASTM C1567 as required in the



paragraph titled ALKALI-AGGREGATE REACTION.

#### 1.6.4 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of ACI SP-15 and CRSI 10MSP at project site.

#### 1.6.5 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.
- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

##### 1.6.5.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer in a U.S. state or territory with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

##### 1.6.5.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI SP-2.
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.
- c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

#### 1.6.6 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and

experience to accomplish required testing. The laboratory must meet the requirements of ASTM C1077 and be Cement and Concrete Reference Laboratory (CCRL) inspected.

#### 1.6.7 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.
- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

#### 1.7 SUSTAINABLE DESIGN REQUIREMENTS

##### 1.7.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

#### PART 2 PRODUCTS

##### 2.1 FORMWORK MATERIALS

- a. Form-facing material in contact with concrete must be lumber, plywood, or metal.
- b. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

##### 2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining.

##### 2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORMWORK ACCESSORIES

- a. Use commercially manufactured formwork accessories, including ties and hangers.
- b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

- a. Use form ties with ends or end fasteners that can be removed without damage to concrete.

2.2.2 Chamfer Materials

Use lumber materials with dimensions of 3/4 x 3/4 in.

2.2.3 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Cementitious Materials

2.3.1.1 Portland Cement

- a. Unless otherwise specified, provide cement that conforms to ASTM C150/C150M Type I or II.
- b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- c. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.
- d. Cementitious materials must be stored and kept dry and free from contaminants.

2.3.1.2 Blended Cements

- a. Blended cements must conform to ASTM C595/C595M Type IP or IS.
- b. Slag cement added to the Type IS blend must meet ASTM C989/C989M.

- c. The pozzolan added to the Type IS blend must meet ASTM C618 Class F and must be interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of pozzolan used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

#### 2.3.1.3 Fly Ash

- a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent.
- b. If fly ash is used it shall range from 15 to 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, it shall not be used. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

#### 2.3.1.4 Slag Cement

ASTM C989/C989M, Grade 100.

#### 2.3.1.5 Other Supplementary Cementitious Materials

Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirement for uniformity.

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to ASTM C618, Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.
- b. The average particle size must not exceed 6 microns.
- c. The sum of  $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$  must be greater than 77 percent.

#### 2.3.2 Water

- a. Water or ice must comply with the requirements of ASTM C1602/C1602M.
- b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.
- c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.
- d. Protect mixing water and ice from contamination during storage and delivery.
- e. Submit test report showing water complies with ASTM C1602/C1602M.

### 2.3.3 Aggregate

#### 2.3.3.1 Normal-Weight Aggregate

- a. Aggregates must conform to ASTM C33/C33M unless otherwise specified in the Contract Documents or approved by the contracting officer.
- b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
- c. Provide sand that is at least 50 percent acid insoluble based on ASTM D3042.
- d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.
- e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33/C33M, and ASTM C1293 expansion data not more than 18 months old.

#### 2.3.4 Admixtures

- a. Chemical admixtures must conform to ASTM C494/C494M.
- b. Air-entraining admixtures must conform to ASTM C260/C260M.
- c. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.
- d. Do not use calcium chloride admixtures.
- e. Use a corrosion-inhibiting admixture for concrete classified under exposure category C1.
- f. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.
- g. Protect stored admixtures against contamination, evaporation, or damage.
- h. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.
- i. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

### 2.4 MISCELLANEOUS MATERIALS

#### 2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

#### 2.4.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107/C1107M.

### 2.5 CONCRETE MIX DESIGN

#### 2.5.1 Properties and Requirements

- a. Use materials and material combinations listed in this section and the contract documents.
- b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.
- c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 9 in. Concrete must not show visible signs of segregation.
- d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.
- e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.
- f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.
- g. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.
- h. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum $f'c$ psi	Exposure Categories <sup>^</sup>
<b>Footings</b>	4000 at 28 days	S0;C0; W1; F0

	Minimum $f'c$ psi	Exposure Categories <sup>^</sup>
<b>Walls</b>	4500 at 28 days	S0; C2; W0; F2

## 2.5.2 Durability

### 2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

- For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.
- For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 must not exceed 0.10 percent at an age of 16 days.
- Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with ASTM C1293 and categorized in accordance with ASTM C1778. Alkali content is calculated as follows:  

$$\text{LBA} = (\text{cement content, pounds per cubic yard}) \times (\text{equivalent alkali content of portland cement in percent} / 100 \text{ percent})$$

### 2.5.2.2 Freezing and Thawing Resistance

- Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

Exposure class	Maximum $w/cm^*$	Minimum $f'c$ , psi	Air content	Additional Requirements
F0	N/A	2500		N/A
F1	0.55	3500	Depends on aggregate size	N/A
F2	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass

<b>Exposure class</b>	<b>Maximum w/cm*</b>	<b>Minimum <math>f'c</math>, psi</b>	<b>Air content</b>	<b>Additional Requirements</b>
F3	0.40	5000	Depends on aggregate size	See limits on maximum cementitious material by mass
F3 plain concrete	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass

- b. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must meet the requirements of the following table:

<b>Nominal maximum aggregate size, in.</b>	<b>Total air content, percent*<sup>^</sup></b>	
	<b>Exposure Class F2 and F3</b>	<b>Exposure Class F1</b>
3/8	7.5	6.0
1/2	7.0	5.5
3/4	6.0	5.0
1	6.0	4.5
1-1/2	5.5	4.5
2	5.0	4.0
3	5.5	3.5

\*Tolerance on air content as delivered must be plus/minus 1.5 percent.

<sup>^</sup>For  $f'c$  greater than 5000 psi, reducing air content by 1.0 percentage point is acceptable.

- c. Submit documentation verifying compliance with specified requirements.
- d. For sections of the structure that are assigned Exposure Class F3, submit certification on cement composition verifying that concrete mixture meets the requirements of the following table:



<b>Cementitious material</b>	<b>Maximum percent of total cementitious material by mass*</b>
Fly ash or other pozzolans conforming to ASTM C618	25
Slag cement conforming to ASTM C989/C989M	50
Silica fume conforming to ASTM C1240	10
Total of fly ash or other pozzolans, slag cement, and silica fume	50 <sup>^</sup>
Total of fly ash or other pozzolans and silica fume	35 <sup>^</sup>

\*Total cementitious material also includes ASTM C150/C150M, ASTM C595/C595M, ASTM C845/C845M, and ASTM C1157/C1157M cement. The maximum percentages above must include:

- i. Fly ash or other pozzolans present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.
- ii. Slag cement present in ASTM C1157/C1157M or ASTM C595/C595M Type IS blended cement.
- iii. Silica fume conforming to ASTM C1240 present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.

<sup>^</sup>Fly ash or other pozzolans and silica fume must constitute no more than 25 percent and 10 percent, respectively, of the total mass of the cementitious materials.

#### 2.5.2.3 Corrosion and Chloride Content

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against reinforcement corrosion in Contract Documents.
- b. Submit documentation verifying compliance with specified requirements.
- c. Water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures must be determined for the concrete mixture by ASTM C1218/C1218M at age between 28 and 42 days.
- d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

<b>Exposure class</b>	<b>Maximum w/cm*</b>	<b>Minimum f'c, psi</b>	<b>Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement</b>
<b>Reinforced concrete</b>			
C0	N/A	2500	1.00
C1	N/A	2500	0.30

Exposure class	Maximum w/cm*	Minimum f'c, psi	Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement
C2	0.4	5000	0.15
Prestressed concrete			
C0	N/A	2500	0.06
C1	N/A	2500	0.06
C2	0.4	5000	0.06

\*The maximum w/cm limits do not apply to lightweight concrete.

#### 2.5.2.4 Sulfate Resistance

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members for sulfate exposure.

Exposure class	Maximum w/cm	Minimum f'c, psi	Required cementitious materials-types			Calcium chloride admixture
			ASTM C150/C150M	ASTM C595/C595M	ASTM C1157/C1157M	
S0	N/A	2500	N/A	N/A	N/A	No restrictions
S1	0.50	4000	II*^	IP (MS) ; IS (<70) (MS) ; IT (MS)	MS	No restrictions
S2	0.45	4500	IV^	IP (HS) ; IS (<70) (HS) ; IT (HS)	HS	Not permitted
S3	0.45	4500	V + pozzolan or slag cement**	IP (HS) + pozzolan or slag cement^; IS (<70) (HS) + pozzolan or slag cement^; IT (HS) + pozzolan or slag cement**	HS + pozzolan or slag cement**	Not permitted

\* For seawater exposure, other types of portland cements with tricalcium aluminate (C3A) contents up to 10 percent are acceptable if the w/cm does not exceed 0.40.

\*\* The amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the

pozzolan or slag used shall not be less than the amount tested in accordance with ASTM C1012/C1012M and meeting the requirements maximum expansion requirements listed herein.

^ Other available types of cement, such as Type III or Type I, are acceptable in exposure classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.

- b. The maximum w/cm limits for sulfate exposure do not apply to lightweight concrete.
- c. Alternative combinations of cementitious materials of those listed in this paragraph are acceptable if they meet the maximum expansion requirements listed in the following table:

Exposure class	Maximum expansion when tested using ASTM C1012/C1012M		
	At 6 months	At 12 months	At 18 months
S1	0.10 percent	N/A	N/A
S2	0.05 percent	0.10 percent^	N/A
S3	N/A	N/A	0.10 percent

^The 12-month expansion limit applies only when the measured expansion exceeds the 6-month maximum expansion limit.

#### 2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed 95°F.

#### 2.5.2.6 Concrete permeability

- a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	Maximum w/cm*	Minimum f'c, psi	Additional minimum requirements
W0	N/A	2500	None
W1	0.5	4000	None

\*The maximum w/cm limits do not apply to lightweight concrete.

- b. Submit documentation verifying compliance with specified requirements.

#### 2.5.3 Trial Mixtures

Trial mixtures must be in accordance to ACI 301.

#### 2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

- a. Type and brand cement
- b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixtures
- e. Total water content expressed by water cementitious material ratio

#### 2.6 REINFORCEMENT

- a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.
- b. When handling and storing coated reinforcement, use equipment and methods that do not damage the coating. If stored outdoors for more than 2 months, cover coated reinforcement with opaque protective material.
- c. Submit manufacturer's certified test report for reinforcement.
- d. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.
- e. Submit request with locations and details of splices not indicated in Contract Documents.

##### 2.6.1 Reinforcing Bars

- a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.
- b. ASTM A615/A615M with the bars marked S, Grade 60
- c. Submit mill certificates for reinforcing bars.

##### 2.6.1.1 Stainless Steel Reinforcing Bars

Stainless steel bars must meet the requirements of ASTM A955/A955M.

##### 2.6.2 Wire

- a. Plain or deformed steel wire must conform to ASTM A1064/A1064M.

##### 2.6.3 Reinforcing Bar Supports

- a. Provide reinforcement support types within structure. Reinforcement

supports must conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.

- b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.
- b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.
- c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

#### 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

##### 3.2.1 General

- a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.
- b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

##### 3.2.2 Subgrade Under Foundations and Footings

- a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.
- b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

##### 3.2.3 Reinforcement and Other Embedded Items

- a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.
- b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

### 3.3 FORMS

- a. Provide forms for concrete placement. Set forms mortar-tight and true to line and grade.
- b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.
- c. Provide formwork with clean-out openings to permit inspection and removal of debris.
- d. Inspect formwork and remove foreign material before concrete is placed.
- e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.
- f. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- g. Provide anchoring and bracing to control upward and lateral movement of formwork system.
- h. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.
- i. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.
- j. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

#### 3.3.1 Coating

- a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
- b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.
- c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

#### 3.3.2 Reuse

- a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.
- b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.
- c. Remove leaked mortar from formwork joints before reuse.

### 3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

### 3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

### 3.3.5 Tolerances for Form Construction

- a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.
- b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.
- c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

### 3.3.6 Removal of Forms and Supports

- a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.
- b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.
- c. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

## 3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
- b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.
- c. Cast-in-place concrete members must have concrete cover for reinforcement given in the following table unless otherwise indicated:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	1-1/2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	1-1/2
		No. 11 bar and smaller	3/4
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	1-1/2

#### 3.4.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

#### 3.4.2 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 Section 3 requirements.

#### 3.4.3 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301. Do not splice at points of maximum stress.

#### 3.4.4 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to



prevent the entry of concrete.

#### 3.4.5 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

- a. Provide fabrication tolerances that are in accordance with ACI 117.
- b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

#### 3.4.6 Placing Reinforcement

Place reinforcement in accordance with ACI 301.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

- a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.
- b. Equip supports on ground and similar surfaces with sand-plates.
- c. Support welded wire reinforcement as required for reinforcing bars.
- d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

- e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.
- f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

#### 3.4.7 Spacing of Reinforcing Bars

- a. Spacing must be as indicated in the Contract Documents.
- b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

#### 3.4.8 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

### 3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

#### 3.5.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

#### 3.5.2 Mixing

- a. Mix concrete in accordance with ASTM C94/C94M, ACI 301 and ACI 304R.
- b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the concrete temperature is less than 84 degrees F.
- c. Place concrete within 60 minutes if the concrete temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.
- d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture, within the manufacturer's recommended

dosage, to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

### 3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

## 3.6 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5. Concrete shall be placed within 15 minutes of discharge into non-agitating equipment.

### 3.6.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

### 3.6.2 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

### 3.6.3 Cold Weather

Cold weather concrete must meet the requirements of ACI 301 unless otherwise specified. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

### 3.6.4 Hot Weather

Hot weather concrete must meet the requirements of ACI 301 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface

throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

### 3.7 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

#### 3.7.1 Mixing Equipment

Before concrete pours, designate on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

#### 3.7.2 Hardened, Cured Waste Concrete

Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.

#### 3.7.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

#### 3.7.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.

### 3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.8.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

#### 3.8.2 Formed Surfaces

##### 3.8.2.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

##### 3.8.2.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

##### 3.8.2.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

### 3.9 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified.

### 3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Grate tampers ("jitterbugs") shall not be used.

#### 3.9.1.1 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with ACI 301 Section 5 for a floated finish.

### 3.10 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating.

#### 3.10.1 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

#### 3.10.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

#### 3.10.3 Curing Unformed Surfaces

- a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.
- b. Accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

#### 3.10.4 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

#### 3.10.5 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

#### 3.10.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

### 3.11 FIELD QUALITY CONTROL

#### 3.11.1 Aggregate Testing

##### 3.11.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C136/C136M and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

##### 3.11.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of

the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

### 3.11.2 Concrete Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

### 3.11.3 Concrete Testing

#### 3.11.3.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge.

The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

#### 3.11.3.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

#### 3.11.3.3 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

#### 3.11.3.4 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

#### 3.11.3.5 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

- a. Failure to meet compressive strength tests as evaluated.
- b. Reinforcement not conforming to requirements specified.
- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
- d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.
- e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

#### 3.11.3.6 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

#### 3.11.3.7 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

- a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.



- b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.
- c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.
- d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

### 3.12 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

#### 3.12.1 Crack Repair

Prior to final acceptance, all cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

#### 3.12.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

#### 3.12.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 05 51 00

METAL STAIRS

02/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283/A283M (2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A29/A29M (2016) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

ASTM A307 (2014; E 2017) Standard Specification for

	Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A575	(1996; E 2013; R 2013) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A6/A6M	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A653/A653M	(2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2018) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM F1679	(2004e1) Standard Test Method for Using a Variable Incidence Tribometer

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(2017) Metal Bar Grating Manual
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Iron and Steel Hardware

Steel Shapes, Plates, Bars, and Strips

Metal Stair System

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars

Structural-Steel Tubing

Cold-Finished Steel Bars

Hot-Rolled Carbon Steel Bars

Galvanized Carbon Steel Sheets

Protective Coating

Steel Stairs

#### SD-07 Certificates

Welding Procedures

Welder Qualification

#### SD-08 Manufacturer's Instructions

Structural-Steel Plates, Shapes, and Bars

Structural-Steel Tubing  
Cold-Finished Steel Bars

Hot-Rolled Carbon Steel Bars

Galvanized Carbon Steel Sheets

### 1.3 QUALITY CONTROL

#### 1.3.1 Qualifications for Welding Work

Submit welding procedures in accordance with AWS D1.1/D1.1M. Make test specimens in the presence of the Contracting Officer, and have the specimens tested by an approved testing laboratory at the Contractor's expense.

Certify welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, ensure that two test welds are retested immediately and that each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds be made.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications referenced in this section.

### 2.2 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are

smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning and treating surfaces and applying surface finishes, including zinc coatings.

#### 2.2.1 General Fabrication

Prepare and submit metal stair system shop drawings with detailed plans and elevations at scales not less than 1 inch to 1 foot and with details of sections and connections at scales not less than 3 inches to 1 foot. Also detail the placement drawings, diagrams, and templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchorage devices.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce a finished product that is strong enough and durable enough for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven methods of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and with straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated for the supporting structure. Fabricate anchoring devices, and space them as indicated and as necessary to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

#### 2.2.2 Floor Grating Treads and Platforms

Provide floor grating treads and platforms conforming to ASTM A6/A6M, ASTM A29/A29M and NAAMM MBG 531, "Metal Bar Grating Manual." Provide the pattern, spacing, and bar sizes as indicated:

- a. Galvanized finish, conforming to ASTM A123/A123M.

Fabricate grating treads with steel plate nosings on one edge and with steel angle or steel plate carriers at each end for string connections. Secure treads to strings with bolts.

Match the nosings of grating platforms with the nosing of grating treads at landings. Provide toeplates where the open-sided edges of floor grating meet platform framing members.

### 2.2.3 Protective Coating

Hot-dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

## 2.3 COMPONENTS

### 2.3.1 Steel Stairs

Provide steel stairs complete with stringers, grating treads, landings, columns, handrails, and necessary bolts and other fastenings. Hot-dip-galvanize steel stairs and accessories.

#### 2.3.1.1 Design Loads

Design stairs to sustain a live load of not less than 100 pounds per square foot, or a concentrated load of 300 pound applied where it is most critical. Except for a commercial product, design and fabricate steel stairs to conform to AISC 360.

#### 2.3.1.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Do not use screw or screw-type connections.

- a. Structural Steel: ASTM A36/A36M.
- b. Gratings for Treads and Landings: NAAMM MBG 531; ASTM A653/A653M, G-90 for steel. Provide gratings with slip resistance exceeding a static coefficient of friction, both wet and dry, of 0.5 as tested in accordance with ASTM F1679.
- c. Support steel grating on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. For exterior stairs, form all exposed joints to exclude water.
- d. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
- e. Clean metal surfaces free of mill scale, flake rust, and rust pitting before shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

#### 2.3.2 Fasteners

Select galvanized zinc-coated fasteners conforming to ASTM A153/A153M for exterior applications. Select the fasteners for the type, grade, and class required for the installation of steel stair items:

- a. Standard/regular hexagon-head bolts and nuts, conforming to ASTM A307, Grade A.
- b. Square-head lag bolts conforming to ASME B18.2.1.
- c. Cadmium-plated steel machine screws, conforming to ASME B18.6.3.
- d. Plain, round, general-assembly-grade, carbon steel washers, conforming

to ASME B18.21.1.

## 2.4 MATERIALS

### 2.4.1 Structural-Steel Plates, Shapes and Bars

Structural-size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes.

### 2.4.2 Structural-Steel Tubing

Provide the following:

- a. Structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

### 2.4.3 Hot-Rolled Carbon Steel Bars

Provide the following:

- a. Hot-rolled carbon steel bars and bar-size shapes, conforming to ASTM A575, grade as selected by the fabricator.

### 2.4.4 Cold-Finished Steel Bars

Provide the following:

- a. Cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

### 2.4.5 Galvanized Carbon Steel Sheets

Provide the following:

- a. Galvanized carbon steel sheets conforming to ASTM A653/A653M, with galvanizing conforming to ASTM A653/A653M and ASTM A924/A924M.

### 2.4.6 Steel Pipe

Provide the following:

- a. Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; galvanized finish, standard weight (Schedule 40).

## PART 3 EXECUTION

### 3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion

### 3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.

#### 3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

#### 3.2.2 Field Welding

Comply with AWS D1.1/D1.1M in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.

#### 3.2.3 Touchup Painting

Immediately after installation, clean all field welds, bolted connections, and abraded areas of the galvanized material, and repaint exposed areas with galvanizing repair paint.

-- End of Section --



SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

11/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME A13.1 (2015) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM C882 (2013a) Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear

ASTM C579 (2001; R 2012) Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

ASTM C580 (2002; R 2012) Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

ASTM C1202 (2017a) Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

ASTM C531 (2000; R 2012) Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing, and Polymer Concretes

ASTM C496 (2017) Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

ASTM D4060 (2014) Abrasion Resistance of Organic Coatings by the Taber Abraser

ASTM D3359 (2017) Standard Test Methods for Rating Adhesion by Tape Test

ASTM D4541 (2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM B117

(2016) Standard Practice for Operating  
Salt Spray (Fog) Apparatus

## 1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment List

SD-03 Product Data

Coating System for Ductile or Cast Iron

Coating System For Carbon Steel

Coating System For Concrete Surfaces

SD-04 Samples

Color Chips

SD-07 Certificates

Coating System for Carbon Steel

Coating System for Ductile or Cast Iron

Coating System for Concrete Surfaces

Manufacturer's Printed Instructions

## 1.3 QUALITY CONTROL

Comply with Master Painters Institute (MPI) Standards indicated and listed in "MPI Approved Products List." Comply with the requirements in "MPI Architectural Painting Specification Manual" before any project is started.

Submit an equipment list consisting of a list of proposed equipment to be used in performance of construction work.

Submit three color chips 3-inch by 4-inch or manufacture's pull-down of each finish color and gloss as scheduled.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against

freezing.

Store solvents, thinners, and equipment cleaners with the same care as the coating materials with ambient temperatures continuously maintained at a minimum 45 degrees F.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

##### 1.5.1 Weather

- a. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
- b. Surface Temperatures: Minimum of 5 degrees F (3 degrees C) above dew point. Unless noted otherwise by manufacturer's instructions.
- c. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
- d. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
- e. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

##### 1.5.2 Ventilation

Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWAD 102.

##### 1.5.3 Dust and Contaminants

- a. Schedule coating work to avoid excessive dust and airborne contaminants.
- b. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

#### 1.6 General Scope of Work

- a. All new carbon steel, cast and ductile iron shall be painted as specified herein unless specified otherwise on the drawings or contract documents. Components that are called out to be hot dipped galvanized shall not be painted.
- b. Equipment delivered to site with a manufacturer's applied finish that is equal to the painting system included in this specification is not require to be recoated.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating

material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per gallon

2.1.1.1 Manufacturer

2.1.1.1.1 Optically Activated Pigment

For immersion surfaces, Opt-Check optically activated pigment (OAP) technology is strongly recommended for rapid holiday detection in accordance with SSPC-TU 11.

2.2 MATERIALS

2.2.1 Coating System for Carbon Steel - Pipe, Equipment and Miscellaneous

2.2.1.1 Exterior Exposed (non-immersion)

1. System Type: Expoy/epoxy/urethane.
2. Surface Preparation: SSPC-SP 6 with a surface profile of 2.0 to 3.0 mils.
3. Primer: Two - Component catalyzed epoxy. DFT 3.0 to 5.0 mils.
4. Intermediate Coat: Two-component catalyzed epoxy. DFT 3.0 to 5.0 mils.
5. Finish Coat: Two-component aliphatic polyurethane. DFT 2.0 to 4.0 mils.
6. Total DFT: 8.0 to 14.0 mils.
7. Finish Color: As indicated by Contracting Officer.
8. Labeling: All exterior process piping along the pipe rack shall be painted according to this section, and shall be labeled. The pipes shall be painted light gray, and be labeled with black 4" block letters for where the pipe leads to in the treatment process and have flow arrows. Labels shall be placed every 30-40 feet from each other.

2.2.1.2 Immersion (Wastewater)

1. System Type: Epoxy flake filled/epoxy flake filled
1. Cementitious Repair Mortar: Trowelable grade, rapid-setting, cementitious repair mortar when concrete/brick/mortar is deteriorated greater than a depth of 1/4-inch (6.35 mm). Apply are required to achieve level substrate for application of the protective primer and finish coat.
2. Surface Preparation: SSPC-SP 10
3. OPTIONAL Shop Primer: Copoxy. DFT 3.0 to 5.0 mils.
4. Primer: Two-component glass flake reinforced amine epoxy: DFT 8.0 to 12.0 mils.
5. Finish Coat: Two-component glass flake reinforced amine epoxy: DFT 8.0 to 12.0 mils.
6. Total DFT: 16.0 to 24.0 mils exluding optional shop primer.
7. Finish Color: As indicated by Contracting Officer.

2.2.2 COATING SYSTEM FOR DUCTILE OR CAST IRON - PIPE, PUMPS, AND VALVES

2.2.2.1 Exterior Exposed

1. System Type: Epoxy/epoxy/urethane.
2. Surface Preparation: NAPF 500-03-04 with the exception that ALL rust and mold coating be removed. Only tightly adherent annealing oxides may remain.
3. Primer: Two-component catalyzed epoxy. DFT 3.0 to 5.0 mils.
4. Intermediate Coat: Two-component catalyzed epoxy. DFT 3.0 to 5.0 mils.
5. Finish Coat: Two-component aliphatic polyurethane. DFT 2.0 to 4.0 mils.
6. Total DFT: 8.0 to 14.0 mils.
7. Finish Color: As indicated by Contracting Officer or color schedule.

2.2.2.2 Immersion (wastewater)

1. System Type: Epoxy/epoxy/epoxy
2. Surface Preparation: NAPF 500-03-04 with the exception that ALL rust and mold coating be removed. Only tightly adherent annealing oxides may remain.
3. Primer: Two component glass flake reinforced amine epoxy: DFT 8.0 to 12.0 mils.
4. Finish Coat: Two component Glass Flake reinforced amine epoxy: DFT 8.0 to 12.0 mils.
5. Total DFT: 16.0 to 24.0 mils.

2.2.3 COATING SYSTEM FOR CONCRETE SURFACES (IMMERSION SURFACE)

The following surfaces will be coated in accordance with the specifications below:

1. Primary Clarifier Influent Chamber Trough
2. Primary Clarifier Interior's (down to one foot below the normal water surface)
3. Upflow Clarifier Interior's (down to one foot below the normal water surface)
4. OWS Pump Station Interior
5. Effluent Structure below the top of flume elevation.

1. System Type: Cycloaliphatic Amine Epoxy
2. Surface Preparation: See paragraph 3.1.4 Surface Preparation For Coating Systems for Concrete Surfaces (Immersion Service)
3. Skim Coat: Epoxy Modified Cementitious Mortar applied at 1/16" - 1/4" to fill all voids and provide a smooth free surface. The epoxy modified cementitious mortar shall have the following properties:

- a. Generic Type: Epoxy Modified Cementitious Mortar
- b. Volume Solids: 100%
- c. Max DFT: 1/4"
- d. Bond Strength (ASTM C882): No less than 1,000 psi
- e. Compressive Strength (ASTM C579): No less than 8,000 psi
- f. Drying Shrinkage (ASTM C596): No more than  $2.5 \times 10^{-6}$  inches linear shrinkage
- g. Flexural Strength and Elasticity (ASTM C580): No less than 1,250 psi flexural strength, average of six tests. No less than

- 8.9 x 10<sup>-5</sup> psi flexural modulus of elasticity, average of six tests.
  - h. Rapid Chloride Permeability (ASTM C1202): No more than 1,300 Coulombs charge passed
  - i. Shrinkage (ASTM C531): No more than 3.1 x 10<sup>-6</sup> inches (80 micrometers) linear shrinkage
  - j. Splitting Tensile Strength (ASTM C496): No less than 600 psi splitting tensile strength
4. 1st Coat: Cycloaliphatic Amine Epoxy applied at 4.0 - 6.0 dry mils. The Cycloaliphatic Amine Epoxy shall have the following properties:
- a. Generic Type: Cycloaliphatic Amine Epoxy
  - b. Volume Solids: 82%
  - c. Abrasion (ASTM D4060): No more than 120 mg loss after 1,000 cycles.
  - d. Adhesion (ASTM D3359): No less than a rating of 5
  - e. Adhesion (ASTM D4541): No less than 900 psi pull, average of three tests.
  - f. Chemical Resistance: Method: Immersion at 75°F in accordance with NACE TM-0174, Procedure B. No blistering, cracking or delamination of film after seven days. Reagents: 50% Sodium Hydroxide, 10% Lactic Acid, 10% Ammonium Hydroxide, 10% Oxalic Acid, 10% Hydrochloric Acid, Ethylene Glycol, 10% Sulfuric Acid, Xylene, 10% Phosphoric Acid, Aliphatic Hydrocarbons, 5% Sodium Chloride, Skydrol
  - g. Fresh Water Immersion: Method: Continuous immersion in tap water at 75°F. No blistering, cracking or delamination of film after four years.
  - h. Salt Spray/Fog (ASTM B117): No blistering, cracking or delamination of film. No more than 1/64" rust creepage at scribe after 5,000 hours
5. 2nd Coat: Cycloaliphatic Amine Epoxy applied at 4.0 - 6.0 dry mils.
6. Finish Color: Color shall be cured concrete. Final color shall be approved by the Contracting Officer.

#### 2.2.4 COATING SYSTEM FOR CONCRETE SURFACES (NON-IMMERSION SURFACE)

EQ Basin exterior and Upflow Clarifier exterior.

- 1. System Type: Epoxy/epoxy/urethane.
- 2. Surface Preparation: SSPC - SP 13/NACE 6 with a surface profile of ICRI CSP 2 or 3. Clean and dry.
- 3. Primer: Two - Component Catalyzed Epoxy. DFT 3.0 to 5.0 mils.
- 4. Intermediate Coat: Two - Component catalyzed epoxy. DFT 3.0 to 5.0 mils.
- 5. Finish Coat: Two - Component aliphatic polyurethane. DFT 2.0 to 4.0 mils.
- 6. Total DFT: 8.0 to 14.0 mils.
- 7. Finish color: Natural cured concrete color to match adjacent uncoated concrete structures. Final selection of color shall receive approval from the Contracting Officer.

#### 2.2.5 Coating System for Secondary Clarifier Floor

The contractor shall grind high spots on the floor of Secondary Clarifiers 1 and 2. Any areas that show signs of apparent dragging of the sludge

suction manifold arm, shall be ground down, and spot repaired using the following specified product or equal.

#### 2.2.5.1 Cementitious Repair Mortar and Concrete

1. Shall be Thmec Series 217 MortarCrete, Sauereisen F-121 Restokrete Resurfacer or equal.
2. Installation Requirements:
  - a. Minimum Thickness: 1/4 inches
  - b. Maximum Thickness: 2.0 inches
3. Shall be a cementitious repair mortar. Shall be a single-component, rapid setting (2 hours or less), hydraulic cementitious resurfacer used to restore deteriorated concrete and brick surfaces.
4. Apply product strictly conforming to the manufacturer's recommendations.

### PART 3 EXECUTION

#### 3.1 Examination

Examine areas and conditions under which coating systems are to be applied. Notify Contracting Officer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

Site Visit: Prior to waterproofing installation, arrange visit to project site with water - proofing manufacturer's representative. Representative shall inspect and certify that concrete surfaces are in acceptable condition to receive waterproofing treatment.

##### 3.1.1 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

##### 3.1.2 SURFACE PREPARATION OF STEEL

Prepare steel surfaces in accordance with manufacturer's instructions.

Fabrication Defects:

1. Correct steel and fabrication defects revealed by surface preparation.
2. Remove weld spatter and slag.
3. Round sharp edges and corners of welds to a smooth contour.
4. Smooth weld undercuts and recesses.
5. Grind down porous welds to pinhole-free metal.
6. Remove weld flux from surface.

Ensure surfaces are dry.

Immersion or below grade surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 10/NACE 2. Create a surface profile as specified in Part 2 or as required by the coating manufacturer.

Exterior Exposed Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3. Create a surface profile as specified in Part 2 or as required by the coating manufacturer.

Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

Shop Primer: Shop primed steel shall receive a field sweep blast prior to the application of subsequent coats. Prepare shop primer to receive field coat in accordance with manufacturer's instructions. Remove all unknown shop primers and re-prime in accordance with this specification.

### 3.1.3 SUBSURFACE PREPARATION OF DUCTILE OR CAST IRON

Prepare ductile or cast iron surfaces in accordance with NAPF 500-03-04 Abrasive Blast Cleaning with the exception that ALL rust and mold coating be removed. Only tightly adherent annealing oxide may remain. Bituminous coated pipe shall NOT be allowed if field painting is required.

Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

### 3.1.4 SURFACE PREPARATION FOR COATING SYSTEMS FOR CONCRETE SURFACES (IMMERSION SERVICE)

Abrasive blast, shot-blast, or mechanically abrade concrete surfaces in accordance with SSPC SP13/NACE 6 Surface Preparation of Concrete to remove existing coatings, laitance, curing compounds, hardeners, sealers and other contaminants and to expose sound concrete to provide a minimum surface profile of ICRI CSP 5. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer. All surfaces must be clean, dry and free of oil, grease, chalk and other contaminants. The final concrete surface to be coated shall be prepared according to the manufacturer's requirements for Surface preparation and application.

### 3.1.5 FIELD QUALITY CONTROL

#### 3.1.5.1 Required Inspections and Documentation

1. Verify coatings and other materials are as specified.
2. Verify environmental conditions are as specified.
3. Verify surface preparation and application are as specified.
4. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges. DFT shall be measured in accordance with SSPC-PA2.
5. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
  - a. Check for holidays or interior steel immersion surfaces using holiday detector in accordance with NACE SP0188 or SSPC TU-11 using a safe blue light inspection lamp if OAP technology is used.
6. Report:
  - a. Prepare inspection reports daily.
  - b. Submit written reports describing inspections made and actions taken to correct nonconforming work.
  - c. Report nonconforming work not corrected.
  - d. Submit copies of report to the Contracting Officer and AE.



#### 3.1.5.2 Manufacturer's Field Services

Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

#### 3.1.6 CLEANING

Remove temporary coverings and protection of surrounding areas and surfaces.

#### 3.1.7 PROTECTION OF COATING SYSTEMS

Protect surfaces of coating systems from damage during construction.

#### 3.1.8 ONE-YEAR INSPECTION

Government will set date for one-year inspection of coating systems.

Inspection shall be attended by the Contracting Officer, Contractor, and manufacturer's representative.

Repair deficiencies in coating systems as determined by Contracting Officer in accordance with manufacturer's instructions.

#### 3.1.9 SCHEDULES

Color Schedule:

To facilitate identification of piping in the plant, follow the identification system (shown below):

Finished or Potable Water	Dark Blue
IWTP Effluent (Effluent from Upflow Clarifiers)	Clay (Light Brown)
Sludge	Dark Brown
IWTP Process Wastewater	Light Grey
Non-Potable Water	Green

#### 3.1.10 APPLICATION OF COATING SYSTEMS FOR CONCRETE SURFACES (IMMERSION SERVICE)

Environmental, including surface temperature of the concrete, and project conditions shall satisfy manufacturer's specifications at the time of product application. The Contractor shall apply the coating per manufacturer's requirements. The Contractor shall cure product in accordance with manufacturer's specified cure times.

#### 3.1.11 Coating Material Preparation

Mix and prepare coating materials in accordance with the coating manufacturer's printed instructions for applying the particular material and coat. Keep materials which are not in actual use in closed containers.

Coating materials that have been mixed with an automatic shaker are allowed

to stand to let air bubbles escape, then given a final hand mixing before application. Stir materials so as to produce a mixture of uniform density. Stir at frequent intervals during application to prevent skinning. Do not stir film which may form on the surface of the material. Remove film and strain, if necessary.

#### 3.1.11.1 Thinning

Thinning is done in accordance with coating manufacturer's printed directions for the particular material and coat.

#### 3.1.11.2 Tinting

Ensure prime and intermediate coats of paint are slightly different tints from the finish coat to facilitate identification of each coat. Tinting is done by the coating manufacturer and clearly identified as to color and coat.

### 3.2 APPLICATION

Do not perform exterior painting in damp or rainy weather. Painting is not allowed below 50 degrees F or above 95 degrees F. Apply paint in accordance with the coating manufacturer's recommendations, and as specified.

Ensure coating application is done by skilled applicators. Apply coatings to clean and properly prepared surfaces. Apply coatings with clean, high-quality application equipment. Allow sufficient time between coats to ensure complete drying and curing. Sand and dust surfaces between coatings, as required, to produce a surface free of visible defects. Lightly sand high gloss coatings and clear finishes between coats to ensure bond of following coats.

Apply coats to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections are not acceptable. Remove defective coating applications and re-coat as directed.

Ensure surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, meet the dry-film thickness not less than specified.

#### 3.2.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

#### 3.2.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

### 3.2.3 Spray Application

Do not allow spray application of coatings. Spray application equipment is limited to airless-spray equipment and electrostatic-spray equipment. Ensure equipment is clean and operated by workmen skilled in high quality application of coating materials.

Spray application of coatings is limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

#### 3.3.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

#### 3.3.3 PIPE IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with ASME A13.1. Place stenciling in clearly visible locations. On piping not covered by ASME A13.1, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

-- End of Section --

SECTION 11 11 11

GATES AND ACTUATORS

04/22

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Stainless Steel Slide Gates

SD-03 Product Data

Stainless Steel Slide Gates

SD-05 Design Data

Slide Gate Components

SD-10 Operation and Maintenance Data

Stainless Steel Slide Gates

1.2 QUALITY CONTROL

1.2.1 Qualifications

The gates supplied under this section shall be standard products of a manufacturer regularly engaged in the design and manufacturing of water control gates. The specifications are based on FONTAINE-AQUANOX Series 20 Slide Gates manufactured by ISE Metal Inc. The gates supplied under this section shall conform to all requirements of ANSI/AWWA C561-14. The slide gate manufacturer must maintain an ISO-9001 certification and also a company certification for its welding operations from the CWB or AWS.

1.3 DELIVERY, STORAGE, AND HANDLING

The manufacturer shall use due and customary care in preparing the gates and accessories for shipment. Self contained frame gates shall be shipped assembled with stem and manual operator. When shipping several gates together, every item shipped separately must be clearly marked to the gate it belongs to.

1.4 WARRANTY

The slide gates and manual operating accessories shall be covered by a five (5) year warranty from the manufacturer against defects in materials, design and workmanship. The warranty period will start from the date of delivery of the equipment to the installation site.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

The contractor is to provide two new stainless steel slide gates to replace SUG-522A and 522B. All Slide Gate Components must be submitted to the Engineer for approval.

### 2.2 STAINLESS STEEL SLIDE GATES

The gates shall be upwards opening of the 4 sides sealing type designed for submergence in water or wastewater applications. They shall have flow control capability by allowing only flow through the open area in partial opening situations. As specified in the gate schedule, each gate shall be either open-frame or self-contained-frame design and either rising or non-rising stem configuration.

#### 2.2.1 Performance and Design

##### 2.2.1.1 Slide

The slide consisting of a flat plate with welded reinforcing ribs shall be designed to withstand the design head specified in the gate schedule with a maximum deflection of  $1/720$  of the gate opening width or  $1/16$  in (1.6mm) whichever is less and with stresses in the slide limited to 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less. Minimum material thickness of all members of the slide shall be  $3/4$  in (6mm).

##### 2.2.1.2 Frame

The gate frame shall be made of formed plates or structural members creating the clear opening of the specified dimensions in a rigid one-piece unit. The mounting and bolting flange of the frame to the wall shall be separate and independent from the seating and sealing plane of the slide. The bottom of the frame will be of the flush invert type. Stresses in the frame under design head shall not exceed 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less. Minimum material thickness of all members of the frame shall be  $3/4$  in (6mm).

##### 2.2.1.3 Yoke

Gates specified as self-contained design shall include a yoke consisting of a beam made of formed plates or structural members mounted on top of the frame to permit mounting of the actuator with proper stem alignment by the use of slotted holes in both directions. The yoke shall be sized to limit deflection under the design load to a maximum of  $1/360$  of the gate opening width or  $3/4$  in (6mm) whichever is less. The yoke design load must be considered as the vertical thrust generated by an 80 lbs (356 N) force on the crank or handwheel (for a manual actuator) or by the actuator in locked rotor condition (for an electric actuator). Per AWWA C561-14, the stresses in the yoke generated by the design load shall not exceed (for a manual actuator) 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less, or (for an electric actuator)  $2/3$  of the yield strength.

#### 2.2.1.4 Guiding and Seating

The slide shall seat and travel on guides made of ultra high molecular weight polyethylene (UHMWPE) designed to perform for the life of the slide gate without replacement. The slide shall be kept in positive contact with the guides on both its upstream and downstream faces, all along its travel in the gate clear opening by an elastomeric cord. Above the gate clear opening, the guides shall extend high enough to ensure that the slide is supported on a minimum of 2/3 of its height when fully opened. The low friction guides shall be secured to the frame by bolted retainers allowing factory adjustment of the contact pressure with the slide. The surface of contact on the side seats shall be large enough to limit the stress under the design head to 600 psi (4137 KPa) without considering the top and bottom seats as load bearing.

#### 2.2.1.5 Sealing

The guides combined with the elastomeric cord will provide sealing on both sides of the opening. Sealing at the top section of the gate will also be achieved with a UHMWPE seat maintained in contact by an elastomeric cord. At the gate invert, the slide shall close on a flush invert rubber seat/seal secured in the bottom member of the gate frame. Under the design seating or unseating head specified in the gate schedule, the slide gates shall restrict leakage to a maximum of 0.04 gpm/ft. (0.5 l/min/m) of clear opening perimeter. Manufacturer shall be able to demonstrate that the sealing system will retain its performance even after 25,000 operating cycles.

#### 2.2.1.6 Stem Connection

In the case of gates with rising stems, the stem or its extension will be connected to the slide by means of a pinned connection. For gates with non-rising stems, the connection to the slide shall be by means of a threaded thrust nut matching the stem threads. Stem connection design shall limit the stress under the design load to a maximum of 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength. The stem connection design load shall be the thrust and torque developed when a 80lbs (356N) efforts is applied the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).

#### 2.2.1.7 Stem

The stem configuration shall be rising or non-rising according to the type specified in the schedule. The threads shall be machine rolled ACME left hand threads with double entry to minimize the number of turns required for operation and provide gate opening by counterclockwise rotation of the manual actuator. Surface finish of the machined threads will be 32 micro inch (0.813  $\mu$ m) or better. For manually operated gates with rising stem, the stem shall be equipped with an adjustable stop collar to prevent over-closing the gate and potentially damaging components.

The stem shall be sized so that its critical buckling load (as determined by the Euler column formula) is higher than the design compression load, defined as the vertical force developed by a 80lbs (356N) effort applied on the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).

#### 2.2.1.8 Couplings

The required stem extensions shall be joined together or to the threaded stem by means of a bolted connection, passing through both pipe and stem.

#### 2.2.1.9 Stem Guides

Guides will be provided as required to meet the stem buckling design criteria and positioned per the manufacturer's recommendations to ensure that the length to radius of gyration ratio ( $l/r$ ) does not exceed 200. The guides shall incorporate a UHMWPE bushing supported by a stainless steel wall bracket adjustable in both horizontal directions.

#### 2.2.1.10 Manual Actuator

##### 1. Operation

Manual actuator of the proper type and mounting location, as listed in the gate schedule or shown on the drawings, shall be provided by the gate manufacturer. The effort required on the manual device to operate the gates shall not exceed 40 lbs (178 N), while to start the gate in motion from the fully closed position with the design pressure, the required effort shall not exceed 60 lbs (267 N). Indication of the opening direction of rotation shall be clearly marked in a permanent manner on the handwheel or crank.

##### 2. Handwheel

The handwheel shall be removable and have a minimum diameter of 16" (406mm). It shall drive the lift nut directly or via the extension pipe of self-contained gates or it shall engage the input shaft of the gearbox, when specified.

##### 3. Crank Operated Gearboxes

The gearbox, comprising a lift nut and thrust bearing assembly (as described below), shall be fully enclosed in a casted housing with seals around the lift nut and around the input pinion shaft. The input pinion shaft shall be supported on ball or tapered roller bearings. The removable crank, equipped with a revolving grip shall engage on the input shaft of the gearbox and have a minimum radius of 12" (305mm).

##### 4. Square Nut Actuator

The square nut shall be 2" x 2" (50mm x 50mm) designed for mounting in the floor box supplied by the contractor and designed to accommodate a standard T-wrench. T-Wrench shall be supplied by the gate manufacturer in the quantity required by the gate schedule.

##### 5. Actuator Lift Nut and Thrust Bearings

All gates shall include a thrust bearing assembly comprising a threaded bronze lift nut to engage the operating stem. This assembly must be enclosed in a machined stainless steel housing or be an integral part of the gearbox when supplied. Needle roller thrust bearings shall be provided above and below the lift nut to support the operating efforts in closing and opening the gate. The length of thread engagement shall be sufficient to ensure that the maximum pressure on the projected area of thread contact does not exceed 2000 psi (13,8 MPa) at normal maximum operating load and that the PV (pressure velocity) factor does not exceed 30,000. The PV factor is calculated by multiplying the pressure on the projected area of thread contact in psi by the surface velocity in ft/min at the pitch diameter of the threads. For non-rising stem gates, the actuator lift nut

shall be keyed to prevent rotation relative to the threaded stem.

6. Mounting

The thrust bearing assembly or the gearbox shall be mounted on the yoke of the gate for all gates specified as self-contained or on a pedestal for gates specified as non self-contained. Pedestal height shall be such that the handwheel or input shaft of the gearbox is located approximately 36" (900mm) above the operating floor. Where shown on the drawings or when specified, a wall bracket shall be supplied to support the pedestal. The pedestal wall bracket shall be designed and supplied by the gate manufacturer to ensure that it can resist to all operating efforts of the gate based on the same design calculation criteria used for the yoke.

7. Stem Cover

All rising stem gates, weather manual or motorized shall be equipped with a clear stem cover with a closed top and ventilation hole. The cover shall bear graduation in both inches and centimeters to indicate the position of the gate.

2.2.1.11 Anchor Bolts

For all bolts, use Hilti HVA adhesive anchors (not less than 5/8" diameter). Expansion type anchors will not be accepted. The quantity, size and location of anchor bolts shall be determined by the gate manufacturer and shown on the submittal drawings. The minimum required load capacity of the anchors used for design must also be indicated on the drawings.

2.2.1.12 Materials

Slide, Frame and Yoke    Stainless Steel    ASTM A240, grade 316L or 304L  
Side Seal/Guides and Top Seal    Ultra High Molecular Weight Polyethylene (UHMWPE)    ASTM D4020

Flush Invert Bottom Seal    Ethylene Propylene (EPDM)    ASTM D2000  
Compression Cord    Ethylene Propylene (EPDM)    ASTM D2000  
Wall Gasket    Ethylene Propylene (EPDM)    ASTM D2000  
Bolts and Hardware    Stainless Steel    ASTM F593, grade 316  
Stem    Stainless Steel    ASTM A582, grade 316 or 304  
Thrust Nut and Lift Nut    Aluminum Bronze or Manganese Bronze    ASTM B505, C95800  
ASTM B584, C86300  
Stem Couplings    Manganese bronze or Stainless Steel    ASTM A582, grade 316  
Stem Guide Bracket    Stainless Steel    ASTM A582, grade 316  
Stem Guide Bushing    Ultra High Molecular Weight Polyethylene (UHMWPE)    ASTM D4020  
Handwheel    Aluminum    ASTM B209, 6061-T6  
Crank    Stainless Steel    ASTM A240, grade 316L  
Pedestal    Stainless Steel    ASTM F593, grade 316  
Gearbox Housing    Cast Iron    ASTM A48 35B/40B  
Square Nut    Cast Aluminum    ASTM B179  
Stem Cover    Clear PVC  
Stem Cover Cap    PVC

2.2.1.13 Factory Tests

The gates shall be tested in the factory for leakage and for operating



force. Leakage shall be measured at the unseating design pressure. Operating force shall be measured with the gate in vertical position, with and without the design pressure. Factory test reports shall be available on request for all gates supplied.

## 2.3 ELECTRIC ACTUATORS

Provide and install two electric actuators for the effluent weir gates at the headworks structure. All electric actuators shall conform to the requirements of AWWA Standard C540-93.

Actuators shall contain motor, gearing, manual over-ride, limit switches, torque switches, drive coupling, integral motor controls, position feedback transmitter (where required) and mechanical dial position indicator (where required).

The motor shall be specifically designed for actuator service. The motor will be of the induction type with class F insulation and protected by means of thermal switches imbedded in the motor windings. Motor enclosure will be totally enclosed, non-ventilated.

All actuators will operate on 120V - 1 phase - 60 Hz power.

Actuator enclosure shall be NEMA 4 (watertight). All external fasteners on the electric actuator will be stainless steel. Fasteners on limit switch and terminal compartments shall be captured to prevent loss while covers are removed.

All gearing shall be grease lubricated and designed to withstand the full stall torque of the motor.

Manual over-ride shall be by handwheel. Manual operation will be via power gearing to minimize required rim pull and facilitate easy change-over from motor to manual operation when actuator is under load. Return from manual to electric mode of operation will be automatic upon motor operation. A seized or inoperable motor shall not prevent manual operation.

Limit switches shall be furnished at each end of travel. Limit switch adjustment shall not be altered by manual operation. Limit switch drive shall be by counter-gear. For modulating (analog) valves, limit switches must be capable of quick adjustment, requiring no more than five (5) turns of the limit switch adjustment spindle. One set of normally open and one set of normally closed contacts will be furnished at each end of travel where indicated. Contacts shall be of silver and capable of reliably switching low voltage DC source from the control system furnished by others.

Mechanically operated torque switches shall be furnished at each end of travel. Torque switches will trip when the valve load exceeds the torque switch setting. The torque switch adjustment device must be calibrated directly in engineering units of torque.

All wiring shall be terminated at a plug and socket type electrical connector with a double seal conduit entry.

Actuator must be capable of the following valve closing times/operating speeds: sluice gates - 12 inches per minute operating speed.

Actuators will be capable of operating in an ambient temperature range of -20 to +175 degrees F (without motor controls) and -20 to +160 degrees F (with motor controls).

All actuators in open/close service will be furnished with integral motor controls consisting of reversing starters, control transformer, phase discriminator, monitor relay (to signal fault conditions such as thermal switch trip, torque switch tripped in mid-travel, wrong phase sequence or phase failure), "open-stop-close" pushbuttons, "local-off-remote" selector switch in addition to red and green indicating lights. An interface with the control system must be furnished with optical isolators to separate incoming voltage signals from the internal motor controls.

All actuators shall be furnished with a feedback potentiometer in addition to the following motor controls: reversing starters, control transformer, phase discriminator, monitor relay, positioner, "open-stop-close" pushbuttons, "local-off-remote" selector switch in addition to red and green indicating lights. The positioner shall be capable of accepting a 4-20mA DC command signal and positioning the valve by comparing the command signal with the present valve position as indicated by the feedback potentiometer mounted inside the actuator. The positioner shall be field adjustable to fail to the "open", "closed" or "last" position on loss of 4-20 mA DC command signal.

### PART 3 EXECUTION

#### 3.1 STAINLESS STEEL SLIDE GATES

##### 3.1.1 INSTALLATION

A. It is the responsibility of the Contractor to handle, store and install the gates in strict accordance with the manufacturer's instructions and recommendations. The Contractor shall review the installation drawings and instructions before proceeding to the installation of the gates.

B. The gate assemblies must be installed on a true vertical plane, square and plumb. The operating stem shall be accurately aligned with the gate guides and properly greased.

##### 3.1.2 FIELD TESTING

A. After installation, the gates must be field tested by the Contractor, in the presence of the Engineer and Owner, to ensure compliance with the requirements of these specifications. Each gate shall be operated on its complete open-close cycle to confirm operation without binding, scraping or distorting. Operating effort on the crank, handwheel or T-wrench shall be observed or measured. In the case of motorized actuators, the operating torque shall be noted, and the initial set-up of each actuator shall be done in accordance with the instructions in the manual.

B. Each gate shall be water tested by the Contractor and sealing performance shall be observed.

C. The Contractor shall supply a detailed report of the field tests to the Engineer for review.

WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P

-- End of Section --

SECTION 22 07 19.00

PLUMBING PIPING INSULATION

08/16

PART 1 GENERAL

Piping insulation in this section is in reference to Sections 33 30 00 and 33 31 23. 00 10 .

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C795	(2008; R 2013) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D579/D579M	(2015) Standard Specification for Greige Woven Glass Fabrics
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(2018) Standard on Types of Building Construction
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SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3779	(2016; Rev B) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant, Aluminum Foil/Glass Cloth
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Insulation Materials

Jacketing

Tape

SD-08 Manufacturer's Instructions

Installation Manual

SD-11 Closeout Submittals

Record Drawings

### 1.3 QUALITY CONTROL

#### 1.3.1 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum recycled material content of the following insulation types are:

- a. Rock Wool - 75 percent slag by weight
- b. Fiberglass - 20-25 percent glass cullet by weight
- c. Plastic Rigid Foam - 9 percent recovered material
- d. Polyisocyanurate/Polyurethane - 9 percent recovered material
- e. Rigid Foam - 9 percent recovered material

Submit recycled materials documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Performance Requirements

Provide noncombustible thermal-insulation system materials, as defined by NFPA 220. Provide adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, with a flame-spread classification (FSC) of 25 or less, and a smoke-developed classification (SDC) of 50 or less. Determine these maximum values in accordance with ASTM E84. Provide coatings and sealants that are nonflammable in their wet state.

Provide adhesives, coatings, and sealants with published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

## 2.2 COMPONENTS

### 2.2.1 Insulation

Provide insulation with maximum value conductances as tested at any point, not an average. Replace or augment insulation conductance found by testing to exceed the specified maximum by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

#### 2.2.1.1 Fiberglass Insulation

Conform to a 118 psf vinyl noise barrier with a reinforced foil facing on one side bonded to a 2 inch thick fiberglass quilted with a non-porous scrim facing equal to B-10 Lag/QFA-9. It shall have a nominal density of 2.0-lb/cu.ft. Material shall have an "R" factor of 8.0.

Fiber glass pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation for aboveground piping.

### 2.2.2 Jacketing

#### 2.2.2.1 Aluminum Jacket

Provide aluminum jackets conforming ASTM B209, Temper H14, minimum thickness of 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on the inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.

### 2.2.3 Tape

Provide a 4 inch foil lag tape suitable for continuous spiral wrapping of insulated pipe bends and fittings that produces a smooth, tight, wrinkle-free surface. Conform to requirements of SAE AMS 3779, ASTM D579/D579M, and ASTM C921 for tape, weighing not less than 10 ounces per square yard.

## 2.3 MATERIALS

Submit manufacturer's catalog data for the following items:

- a. Insulation Materials
- b. Jacketing
- c. Tape

Provide compatible materials that do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state. Meet ASTM C795 requirements for materials to be used on stainless steel surfaces. Provide materials that are asbestos free.

### PART 3 EXECUTION

Apply insulation only to the system or component surfaces that have previously been tested and approved by the Contracting Officer.

#### 3.1 PREPARATION

Submit installation drawings for pipe insulation, conforming with the adhesive manufacturer's written instructions for installation. Submit installation manual clearly stating the manufacturer's instructions for insulation materials.

Clean surfaces to remove oil and grease before insulation adhesives or mastics are applied. Provide solvent cleaning required to bring metal surfaces to such condition.

#### 3.2 INSTALLATION OF INSULATION SYSTEMS

Apply materials in conformance with the recommendations of the manufacturer.

Install smooth and continuous contours on exposed work. Smoothly and securely paste down , flaps, bands, and tapes.

Install insulation lengths tightly butted against each other at joints. Where lengths are cut, provide smooth and square and without breakage of end surfaces. Where insulation terminates, neatly taper and effectively seal ends, or finish as specified. Direct longitudinal seams of exposed insulation away from normal view.

Use insulation meeting maximum value conductance as tested at any point, do not use an average. Meet or exceed the specified maximum conductance by adding additional insulation thickness. Insulate above ground pipes and valves with diameters less than 12".

Determine the circumference of the pipe to be wrapped. Note additional length required to accommodate thickness of material. Add 2-4 inches overlap of product onto itself. (Note: Quilted fiberglass side goes up against the pipe)

After cutting piece from roll, install first section on the pipe. Drape the cut piece over the pipe with equal parts of the product hanging over each side. One side is then brought up and adhered to the pipe with a foil lag tape. The other side is then brought up, making sure to overlap the first side, and secured with tape. This method allows for circumferential seams approximately every 50" to 52", and a single seam running along the bottom of the pipe.

Add additional wraps of tape around circumference as required to snug lagging to pipe. As required, banding should be installed in addition to tape to secure lag to pipe.

Cut and install the next section in the same fashion. Each progressive section should overlap the previous section by 2 inches (+/-). When covering an elbow, the usual method is to "gore" the product.

#### 3.3 CLOSEOUT ACTIVITIES

Final acceptance of the performed work is dependent upon providing Record

Drawings details to the Contracting Officer. Include construction details, by building area, the insulation material type, amount, and installation method. An illustration or map of the pipe routing locations may serve this purpose.

Provide a cover letter/sheet clearly marked with the system name, date, and the words "Record Drawings Insulation/Material" for the data. Forward to the Contracting Officer for inclusion in the Maintenance Database."

-- End of Section --



SECTION 22 13 29

SANITARY SEWERAGE PUMPS  
02/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings

ASME INTERNATIONAL (ASME)

ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA MG 1 (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation

SD-03 Product Data

Materials and Equipment  
Framed Instructions  
Spare Parts

SD-06 Test Reports

Field Testing and Adjusting Equipment

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals

### 1.3 DELIVERY, STORAGE, AND HANDLING

Protect from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants all equipment delivered and placed in storage.

### 1.4 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 3 months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Pump casings shall be constructed of cast iron of uniform quality and free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Impellers shall be cast iron .

#### 2.1.1 Nameplates

Provide each major item of equipment with the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 2.1.2 Equipment Guards

Enclose or guard belts, pulleys, chains, gears, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto.

#### 2.1.3 Special Tools

Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment.

#### 2.1.4 Electric Motors

Motors shall conform to NEMA MG 1.

#### 2.1.5 Motor Controls

Controls shall conform to NEMA ICS 1.

#### 2.1.6 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be steel; galvanized in accordance with ASTM A153/A153M.

#### 2.1.7 Pressure Gauges

Compound gauges shall be provided on the suction side of pumps and standard pressure gauges on the discharge side of pumps. Gauges shall comply with ASME B40.100. Gauge ranges shall be as appropriate for the particular installation.

### 2.2 GRAVITY THICKENER SCUM PUMP STATION SUBMERSIBLE PUMPS

Submersible centrifugal pumps shall be centrifugal type pumps designed to pump solids up to 3 inches in diameter and shall be capable of withstanding submergence as required for the particular installation.

#### 2.2.1 Pump Characteristics

The submersible pumps located in the two gravity thickener scum pump stations shall have the following operating characteristics:

Design Operating Point	Gravity Thickener Scum Pumps  200 gpm flow, 26 feet head, minimum 60 percent efficiency
Impeller Type	Single Vane Impeller (Closed)
Operating Speed	1750 rpm
Depth of Submergence	2 feet
Electrical Characteristics	460 volts ac, 3 phase, 60 Hz
Horsepower	Non overloading over the entire operating curve.
Size	Within rated load driving pump at specified rpm

Pump Control	Hand, Off, and Automatic
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#### 2.2.2 Pump Casing

The casing shall be capable of withstanding operating pressures 50 percent greater than the maximum operating pressures. The volute shall have smooth passages which provide unobstructed flow through the pump.

#### 2.2.3 Mating Surfaces

Mating surfaces where watertight seal is required, including seal between discharge connection elbow and pump, shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.

#### 2.2.4 Coatings

Exterior surfaces of the casing in contact with sewage shall be protected by a sewage resistant coal tar epoxy coating. All exposed nuts and bolts shall be stainless steel.

#### 2.2.5 Impeller

The impeller shall be of the single shrouded non-clogging design to minimize clogging of solids, fibrous materials, heavy sludge, or other materials found in sewage. The impeller shall be statically, dynamically, and hydraulically balanced within the operating range and to the first critical speed at 150 percent of the maximum operating speed. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction.

#### 2.2.6 Wearing Rings

Wearing rings, when required, shall be renewable type and shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Material for wear rings shall be standard of pump manufacturer. Wearing rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.

#### 2.2.7 Pump Shaft

The pump shaft shall be of high grade alloy steel and shall be of adequate size and strength to transmit the full driver horsepower with a liberal safety factor.

#### 2.2.8 Seals

A tandem mechanical shaft seal system running in an oil bath shall be provided. Seals shall be held in contact by its own spring system. Conventional mechanical seals which require a constant pressure differential to effect sealing will not be allowed.

#### 2.2.9 Bearings

Pump bearings shall be ball or roller type designed to handle all thrust

loads in either direction. Pumps depending only on hydraulic balance end thrust will not be acceptable. Bearings shall have an ABEMA L-10 life of 50,000 hours minimum, as specified in ABMA 9 or ABMA 11.

#### 2.2.10 Motor

The pump motor shall have Class F insulation, NEMA B design, in accordance with NEMA MG 1, and shall be watertight. The motor shall be either oil filled, air filled with a water jacket, or air filled with cooling fins which encircles the stator housing.

#### 2.2.11 Power Cable

The power cable shall comply with NFPA 70, Type SO, and shall be of standard construction for submersible pump applications. The power cable shall enter the pump through a heavy duty entry assembly provided with an internal grommet assembly to prevent leakage. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems are not acceptable.

#### 2.2.12 Installation Systems

##### 2.2.12.1 Rail Mounted Systems

Rail mounted installation systems shall consist of guide rails, a sliding bracket, and a discharge connection elbow. Guide rails shall be stainless steel and of the size and type standard with the manufacturer and shall not support any portion of the weight of the pump. The sliding guide bracket shall be an integral part of the pump unit. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service without entering the pump well. All hardware shall be stainless steel.

##### 2.2.12.2 Bolt Down Systems

The pump mount system shall include a base designed to support the weight of the pump. The base shall be capable of withstanding all stresses imposed upon it by vibration, shock, and direct and eccentric loads.

##### 2.2.12.3 Lifting Chain

Pumps shall be provided with an oversized bail to allow for capture and removal via an overhead stainless steel chain hoist equipped with a clevis hook. The OWS pump station shall be provided with a stainless pedestal mounted hoist with grab hook. Provide stainless steel chain connected to pump, and deadman chain with grab hook as shown on the drawings. All hoists, chains and related hardware shall have a rated working capacity that is greater than the pump weight.

#### 2.2.13 Pump Control

##### 2.2.13.1 GT Scum Pump Stations

Control of the pump stations will be conducted by the PLC as described in section 409500. The control panel for the influent pumps will be located in

B1005 at the MCC. If thermal protection alarm indicates a thermal overload condition for the active pump, the active pump shall be stopped and locked-out and the control panel shall generate a "Pump Failure" alarm locally and remotely via external telemetry. If moisture seal protection alarm indicates a high moisture condition, the pumps shall be stopped and the control panel shall generate a "Pump Failure" alarm locally and remotely via external telemetry.

### 2.3 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, controls and wiring in accordance with the electrical specifications for this contract. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices but not shown, shall be provided.

## PART 3 EXECUTION

### 3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

### 3.2 EQUIPMENT INSTALLATION

Submit Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show on the Drawings proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

#### 3.2.1 Pump Installation

Install pumping equipment and appurtenances in the position indicated and in accordance with the manufacturer's written instructions. Provide all appurtenances required for a complete and operating pumping system, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.

#### 3.2.2 Concrete

Concrete shall conform to Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 3.3 PAINTING

Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not finished at the factory is specified in Section 09 96 00 HIGH PERFORMANCE COATINGS.

### 3.4 FRAMED INSTRUCTIONS

Post, where directed, framed instructions containing wiring and control diagrams under glass or in laminated plastic. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. Post the framed instructions before acceptance testing of the system. Submit pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent (100 percent for positive displacement pumps) of design capacity. Submit a complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Diagrams, instructions, and other sheets proposed for posting.

### 3.5 FIELD TESTING AND ADJUSTING EQUIPMENT

#### 3.5.1 Operational Test

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

#### 3.5.2 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

#### 3.5.3 Performance Test Reports

Submit performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. In each test report indicate the final position of controls.

### 3.6 MANUFACTURER'S SERVICES

Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

### 3.7 FIELD TRAINING

Provide a field training course for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals. Submit six copies of operation and six copies of maintenance manuals for

the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Include in the operation manuals the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List in the maintenance manuals routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course.

-- End of Section --



SECTION 25 05 11

CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS  
05/21

PART 1 GENERAL

Many subparts in this Section contain text in curly braces ("{" and "}") indicating which cybersecurity control and control correlation identifier (CCI) the requirements of the subpart relate to. The text inside these curly braces is for Government reference only and enables coordination of the requirements of this Section with the RMF process throughout the design and construction process. Text in curly braces are not contractor requirements.

This Section refers to Security Requirements Guide (SRGs) and Security Technical Implementation Guide (STIGs). STIGs and SRGs are available online at the Information Assurance Support Environment (IASE) website at <https://public.cyber.mil/stigs/downloads/> and an SRG/STIG Applicability Guide and Collection Tool is available at <https://public.cyber.mil/stigs/SCAP/>. Not all control system components have applicable STIGs or SRGs. The "Control Systems SRG" does not apply to work performed under this Section; all requirements within this section to apply applicable SRGs DO NOT include the "Control Systems SRG".

1.1 RELATED REQUIREMENTS

This section does not contain sufficient requirements to procure a control system and must be used in conjunction with other Sections which specify control systems. This Section adds cybersecurity requirements to the control systems specified in other Sections, and as these requirements are conditioned on the control system being provided, there may be requirements in this Section that will not apply to this project. All Sections containing facility-related control systems or control system components are related to the requirements of this Section. Review all specification sections to determine related requirements.

Other related requirements include UFC 04 010 06 - Cybersecurity for Facility Related Control Systems.

In cases where a requirement is specified in both this Section and in another Section, the more stringent requirement must be met. In cases where a requirement in this Section conflicts with the requirements of another Section such that both requirements cannot be met at the same time, request direction from the Contracting Officer Representative to determine which requirement applies to the project.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.1x (2010) Local and Metropolitan Area  
Networks - Port Based Network Access  
Control

### NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST FIPS 140-2 (2001) Security Requirements for  
Cryptographic Modules

### U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 8551.01 (2014) Ports, Protocols, and Services  
Management (PPSM)

DTM 08-060 (2008) Policy on Use of Department of  
Defense (DoD) Information Systems -  
Standard Consent Banner and User Agreement

## 1.3 DEFINITIONS

### 1.3.1 Administrator Account

An administrator account is an account with full permissions to a device, application, or operating system, including the ability to create and modify other user accounts.

Note that the operating system Administrator Account may be different than Administrator Accounts for applications hosted on that operating system. Also, most controllers will not have any support for accounts and will therefore not have an 'Administrator Account'.

### 1.3.2 Computer

A computer is one of the following:

- a. a device running a non-embedded desktop or server version of Microsoft Windows
- b. a device running a non-embedded version of MacOS
- c. a device running a non-embedded version of Linux
- d. a device running a version or derivative of the Android Operating System, where Android is considered separate from Linux
- e. a device running a version of Apple iOS

Unless otherwise indicated or clear from context use of the word "device" in this Section includes computers.

### 1.3.3 Controller

A device other than a computer or Ethernet switch.

### 1.3.4 Mission Space

A device or media is in mission space if physical access to the device or media is controlled by the organization served by the device. The new/replaced network components are deemed as in Mission space because physical access to the PLC devices, HMI media, and operator workstations are controlled by the organization served by the device.

### 1.3.5 Network

A network is a group of two or more devices that can communicate using a network protocol. Network protocols must provide a method for addressing devices on the network; a communication method that does not provide an addressing scheme is not a networked form of communication. Devices that communicate using a method of communication that does not support device addressing are not using a network.

### 1.3.6 Network Connected

A component is network connected (or "connected to a network") only when the device has a network transceiver which is directly connected to the network and implements the network protocol. A device lacking a network transceiver (and accompanying protocol implementation) can never be considered network connected. Note that (unlike many IT definitions of "Network Connected") a device connected to a non-IP network is still considered network connected (an IP connection or IP address is not required for a device to be network connected).

### 1.3.7 Network Media

The thing that provides the communication channel between the devices on a network. Typically wire, but might include wireless, fiber optic, or even power line (some network protocols allow sending network signals over power wiring).

### 1.3.8 User Account Support Levels

The support for user accounts is categorized in this Section as one of three levels:

#### 1.3.8.1 FULLY Supported

Device supports configurable individual accounts. Accounts can be created, deleted, modified, etc. Privileges can be assigned to accounts. These devices support user-based (as opposed to role-based) authentication.

#### 1.3.8.2 MINIMALLY Supported

Device supports a small, fixed number of accounts (perhaps only one). Accounts cannot be modified. A device with only a "User" and an "Administrator" account would fit this category. Similarly, a device with two PINs for logon - one for restricted and one for unrestricted rights would fit here (in other words, the accounts do not have to be the

traditional "username and password" structure). These devices typically only support role-based authentication.

Examples of devices which MINIMALLY support accounts are a) a variable frequency drive with a single account which requires a PIN for access to configuration; and b) a room lighting control touchpad interface that has a single account.

#### 1.3.8.3 NOT Supported

Device does not support any Access Enforcement therefore the whole concept of "account" is meaningless.

#### 1.3.9 Manual Local Input

Manual Local Inputs are system analog or binary inputs that are adjustable by a person but are, by intrinsic hardware design, very limited in potential capabilities. Manual Local Inputs do not have touch screens or full keyboards, but may have a few buttons or dials to allow input. Manual Local Inputs do not have full graphic screens or dot-matrix displays, but may have simple lights (LEDs) or 7-segment displays. Manual Local Inputs do not have any sort of menu structure, each button has a single well-defined function.

Examples of Manual Local Inputs are H-O-A switches, simple thermostats, and disconnect switches.

#### 1.3.10 Card Reader

A card reader is an input/output device whose primary function is to assist in two-factor authentication. A card reader must have an interface to read data from a card and may be able to write data to a card. A card reader may have a means (such as buttons, keypad, touchscreen, etc.) for a user to input a PIN or password, as well as a limited display.

#### 1.3.11 User Interface

A User Interface (UI) is something other than a Manual Local Input or Card Reader that allows a person to interact with the system or device. Note that while a Card Reader is not by itself a User Interface, a User Interface may contain a Card Reader in order for it to authenticate its user. Within control systems, there are a wide range of User Interfaces.

Two important distinctions are 1) whether the user interface is Local or Remote, and 2) the effective capabilities of the User Interface to alter data, which is the "privilege" of the user interface (where effective privilege available to a specific user at a specific user interface is the combination of the greatest privilege offered by the user interface and the specific account the user is logged into).

##### 1.3.11.1 Local User Interface

A Local User Interface is a user interface where the physical hardware the user interacts with (keyboard, buttons, display, etc.) is physically part of the device being affected. All of the relevant characteristics of the user interface are embodied within a single device.

Note that a Local UI may be able to access data in a different device,

Local versus Remote in this context refers to the user interface itself; the capability to access data in a different device is covered under "Full User Interface".

#### 1.3.11.2 Remote User Interface

A Remote User Interface implements a Client/Server model where the physical hardware the user interacts with (Client) is physically distinct from the device being affected (Server). Most or all of the security and functionality characteristics of the user interface are defined by the Server, not the Client. The Client and Server communicate via a network connection. A common example of a remote user interface is a web-based interface where the browser (client) is generally on different hardware than the web server (server). A Remote UI remains a Remote UI even if the user happens to be at a Client on the same hardware as the Server. What is important is that a) the Client may be on different hardware than the Server and b) the majority of the security and functional characteristics of the interface are defined at the Server.

Note that this definition of "remote" is consistent with that generally used in the control industry but is not aligned with the NIST 800-53 definition of "Remote", which refers to "outside the system". The term "Remote" here better aligns with the NIST 800-53 definition of "Network" (remote from within the system) Access.

#### 1.3.11.3 Types of User Interface (by capability)

User interfaces are also categorized by their capabilities as being Read Only, Limited, or Full.

##### 1.3.11.3.1 Read-Only User Interface

A Read Only User Interface (also referred to as a View-Only User Interface) is a user interface that only allows for reading data, it does not allow (have the capability to) modify data. A Read Only User Interface may be either Local or Remote. A User Interface that is configured to be Read Only (by some other means than the interface itself, such as using configuration software on a laptop) is a Read-Only Interface. Note a Read Only User Interface may have buttons (or touch screen, etc.) allowing the user to navigate through the presentation of data.

Examples of a Read Only User Interfaces are a) a publicly viewable "energy dashboard" showing weather data and energy usage within a building and b) digital wayfinding signage.

##### 1.3.11.3.2 Limited User Interface

A Limited User Interface is a user interface that - by design - can only alter information local to the user interface. Note that the determination of "alter" includes only direct interactions, it explicitly excludes interactions that might occur as secondary effects. For example, an interface changing the flow setpoint in a pump controller is a direct interaction, the subsequent change in flow (as well as any subsequent downstream changes in valve position) are not direct interactions.

Two examples of LIMITED UIs are: a) a variable speed drive has a Limited Local User Interface which allows the user to change properties within the drive, but does not allow affecting things outside the drive; and b) a typical home WiFi Router has a Limited Remote User Interface which allows

configuration of the Router, but does not allow direct interaction with other devices.

#### 1.3.11.3.3 Full User Interface

A Full User Interface can alter information in devices outside the device with the user interface. For example, a typical Local Display Panel is a Full Local User Interface while a browser-based front end is a Full Remote User Interface.

#### 1.3.11.3.4 View-Only User Interface

See Read-Only User Interface

#### 1.3.11.4 Other User Interface Terminology

In addition to defining whether a user interface is a Hardware Limited, Read-Only, Limited or Full, and whether it is Local or Remote, user interfaces are classified by whether they are writable or privileged.

##### 1.3.11.4.1 Writable User Interface

Any User Interface that is not Read-Only is Writable. (Limited User Interfaces and Full User Interfaces are both writable user interfaces (as they are capable of changing a value)).

##### 1.3.11.4.2 Privileged User Interface

A Privileged UI is a UI that has sufficient capabilities or functionality that it requires specific cybersecurity measures to be put in place to limit its unauthorized use. Ultimately, whether a specific user interface is considered a Privileged User Interface must be determined by usage. Unless otherwise specified, user interfaces can be determined to be privileged or not using the following:

- a. Read-Only User Interfaces are not privileged user interfaces.
- b. Full User Interfaces are privileged user interfaces.
- c. User interfaces that allow for configuration of auditing or allows for modification or deletion of audit logs are privileged user interface.
- d. User interfaces that allow for reprogramming a network connected device is a privileged user interface.
- e. Except as specified above, a Limited User Interface must be determined to be privileged or not based on the specific capabilities and use case of the user interface. In general however, user interfaces that do not offer significant capabilities above and beyond those available at that location via other means (e.g. such as a disconnect switch, breaker, or hand-off-auto switch, or physical attack) are not privileged.

#### 1.3.12 Wireless Network

Any network that communicates without using wires or fiber optics as the communication media. Wireless networks include: WiFi, Bluetooth, ZigBee, cellular, satellite, 900 MHz radio, 2.4 GHz, free space optical, point-to-point laser, and IR.

#### 1.3.13 Wired Broadcast Network

Wired Broadcast Networks are any network, such as powerline carrier networks and modem (wired telephony), that use wire-based technologies where there is not a clearly defined boundary for signal propagation.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

##### 1.4.1 Points of Contact

Coordinate with the following Points of Contact as indicated in this Section and as required. Not all projects will require coordination with all Points of Contact. When coordination is required and no Point of Contact is indicated, coordinate with The Contracting Office Representative (COR).

- a. Government Computer Access Point of Contact: The Contracting Office Representative (COR)
- b. HTTPS Certificate Point of Contact: The Contracting Office Representative (COR)
- c. Email Address Point of Contact: The Contracting Office Representative (COR)
- d. Password Point of Contact: The Contracting Office Representative (COR)
- e. Mobile Code Point of Contact: The Contracting Office Representative (COR)

##### 1.4.2 Coordination

Coordinate the execution of this Section with the execution of all other Sections related to control systems as indicated in the paragraph RELATED REQUIREMENTS. Items that must be considered when coordinating project efforts include but are not limited to:

- a. If requesting permission for wireless or wired broadcast communication, the Wireless and Wired Broadcast Communication Request submittal must be approved prior to control system device selection and installation.
- b. If requesting permission for alternate account lock permissions, the Device Account Lock Exception Request must be approved prior to control system device selection and installation.
- c. If requesting permission for the use of a device with multiple physical connections to IP networks, the Multiple IP Connection Device Request must be approved prior to control system device selection and installation.
- d. Wireless testing may be required as part of the control system testing. See requirements for the Wireless Communication Test Report submittal.
- e. If the Device Audit Record Upload Software is to be installed on a computer not being provided as part of the control system, coordination is required to identify the computer on which to install the software.

- f. The Cybersecurity Interconnection Schedule must be coordinated with other work that will be interconnected to, and interconnections must be approved by the Government before relying on them for system functionality.
  - g. Cybersecurity testing support must be coordinated across control systems and with the Government cybersecurity testing schedule.
  - h. Passwords must be coordinated with the indicated contact for the project site.
  - i. If applicable, HTTPS web server certificates must be obtained from the indicated HTTPS Certificate Point of Contact.
  - j. Contractor Computer Cybersecurity Compliance Statements must be provided for each contractor using contractor owned computers.
- 1.5 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Multiple Ethernet Connection Device Request

Contractor Computer Cybersecurity Compliance Statements

Contractor Temporary Network Cybersecurity Compliance Statements

Cybersecurity Interconnection Schedule

Proposed STIG and SRG Applicability Report

SD-02 Shop Drawings

Network Communication Report

Cybersecurity Riser Diagram

SD-03 Product Data

Control System Cybersecurity Documentation

SD-06 Test Reports

Control System Cybersecurity Testing Procedures

Control System Cybersecurity Testing Report

SD-07 Certificates

Software Licenses



SD-11 Closeout Submittals

Confidential Password Report

Enclosure Keys

Software and Configuration Backups

Auditing Front End Software

Device Audit Record Upload Software

System Maintenance Tool Software

Control System Scanning Tools

STIG, SRG and Vendor Guide Compliance Result Report

Control System Inventory Report

1.6 CYBERSECURITY DOCUMENTATION

1.6.1 Proposed STIG and SRG Applicability Report

For each model of network connected or network infrastructure device, use the DISA SRG/STIG Applicability Guide and Collection Tool (available at <https://public.cyber.mil/stigs/SCAP/>) to identify applicable STIGs or SRGs and provide a report indicating applicable STIGs and SRGs for each model.

1.6.2 Cybersecurity Interconnection Schedule

Provide a completed Cybersecurity Interconnection Schedule documenting network connections between the installed system and other systems. Provide the following information for each device directly communicating between systems: Device Identifier, Device Description, Transport layer Protocol, Network Address, Port (if applicable), MAC (Layer 2) address (if applicable), Media, Application Protocol, Service (if applicable), Descriptive Purpose of communication.

In addition to the requirements of Section 01 33 00 SUBMITTAL PROCEDURES, provide the Cybersecurity Interconnection Schedule as an editable Microsoft Excel file (a template Cybersecurity Interconnection Schedule in Excel format is available at <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-05-11>).

1.6.3 Network Communication Report

Provide a network communication report. For each networked device, document the communication characteristics of the device including

communication protocols, services used, encryption employed, and a general description of what information is communicated over the network. For each device using IP, document all TCP and UDP ports used. For non-IP communications, document communication protocol and media used. If other control system Sections used on this project include submittals documenting this information, provide copies of those submittals to meet this requirement.

In addition to the requirements of Section 01 33 00 SUBMITTAL PROCEDURES, provide the Network Communication Report as an editable Microsoft Excel file.

#### 1.6.4 Control System Inventory Report

Provide a Control System Inventory report using the Inventory Spreadsheet listed under this Section at

<https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-05-11> documenting all networked devices, including network infrastructure devices.

For each device provide all applicable information for which there is a field on the spreadsheet in accordance with the instructions on the spreadsheet.

In addition to the requirements of Section 01 33 00 SUBMITTAL PROCEDURES, provide the Control System Inventory Report as an editable Microsoft Excel file.

#### 1.6.5 Software and Configuration Backups

For each computer on which software is installed under this project, provide a recovery image of the final as-built computer. This image must allow for bare-metal restore such that restoration of the image is sufficient to restore system operation to the imaged state without the need for re-installation of software. If additional user permissions are required to meet this requirement, coordinate the creation of the image with the identified Government Computer Access Point of Contact.

For all ethernet switches provide a backup of the switch configuration. For all controllers, provide a backup of the controller configuration and the source code for all loaded application programs (all software that is not common to every controller of the same manufacturer and model).

If any or all of these are provided under another Section, provide documentation indicating this and referencing those submittals.

#### 1.6.6 Cybersecurity Riser Diagram

Provide a cybersecurity riser diagram of the complete control system including all network and device hardware. If the control system specifications require a riser diagram submittal, provide a copy of that submittal as the cybersecurity riser diagram. Otherwise, provide a riser diagram in one-line format.

#### 1.6.7 STIG, SRG and Vendor Guide Compliance Result Report

For every component (device or software) with an applicable STIG or SRG in the Proposed STIG and SRG Applicability Report, provide a result report documenting compliance with the STIG or SRG requirements. For components which are scannable by the SCAP (security content automation protocol) tool (available online at <https://public.cyber.mil/stigs/scap>), provide the SCAP report and raw scan results.

For every component (device or software) with manufacturer provided cybersecurity documentation, procedure, or method for secure configuration or installation, provide a report documenting how the component was configured and any deviation from the manufacturer instructions.

#### 1.6.8 Control System Cybersecurity Documentation

Provide a Control System Cybersecurity Documentation submittal containing the indicated information for each device and software application.

##### 1.6.8.1 Software Applications

For all software applications running on computers provide:

- a. administrator documentation that describes secure configuration of the software
- b. administrator documentation that describes secure installation of the software etc.
- c. administrator documentation that describes secure operation of the software {For Government Reference Only: relates to CCI-003124}
- d. administrator documentation that describes effective use and maintenance of security functions or mechanisms for the software {For Government Reference Only: relates to CCI-003127}
- e. administrator documentation that describes known vulnerabilities regarding configuration and use of administrative (i.e. privileged) functions for the software {For Government Reference Only: relates to CCI-003128}
- f. user documentation that describes user-accessible security functions or mechanisms in the software and how to effectively use those security functions or mechanisms {For Government Reference Only: relates to CCI-003129}
- g. user documentation that describes methods for user interaction which enables individuals to use the software in a more secure manner {For Government Reference Only: relates to CCI-003130}
- h. user documentation that describes user responsibilities in maintaining the security of the software {For Government Reference Only: relates to CCI-003131}

#### 1.6.8.2 Default Requirements for Control System Devices

For control system devices where Control System Cybersecurity Documentation requirements are not otherwise indicated in this Section, provide:

- a. Documentation that describes secure configuration of the device {For Government Reference Only: relates to CCI-003124}
- b. Documentation that describes secure installation of the device {For Government Reference Only: relates to CCI-003125}
- c. Documentation that describes secure operation of the device {For Government Reference Only: relates to CCI-003124}
- d. Documentation that describes effective use and maintenance of security functions or mechanisms for the device {For Government Reference Only: relates to CCI-003127}
- e. Documentation that describes known vulnerabilities regarding configuration and use of administrative (i.e. privileged) functions for the device {For Government Reference Only: relates to CCI-003128}
- f. Documentation that describes user-accessible security functions or mechanisms in the device and how to effectively use those security functions or mechanisms {For Government Reference Only: relates to CCI-003129}
- g. Documentation that describes methods for user interaction which enables individuals to use the device in a more secure manner {For Government Reference Only: relates to CCI-003130}
- h. Documentation that describes user responsibilities in maintaining the security of the device {For Government Reference Only: relates to CCI-003131}

#### 1.7 SOFTWARE LICENSING

{For Government Reference Only: This subpart (and its subparts) relates to SI-2(a), SI-2(c), SI-7(14); CCI-001227, CCI-002605, CCI-002737}

For all software provided that has not already been licensed to the government or project site, provide a license to the project site for a period of no less than 5 years, and the license must also include the following software updates:

- a. Security and bug-fix patches issued by the software manufacturer.
- b. Security patches to address any vulnerability identified in the National Vulnerability Database at <http://nvd.nist.gov> with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or higher.

Provide a single Software Licenses submittal with documentation of the software licenses for all software provided

#### 1.8 CYBERSECURITY DURING CONSTRUCTION

{For Government Reference Only: This subpart (and its subparts) relates to

AC-18, SA-3; CCI-000258}

In addition to the control system cybersecurity requirements indicated in this section, meet following requirement throughout the construction process.

#### 1.8.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. Contractor computers connected to the control system, control system network, or a control system component at any point during construction must meet the following requirements:

##### 1.8.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

##### 1.8.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. Computers used on this project must be scanned using the installed software at least once per day.

##### 1.8.1.3 Passwords and Passphrases

The passwords and passphrases for computers, applications, and web-based applications supporting passwords must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

##### 1.8.1.4 User-Based Authentication

Each user must have a unique account; sharing of a single account between multiple users is prohibited.

##### 1.8.1.5 Demonstration of Compliance

The Government has the right to require demonstration of computer compliance with these requirements at any time during the project.

##### 1.8.1.6 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-05-11>. Each Statement must be signed by a cybersecurity representative for the relevant company.

#### 1.8.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction.

When used, temporary contractor-installed IP networks connected to the control system, control system network, or a control system component at any point during construction must meet the following requirements:

#### 1.8.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than those specifically provided or furnished for this project. Any and all access to the network from outside the project site is prohibited.

#### 1.8.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

#### 1.8.4 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

#### 1.8.5 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-05-11>. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

### 1.9 CYBERSECURITY DURING WARRANTY PERIOD

All work performed on the control system after acceptance must be performed using Government Furnished Equipment or equipment specifically and individually approved by the Government.

## PART 2 PRODUCTS

All products used on this project must meet the indicated requirements, but not all products specified here will be required by every project.

### 2.1 ETHERNET SWITCH

Provide Open Systems Interconnection (OSI) Layer 2 Ethernet switches with the following capabilities, and with an interface to support switch configuration for these capabilities:

#### 2.1.1 Required Functionality

Switches must:

- a. Copper Ethernet ports must auto negotiate for 10, 100 and 1000 megabits-per-second links.

- b. Be capable of implementing port level access control by MAC address and limit the number of MAC addresses to one MAC address per port.
- c. Reference Section 40 60 00 - Process Control for Switch performance requirements.

#### 2.1.2 Configuration Requirements

Switches must:

- a. Support configuration save and restore.
- b. Support both manual IP address assignment and acquisition of a dynamic IP address via Dynamic Host Configuration Protocol (DHCP).
- c. Be capable of limiting access for configuration to one or more of: a web interface using HTTPS, a command line interface using SSH, or an SNMP connection using SNMP version 3 or later.

#### 2.2 DAISY CHAIN IP CONTROLLERS

Controllers used as Daisy Chain IP Controllers must be IP controllers with exactly two Ethernet network connections and basic built-in switch capabilities to allow implementation of an Ethernet network in a daisy chain architecture. Switches incorporated by Daisy Chain IP Controllers are not required to meet the requirements for Ethernet Switches as defined in this Section.

### PART 3 EXECUTION

#### 3.1 CYBERSECURITY HARDENING AND CONFIGURATION GUIDES

Install, configure, and harden all hardware and software furnished on this project in accordance with manufacturer provided documentation, procedures, or methods for secure configuration or installation. Do not implement specific hardening actions if that action would conflict with required functionality or another requirement of this Section.

#### 3.2 NETWORK REQUIREMENTS

##### 3.2.1 Non-IP Control Networks

When control system specifications require particular communication protocols, use only those communication protocols and only as specified. Do not implement any other communication protocol.

When control system specifications do not indicate requirements for communication protocols, use only those protocols required for operation of the system as specified.

##### 3.2.2 IP Control Networks

{For Government Reference Only: This subpart relates to CM-6(a), CM-7(a), CM-7(b), CM-7(1)(b), SC-41; CCI-001588, CCI-000381, CCI-000380, CCI-000381, CCI-000382, CCI-001761, CCI-001762, CCI-002544, CCI-002545, CCI-002546.}

IP Networks must be Ethernet networks and must use switches which are

Ethernet Switches or Daisy Chain IP Controllers as defined in this Section. Do not use nonsecure functions, ports, protocols and services as defined in DODI 8551.01 unless those ports, protocols and services are specifically required by the control system specifications or otherwise specifically authorized by the Government. Do not use ports, protocols and services that are not specified in the control system specifications or required for operation of the control system.

#### 3.2.2.1 IP Network Routers

Do not install any device that performs IP routing.

#### 3.2.2.2 IP Devices With Multiple Ethernet Connection

Except for Ethernet Switches and Daisy Chain IP Controllers, devices must not have more than one Ethernet connection to IP networks unless doing so is required by the project specifications and the specific application is approved. If a device with Multiple Ethernet Connections to IP networks is required, provide a Multiple Ethernet Connection Device Request using the Multiple Ethernet Connection Device Request Template at <https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-05-11> to request approval for each device. If a device with Multiple Ethernet Connections to IP networks is not required, instead provide a document stating that no approval is being requested.

#### 3.2.3 Cryptographic Protection

{For Government Reference Only: This subpart relates to IA-2(9), IA-3(1), SC-8, SC-13, SC-23(1), SC-23(3); CCI-001942, CCI-001959, CCI-001967, CCI-002418, CCI-002449, CCI-002450, CCI-001185, CCI-001188, CCI-001664.}

All remote user interfaces must use HTTPS for all traffic between the user interface client and user interface server.

#### 3.2.4 Device Identification and Authentication

{For Government Reference Only: This subpart (and its subparts) relates to IA-3; CCI-000777, CCI-000778, CCI-001958.}

All computers must support IEEE 802.1x for device authentication to the network.

##### 3.2.4.1 Default Requirements for Control System Devices

For control system devices where Device Identification and Authentication requirements are not otherwise indicated in this Section: Devices using Ethernet must support IEEE 802.1x. Devices using HTTP as a control protocol must use HTTPS instead.

#### 3.2.5 Cryptographic Module Authentication

{For Government Reference Only: This subpart (and its subparts) relates to IA-7; CCI-000803}

For devices (including but not limited to NIST FIPS 140-2 compliant radios) that have STIG/SRGs related to cryptographic module authentication (CCI-000803), comply with the requirements of those STIG/SRGs.



### 3.3 ACCESS CONTROL REQUIREMENTS

#### 3.3.1 User Accounts

{For Government Reference Only: This subpart (and its subparts) relate to AC-2(a), AC-3, AC-6(1), AC-6(10), AC-6(2), AC-6(9), CM-11(2), and IA-2; CCI-002110, CCI-000213, CCI-002235, CCI-001558, CCI-002221, CCI-002222, CCI-002223, CCI-002235, CCI-000039, CCI-001419, CCI-002234, CCI-001812, and CCI-000764.}

Any user interface supporting user accounts (either FULLY or MINIMALLY) must limit access according to specified limitations for each account. Install and configure any device having a STIG or SRG in accordance with that STIG or SRG.

All user interfaces FULLY supporting accounts must implement user-based authentication where each account is uniquely assigned to a specific user. User interfaces FULLY supporting accounts must implement at least three (3) levels of user account privilege including: 1) an account with read-only permissions 2) an account with full permissions including account creation and modification and 3) an account with greater permissions than read-only but without account creation and modification.

##### 3.3.1.1 Computers

All computer operating systems must FULLY support user accounts and implement accounts for access. Each control system software application not supporting accounts and running on a computer must be installed such that use of the software is restricted by the computer operating system to specific users.

Applications running on computers shall not require the user be logged in to a computer operating system administrator account for normal operation. It is permissible to require the computer operating system administrator account for initial application installation and configuration.

##### 3.3.1.2 Controllers

For user interfaces provided by controllers, provide access control in accordance with the User Interface Requirements table for the applicable control system and user interface type.

- a. For table entries of "NA": NA means Not Applicable, there are no interfaces in this category.
- b. For table entries of "None Required": The user interface is not required to support user accounts.
- c. For table entries of "MINIMALLY": The user interface must at least MINIMALLY support user accounts.
- d. For table entries of "FULLY": The user interface must at FULLY support user accounts.
- e. For table entries of "KEY": The user interface must have physical

security in the form of either a key lock on the interface itself or be furnished inside a locked enclosure. Where this is required for a read only interface, this lock must prevent viewing of data on the interface; for other interfaces, this lock must prevent using the interface to alter data.

- f. For table entries of "Physical Security": For Local FULL interfaces, the interface must be located inside mission space. For Local Limited (not FULL) interfaces, the user interface must either a) be located within mission space or b) be protected by physical security at least as good as the control devices (and equipment controlled by the control devices) affected by the interface. For purposes of this requirement, 'affected' includes controllers with data that can be directly altered by the interface, as well as mechanical and/or electrical equipment directly controlled by those controllers, but does not include other interactions.
- g. Entries of the form "X and Y" must meet both the requirement indicated for X and the requirement indicated for Y. For example, an entry of "MINIMALLY and Physical Security" indicates the user interface must both MINIMALLY support accounts and have physical security.
- h. Entries of the form "X or Y" must meet either the requirement indicated for X or the requirement indicated for Y.

#### 3.3.1.2.1 Default Requirements for Other Control Systems

For control system devices where User Interface Requirements are not otherwise indicated in this Section, use the Default User Interface Requirements tables.

Default User Interface Requirements for LOW Impact Control Systems	
<u>User Interface Type</u>	<u>Access Control Requirement</u>
Local Read Only (see note 1)	None Required
Local Limited, Non-privileged	MINIMALLY
Local Limited, Privileged	MINIMALLY and Physical Security
Local Full	FULLY
Remote Read Only	MINIMALLY
Remote Limited, Non-Privileged	MINIMALLY
Remote Limited, Privileged AND Remote Full (see note 2)	FULLY
Notes: 1) Local Read Only User Interfaces are always Non-Privileged 2) Remote Full User Interfaces are always Privileged	

### 3.3.2 Unsuccessful Logon Attempts

{For Government Reference Only: This subpart (and its subparts) relate to AC-7 (a), AC-7 (b); CCI-000043, CCI-000044, CCI-001423, CCI-002236, CCI-002237, CCI-002238}

Except for high availability user interfaces indicated as exempt, devices must meet the indicated requirements for handling unsuccessful logon attempts. If a device cannot meet these requirements, document device capabilities to protect from subsequent logon attempts and propose alternate protections in a Device Account Lock Exception Request submittal. Do not implement alternate protection measures in lieu of the indicated requirements without explicit permission from the Government. If no Device Account Lock Exceptions are requested, provide a document stating that no approval is being requested as the Device Account Lock Exception Request.

#### 3.3.2.1 Devices MINIMALLY Supporting Accounts

For LOW Impact Systems: Devices which MINIMALLY (but not FULLY) support accounts are not required to lock based on unsuccessful logon attempts.

#### 3.3.2.2 Devices FULLY Supporting Accounts

Devices which FULLY support accounts must meet the following requirements.

- a. It must lock the user account when three unsuccessful logon attempts occur within a 15 minute interval.
- b. Once an account is locked, the account must stay locked until unlocked by an administrator. If the account being locked is the sole administrator account on the device, the account must stay locked for 1 hour and then automatically unlock.
- c. Once the indicated number of unsuccessful logon attempts occurs, delay further logon prompts by 5 seconds.

#### 3.3.2.3 High Availability Interfaces Exempt from Unsuccessful Logon Attempts Requirements

There are no high availability interfaces which are exempt from unsuccessful logon attempts requirements.

### 3.3.3 System Use Notification

{For Government Reference Only: This subpart (and its subparts) relates to AC-8; CCI-000048, CCI-002247, CCI-002243, CCI-002244, CCI-002245, CCI-002246, CCI-000050, CCI-002248}

#### 3.3.3.1 System Use Notification for Remote User Interfaces

Remote user interfaces must display a warning banner meeting the requirements of DTM 08-060 on screen.

### 3.3.3.2 System Use Notification for Local User Interfaces

Devices which are connected to a network and have a local user interface must display a warning banner meeting the requirements of DTM 08-060 on the user interface screen if capable of doing so and must have a permanently affixed label with an approved banner from DTM 08-060 if unable to display the warning banner on the screen. Where it is impractical (perhaps due to device size) to affix the label to the device, affix the label to the device enclosure.

Labels must be machine printed or engraved, plastic or metal, designed for permanent installation, must use a font no smaller than 14 point, and must provide a high contrast between font and background colors.

### 3.3.4 Permitted Actions Without Identification or Authentication

{For Government Reference Only: This subpart (and its subparts) relates to AC-14; CCI-000061, CCI-000232}

The control system must require identification and authentication before allowing any actions except read-only actions by a user acting from a user interface which MINIMALLY or FULLY supports accounts.

### 3.3.5 Enclosures

Prior to final acceptance of the system, lock all lockable enclosures. Submit an Enclosure Keys submittal with all copies of keys for all enclosures and a key inventory list documenting all keys. Label each key with the matching enclosure identifier.

## 3.4 USER IDENTIFICATION AND AUTHENTICATION

{For Government Reference Only: This subpart (and its subparts) relates to IA-2, IA-2(1), IA-2(12), IA-5 IA-5(b), IA-5(c), IA-5(e), IA-5(g), IA-5(1), IA-5(11); CCI-000764, CCI-000765, CCI-001953, CCI-001954, CCI-001544, CCI-001989, CCI-000182, CCI-001610, CCI-000192, CCI-000193, CCI-000194, CCI-000205, CCI-001619, CCI-001611, CCI-001612, CCI-001613, CCI-001614, CCI-000195, CCI-001615, CCI-000196, CCI-000197, CCI-000199, CCI-000198, CCI-001616, CCI-001617, CCI-000200, CCI-001618, CCI-002041, CCI-002002, CCI-002003. }

This subpart indicates requirements for specific methods of identification and authentication for users and user accounts. Where these requirements conflict apply the following order of precedence: 1) If present, Device Specific Requirements take precedence over any other requirements; and then 2) multifactor authentication requirements take precedence over password requirements.

### 3.4.1 User Identification and Authentication for All System Types

Unless otherwise indicated, all user interfaces supporting accounts (either FULLY or MINIMALLY) must implement Identification and Authorization via passwords.

#### 3.4.2 User Identification and Authentication for Specific System Types

System specific requirements are in addition to and supersede those indicated for all system types. When no additional requirements are indicated for a specific system type the requirements for all systems still apply to that system type.

#### 3.4.3 User Identification and Authentication for Specific Devices

There are no additional device specific user interface requirements

#### 3.4.4 Implementation of Identification and Authorization Requirements

Identification and Authorization must be met by one of the following methods:

- a. Direct implementation in the user interface.
- b. For user interfaces on a computer: inheriting the Identification and Authorization from the computer operating system, either by the operating system limiting access to specific applications by user, or by the application itself having permissions based on the user logged into the computer.
- c. For remote interfaces: an implementation shared between the remote user interface server and the remote user interface client. For example, a requirement for PIV authentication may be met on a remote user interface by a PIV reader on a web browser client which sends the authentication information via HTTPS to the remote server.

#### 3.4.5 Password-Based Authentication Requirements

##### 3.4.5.1 Passwords for Software and Applications Running on Computers

All software and applications running on computers supporting password-based authentication must enforce the following requirements:

- a. Minimum password length of 12 characters
- b. Password must contain at least one uppercase character.
- c. Password must contain at least one lowercase character.
- d. Password must contain at least one numeric character.
- e. Password must contain at least one special character. The list of supported special characters must include at least 4 separate characters.
- f. Password must have a minimum lifetime of 24 hours.
- g. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do not lock accounts due to expired passwords.
- h. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters (where

location is significant, a character may be reused if it is in a different position).

- i. Passwords must be cryptographically protected during storage and transmission.

#### 3.4.5.2 Passwords for Controllers FULLY Supporting Accounts

All controllers FULLY supporting accounts and supporting password-based authentication must enforce the following requirements:

- a. Minimum password length of twelve (12) characters
- b. Password must contain at least one uppercase character.
- c. Password must contain at least one lowercase character.
- d. Password must contain at least one numeric character.
- e. Password must contain at least one special character. The list of supported special characters must include at least 4 separate characters.
- f. Password must have a maximum lifetime of sixty (60) days. When passwords expire, prompt users to change passwords. Do not lock accounts due to expired passwords.
- g. Password must differ from previous five (5) passwords, where differ is defined as changing at least fifty percent of the characters.
- h. Passwords must be cryptographically protected during storage and transmission.

#### 3.4.5.3 Passwords for Remote Interfaces

Passwords for connecting to a Remote User Interface supporting password-based authentication must enforce the following requirements:

- a. Minimum password length of twelve (12) characters
- b. Password must contain at least one uppercase character.
- c. Password must contain at least one lowercase character.
- d. Password must contain at least one numeric character.
- e. Password must contain at least one special character. The list of supported special characters must include at least 4 separate characters.
- f. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do not lock accounts due to expired passwords.
- g. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters (where location is significant, a character may be reused if it is in a different position).

- h. Passwords must be cryptographically protected during storage and transmission.

#### 3.4.5.4 Passwords for Devices Minimally Supporting Accounts

Devices MINIMALLY supporting accounts must support passwords with a minimum length of four characters.

#### 3.4.5.5 Password Configuration and Reporting

For all devices with a password, change the password from the default password. Coordinate selection of passwords with the Password Point of Contact. Do not use the same password for more than one device unless specifically instructed to do so. Provide a Confidential Password Report documenting the password for each device and describing the procedure to change the password for each device.

Do not provide the Password Summary Report in electronic format. Provide two hardcopies of the Password Summary Report, each copy in its own sealed envelope.

#### 3.4.6 Authenticator Feedback

{For Government Reference Only: This subpart relates to IA-6; CCI-000206}

Devices must never show authentication information, including passwords, on a display. Devices that momentarily display a character as it is entered, and then obscure the character, are acceptable. For devices that have STIGs or SRGs related to obscuring of authenticator feedback (CCI-000206), comply with the requirements of those STIGs/SRGs.

### 3.5 CYBERSECURITY AUDITING

Where an auditing requirement exists for email notification, notify via email the application administrator and Information System Security Officer (ISSO) of the event. Coordinate with the Email Address Point of Contact for email addresses. If outgoing email is not available to the system, configure the system for these notifications for future support of outgoing email.

#### 3.5.1 Audit Events, Content of Audit Records, and Audit Generation

{For Government Reference Only: This subpart (and its subparts) relates to AU-2(a), AU-2(c), AU-2(d), AU-3, AU-10, AU-12, AU-13(3), AU-14(b), AU-14(1), AU-14(2), AU-14(3), CM-5(1), SC-7 (9); CCI-000123, CCI-001571, CCI-000125, CCI-001485, CCI-000130, CCI-000131, CCI-000132, CCI-00133, CCI-000134, CCI-001487, CCI-000166, CCI-001899, CCI-000169, CCI-001459, CCI-000171, CCI-000172, CCI-001910, CCI-001914, CCI-001919, CCI-001464, CCI-001462, CCI-001920, CCI-001814, CCI-002400. }

For devices that have STIG/SRGs related to audit events, content of audit records or audit generation, comply with the requirements of those STIG/SRGs.

If auditing requirements can be met using existing control system alarm or event capabilities, those existing capabilities may be used to meet these

requirements.

#### 3.5.1.1 Computers

For each computer, provide the capability to select audited events and the content of audit logs. Configure computers to audit the indicated events, and to record the indicated information for each auditable event

##### 3.5.1.1.1 Audited Events

Configure each computer to audit the following events:

- a. Successful and unsuccessful attempts to access, modify, or delete privileges, security objects, security levels, or categories of information (e.g. classification levels)
- b. Successful and unsuccessful logon attempts
- c. Successful logouts
- d. Privileged activities or other system level access
- e. Concurrent logons from different workstations
- f. Successful and unsuccessful accesses to objects
- g. All program initiations
- h. All direct access to the information system
- i. All account creations, modifications, disabling, and terminations.
- j. All kernel module load, unload, and restart

##### 3.5.1.1.2 Audit Event Information To Record

Configure each computer to record, for each auditable event, the following information (where applicable to the event):

- a. What type of event occurred
- b. When the event occurred
- c. Where the event occurred
- d. The source of the event
- e. The outcome of the event
- f. The identity of any individuals or subjects associated with the event

#### 3.5.1.2 Default Requirements for Control System Controllers

For control system controllers where Audit Events, Content of Audit Records, and Audit Generation are not otherwise indicated in this Section:

##### 3.5.1.2.1 Controllers Which FULLY Support Accounts

For each controller which FULLY supports accounts, provide the capability



to select audited events and the content of audit logs. Configure controllers to audit the indicated events, and to record the indicated information for each auditable event.

#### 3.5.1.2.1.1 Audited Events

Configure each controller to audit the following events:

- a. Successful and unsuccessful attempts to access, modify, or delete privileges, security objects, security levels, or categories of information (e.g. classification levels)
- b. Successful and unsuccessful logon attempts
- c. Successful logouts
- d. Concurrent logons from different workstations
- e. All account creations, modifications, disabling, and terminations.
- f. All kernel module load, unload, and restart

#### 3.5.1.2.1.2 Audit Event Information To Record

Configure each controller to record, for each auditable event, the following information (where applicable to the event):

- a. what type of event occurred
- b. when the event occurred
- c. where the event occurred
- d. the source of the event
- e. the outcome of the event
- f. the identity of any individuals or subjects associated with the event

#### 3.5.1.2.2 Controllers Which Do Not FULLY Support Accounts

For each controller which does not FULLY support accounts configure the controller to audit all controller shutdown and startup events and to record for each event the type of event and when the event occurred.

#### 3.5.2 Audit Time Stamps

{For Government Reference Only: This subpart (and its subparts) relates to AU-8; CCI-000159, CCI-001889, CCI-001890.}

Any device (computer or controller) generating audit records must have an internal clock capable of providing time with a resolution of one second. Clocks must not drift more than 10 seconds per day. Configure the system so that each device (computer or controller) generating audit records maintains accurate time to within 1 second. Note that if the control system specifications include requirement for clocks, the most stringent requirement applies.

### 3.5.3 Auditing Front End Software

The project site currently has the following software to support control system auditing: none. If there is no existing auditing front end software or the software is not compatible with the provided control systems, provide Auditing Front End Software with audit log import and upload, export, notification, and analysis functionality. The Auditing Front End Software may be provided as a component of the control system front end or as a separate software package, and a single package may serve multiple control systems provided under the same projects if they are sharing a cybersecurity authorization.

When the Auditing Front End Software is neither existing nor installed under the requirements of another Section, furnish the Auditing Front End Software media and license the control system front end computer within the WWTP facility. Submit copies of Auditing Front End Software if this function is not part of the software provided with the control system to meet requirements of other Sections.

#### 3.5.3.1 Import and Upload Requirements

Auditing Front End Software must be capable of importing audit logs from the Device Audit Record Upload Software and of uploading audit logs over the network from all control system devices supporting network upload of audit logs.

#### 3.5.3.2 Export Requirements

Auditing Front End Software must be capable of exporting to a file format supported by Microsoft Excel.

### 3.5.4 Audit Storage Capacity and Audit Upload

{For Government Reference Only: This subpart (and its subparts) relates to AU-4; CCI-001848, CCI-001849}

The creation of audit records must never interfere with normal device operation. Devices must cease collection of auditing information if required to maintain normal operation.

- a. For devices that have STIG/SRGs related to audit storage capacity (CCI-001848 or CCI-001849) comply with the requirements of those STIG/SRGs.
- b. For controllers capable of generating audit records, provide 60 days worth of secure local storage, assuming 10 auditable events per day.

#### 3.5.4.1 Device Audit Record Upload Software

For each device (computer or controller) required to audit events and for which audit logs cannot be uploaded over the network by the Auditing Front End Software, provide and license to the Government software implementing a secure mechanism of uploading audit records from the device and exporting them to the Auditing Front End Software. Where different devices use different software, provide software of each type required to upload audit logs from all devices.

Submit copies of device audit record upload software if this function is not part of the software provided with the control system to meet requirements of other Sections. If there are no devices requiring this software, provide a document stating this in lieu of this submittal.

### 3.5.5 Response to Audit Processing Failures

{For Government Reference Only: This subpart (and its subparts) relates to AU-5; CCI-000139, CCI-000140, CCI-001490.}

In the case of a failure in the auditing system, computers associated with auditing must provide email notification and must overwrite oldest audit records. In case of an audit failure, if possible, continue to collect audit records by overwriting existing audit records.

## 3.6 REQUIREMENTS FOR LEAST FUNCTIONALITY

{For Government Reference Only: This subpart (and its subparts), along with the network communication report submittal specified elsewhere in this section, relates to CM-6(a), CM-6(c), CM-7, CM-7(1)(b), SC-41; CCI-000363, CCI-000364, CCI-000365, CCI-001588, CCI-001755, CCI-000381, CCI-000380, CCI-00382, CCI-001761, CCI-001762, CCI-002544, CCI-002545, CCI-002546. }

For devices that have a STIG or SRG related to Requirements for Least Functionality (such as configuration settings and port and device I/O access for least functionality), install and configure the device in accordance with that STIG or SRGs.

### 3.6.1 Device Capabilities

Do not provide devices with remote user interfaces or with full user interfaces where one was not required. Do not use a networked sensor or actuator where a non-networked sensor or actuator would suffice.

### 3.6.2 Software

For software that has a STIG or SRG related to Requirements for Least Functionality (such as configuration settings and port access for least functionality), install and configure the software in accordance with that STIG or SRG.

## 3.7 SYSTEM AND COMMUNICATION PROTECTION

### 3.7.1 Collaborative Computing

{For Government Reference Only: This subpart relates to SC-15(a), SC-15(b); CCI-001150, CCI-001152.}

Without explicit approval from the project site, control systems must not use collaborative computing technologies.

### 3.7.2 Denial of Service Protection

{For Government Reference Only: This subpart relates to SC-5, SC-39, SC-7(a); CCI-001093, CCI-002385, CCI-002386, CCI-002430, CCI-001097. }

To the greatest extent practical, implement control logic without reliance on the network. Except when required to meet the requirements of the control system Section (where the requirement can only be met using computer hardware), do not implement control logic in computers.

### 3.8 SAFE MODE AND FAIL SAFE OPERATION

{For Government Reference Only: This subpart (and its subparts) relates to CP-12, SI-10(3), SI-17; CCI-002855, CCI-002856, CCI-002857, CCI-002754, CCI-002773, CCI-002774, CCI-002775}

For all control system components with an applicable STIG or SRG, configure the component in accordance with all applicable STIGs and SRGs.

### 3.9 SYSTEM MAINTENANCE TOOL SOFTWARE

{For Government Reference Only: This subpart (and its subparts) relates to MA-3; CCI-000865.}

Submit and license to the Government all software required to operate, maintain and modify the control system such the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer. Submit hard copies of user manuals for each software with the software submittal.

For software provided and licensed to the Government under the requirements of another Section, submit a statement indicating the Section and Submittal under which the software was provided. For software provided to meet the requirements of this Section and not provided and licensed under another Section, submit software and software user manuals on DVD or CD as a Technical Data Package and submit one hard copy of the software user manual for each piece of software.

### 3.10 DEVICE POWER

{For Government Reference Only: This subpart (and its subparts) relates to PE-11, PE-11(1); CCI-002955, CCI-000961. }

For LOW Impact Systems: Provide emergency power in accordance with the control system and equipment specification Sections, 40 60 00

### 3.11 VULNERABILITY SCANNING

{For Government Reference Only: This subpart (and its subparts) relates to RA-5 RA-5(a), RA-5(b), RA-5(c), RA-5(d); CCI-001054, CCI-001055, CCI-000156, CCI-001641, CCI-001643, CCI-001057, CCI-001058, CCI-001059. }

All IP devices must be scannable, such that the device can be scanned by industry standard IP network scanning utilities without harm to the device, application, or functionality.

### 3.11.1 Computers and Software Running on Computers

Computers and applications running on computers must meet relevant vulnerability scanning STIGs/SRGs and respond to approved DoD vulnerability scanning tools.

### 3.11.2 Controllers

Controllers shall be scannable by standard control system discovery tools or control system browsers and return meaningful status information including the network inputs and outputs for the controller. This information shall contain sufficient detail to detect vulnerabilities or exploits of the controller.

Provide all software needed to scan the control system as the Control System Scanning Tools submittal. If the software required to scan the system is already installed at the project site or is provided under a separate section instead provide a statement indicating this.

## 3.12 CONTROL SYSTEM CYBERSECURITY TESTING

### 3.12.1 Control System Cybersecurity Testing Procedures

Prepare Control System Cybersecurity Testing Procedures explaining step-by-step, the actions and expected results that will demonstrate that the control system meets the requirements of this Section.

Submit 4 copies of the Control System Cybersecurity Testing Procedures. The Control System Cybersecurity Testing Procedures may be submitted as a Technical Data Package.

### 3.12.2 Control System Cybersecurity Testing Execution

Using the Control System Cybersecurity Testing Procedures verify that the control system meets the requirements of this Section. UNLESS GOVERNMENT WITNESSING OF A TEST IS SPECIFICALLY WAIVED BY THE GOVERNMENT, PERFORM ALL TESTS WITH A GOVERNMENT WITNESS. If testing reveals deficiencies in the system, correct the deficiency and retest until successful.

### 3.12.3 Control System Cybersecurity Testing Report

Prepare and submit a Control System Cybersecurity Testing Report documenting all tests performed and their results. Include all tests in the Control System Cybersecurity Testing Procedures and any additional tests performed during testing. Document test failures and repairs conducted with the test results.

Submit four copies of the Control System Cybersecurity Testing Report. The Control System Cybersecurity Testing Report may be submitted as a Technical Data Package.

## 3.13 FIELD QUALITY CONTROL, CYBERSECURITY VALIDATION SUPPORT

In addition to testing and testing support required by other Sections, provide a minimum of 8 hours of technical support for cybersecurity testing

of control systems to support the DoD Risk Management Framework process Cybersecurity assessment of the control system. This support is independent of (and in addition to) the Control System Cybersecurity Testing specified in this section.

#### 3.14 CYBERSECURITY TRAINING

Provide eight hours of classroom training for six Government personnel on the cybersecurity operation and maintenance of the control system provided. This training is in addition to and must be coordinated with control system training specified in other Sections.

The Government will provide the training location. Training must cover, at a minimum: (a) applying software and firmware updates, (b) user account creation, modification and deletion, (c) audit log upload procedures and (d) identification of privileged user interfaces and system impact of those interfaces. Training session must include a question and answer period during which government staff questions about cybersecurity aspects of the control system are answered.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

08/19, CHG 2: 05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 (2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1 (2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7 (2014) Requirements for Watthour Meter Sockets

ANSI C80.1 (2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)

ANSI C80.5 (2015) American National Standard for Electrical Rigid Aluminum Conduit

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2018) Motors and Generators
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(2014) Dry-Type Transformers for General Applications
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2016) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WD 1	(1999; R 2015) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2016) Wiring Devices Dimensions Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-607	(2015c; Addendum 1 2017) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.303	Electrical, General

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jan 2020) UL Standard for Safety Flexible Metal Conduit
UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Mar 2021) UL Standard for Safety Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 20	(2018; Reprint Jan 2021) UL Standard for Safety General-Use Snap Switches
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Jul 2020) UL Standard for Safety Panelboards
UL 360	(2013; Reprint Oct 2020) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Feb 2021) UL Standard for Safety Attachment Plugs and Receptacles
UL 506	(2017) UL Standard for Safety Specialty Transformers
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint May 2020) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Feb 2020) UL Standard for

Safety Nonmetallic Outlet Boxes,  
Flush-Device Boxes, and Covers

UL 651	(2011; Reprint Mar 2020) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 854	(2020) Standard for Service-Entrance Cables
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 870	(2016; Reprint Mar 2019) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors
UL 1063	(2017) UL Standard for Safety Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021) UL Standard for Safety Surge Protective Devices
UL 1660	(2019) Liquid-Tight Flexible Nonmetallic Conduit
UL 1699	(2017; Reprint Nov 2020) UL Standard for Safety Arc-Fault Circuit-Interrupters

## 1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100.

## 1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards

Wireways

Marking Strips Drawings

SD-03 Product Data

Receptacles

Circuit Breakers

Switches

Enclosed Circuit Breakers

Motor Controllers

Manual Motor Starters

Surge Protective Devices

SD-06 Test Reports

600-volt Wiring Test

Grounding System Test

Transformer Tests

Ground-fault Receptacle Test

SD-07 Certificates

SD-09 Manufacturer's Field ReportsTransformer Factory Tests

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5

Metering, Data Package 5

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated. NECA NEIS 1 shall be considered the minimum standard for workmanship.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers

regularly engaged in the production of such products which are of equal material, design and workmanship and:

- a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.
- b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
- c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

#### 1.4.3.1 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

### 1.5 MAINTENANCE

#### 1.5.1 Electrical Systems

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein. Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

### 1.6 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

### 2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit.

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-80 in accordance with NEMA TC 2, UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.5 Flexible Metal Conduit

UL 1, limited to 6 feet.

2.2.5.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360, limited to 6 feet.

2.2.6 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.6.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.2.8 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 4X enclosure; stainless steel. Where exposed to wet, damp, or corrosive environments, NEMA Type 4X.2.5 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

#### 2.5.1 Conductors

Provide the following:

- a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.
- b. Conductors No. 8 AWG and larger diameter: stranded.
- c. Conductors No. 10 AWG and smaller diameter: solid.
- d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.
- e. All conductors: copper.

##### 2.5.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

- a. Branch circuits: No. 12 AWG.
- b. Class 1 remote-control and signal circuits: No. 14 AWG.
- c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.
- d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.
- e. Digital low voltage lighting control (DLVLC) system at 24 Volts or less: Category 5 UTP cables in accordance with DLVLC system manufacturer requirements.

#### 2.5.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

##### 2.5.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

- a. Grounding conductors: Green.
- b. Neutral conductors: White.
- c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

##### 2.5.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

- a. 208/120 volt, three-phase
  - (1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

#### 2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type XHHW-2 conforming to UL 44, remote-control and signal circuits: Type XHHW-2, conforming to UL 44. Where equipment or devices require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

#### 2.5.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

#### 2.5.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

#### 2.6 DEVICE PLATES

Provide the following:

- a. UL listed, one-piece device plates for outlets to suit the devices installed.
- b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.
- c. Screws: machine-type with countersunk heads in color to match finish of plate.
- d. Sectional type device plates are not be permitted.
- e. Plates installed in wet locations: gasketed and UL listed for "wet locations," Corrosion resistant cast aluminum.

#### 2.7 SWITCHES

##### 2.7.1 Toggle Switches

NEMA WD 1, UL 20, single pole, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw, heavy duty specification grade. Include the following:

- a. Handles: brown thermoplastic.

- b. Wiring terminals: screw-type, side-wired.
- c. Contacts: silver-cadmium and contact arm - one-piece copper alloy.
- d. Switches: rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated. 2.8 RECEPTACLES

Provide the following:

- a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.
- b. Ratings and configurations: as indicated.
- c. Bodies: brown as per NEMA WD 1.
- d. Face and body: thermoplastic supported on a metal mounting strap.
- e. Dimensional requirements: per NEMA WD 6.
- f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.
- g. Grounding pole connected to mounting strap.
- h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

#### 2.8.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations" with integral GFCI protection. Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, die-cast metal/aluminum cover plate. Specification grade receptacles are required.

#### 2.8.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

#### 2.9 PANELBOARDS

Provide panelboards in accordance with the following:

- a. UL 67 and UL 50 having a short-circuit current rating of 22,000 amperes symmetrical minimum for voltages 240 V and below of 14,000 amperes symmetrical minimum for 480 V. Unless otherwise indicated on drawings.
- b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.
- c. Panelboards: circuit breaker-equipped.
- d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental



insulation supplied as means of obtaining clearances as required by UL.

- e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, obtain Government approval prior to device installation.
- f. Use of "Subfeed Breakers" is not acceptable.
- g. Main breaker: "separately" mounted "above" branch breakers.
- h. Where "space only" is indicated, make provisions for future installation of breakers.
- i. Directories: indicate load served by each circuit in panelboard.
- j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).
- k. Provide new directories for existing panels modified by this project as indicated.
- l. Type directories and mount in holder behind transparent protective covering.
- m. Panelboards: listed and labeled for their intended use.
- n. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.
- a. UL 67 and UL 50.
- b. Panelboards for use as service disconnecting: additionally conform to UL 869A.
- c. Panelboards: circuit breaker-equipped.
- d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.
- e. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated.
- f. Directories: indicate load served by each circuit of panelboard.
- g. Directories: indicate source of service (e.g. upstream panel, switchboard, motor control center) to panelboard.
- h. Type directories and mount in holder behind transparent protective covering.
- i. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

#### 2.9.1 Enclosure

Provide panelboard enclosure in accordance with the following:

- a. UL 50.
- b. Cabinets: painted in accordance with paragraph PAINTING.
- c. Outdoor cabinets: NEMA 4x 304 Stainless Steel.
- d. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.
- e. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.
- f. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.
- g. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.
- h. Each door: fitted with a combined catch and lock latch.
- i. Keys: two provided with each lock, with all locks keyed alike.
- j. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

#### 2.9.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet. All buss work shall be tin plated copper.

#### 2.9.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

##### 2.9.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

##### 2.9.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher per requirements of UL 943 for Class A ground-fault circuit

interrupter devices.

#### 2.9.3.3 Arc-Fault Circuit Interrupters

UL 489, UL 1699 and NFPA 70. Molded case circuit breakers: rated as indicated. Provide with "push-to-test" button.

#### 2.10 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

#### 2.11 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs): UL 508 and UL 489, and provided as shown. Provide MSCPs that consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. Rate MSCPs in accordance with the requirements of NFPA 70.

#### 2.12 MOTORS

Provide motors in accordance with the following:

- a. NEMA MG 1.
- b. Hermetic-type sealed motor compressors: Also comply with UL 984.
- c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.
- d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.
- e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.
- f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.
- g. Unless otherwise indicated, use continuous duty type motors if rated 1 HP and above.
- h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.
- i. Use Inverter-Duty motors designed to operate with adjustable speed drive (ASD).

##### 2.12.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types are not acceptable. In exception, for special purpose

motors and motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

#### 2.12.2 Premium Efficiency Polyphase and Single-Phase Motors

Select polyphase and continuous-duty single phase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10 and NEMA MG 11. In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

#### 2.12.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

#### 2.12.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment using adjustable speed drive (ASD) manufacturer required wiring type and length, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

### 2.13 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

- a. UL 508, NEMA ICS 1, and NEMA ICS 2.
- b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.
- c. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.
- d. Provide protection for motors from immediate restart by a time adjustable restart relay.
- e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch

with the controller.

- f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position.
- g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.
- h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.
- i. Provide selector switch with the means for locking in any position.
- j. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.
- k. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.
- l. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.
- m. Minimum short circuit withstand rating of combination motor controller: 22kA rms symmetrical amperes.
- n. Provide controllers in hazardous locations with classifications as indicated.

#### 2.13.1 Control Wiring

Provide control wiring in accordance with the following:

- a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and passing the VW-1 flame tests included in those standards.
- b. Hinge wire: Class K stranding.
- c. Current transformer secondary leads: not smaller than No. 10 AWG.
- d. Control wire minimum size: No. 14 AWG.
- e. Power wiring for 480-volt circuits and below: the same type as control wiring with No. 12 AWG minimum size.
- f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

### 2.13.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

- a. NEMA ICS 4.
- b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.
- c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.
- d. Terminals: not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.
- e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.
- f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.
- g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

#### 2.13.2.1 Types of Terminal Blocks

- a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.
- b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

### 2.13.3 Control Circuits

Control circuits: maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers: conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits: provide primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side.

#### 2.13.4 Enclosures for Motor Controllers

NEMA ICS 6.

#### 2.13.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked.  
Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

#### 2.13.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: 30mm heavy duty, oil-tight design.

#### 2.13.7 Pilot and Indicating Lights

Provide LED cluster lamps with 30mm push to test type NEMA 4X.

#### 2.13.8 Reduced-Voltage Controllers

Provide for polyphase motors 5 horsepower and larger. Reduced-voltage starters: single-step, closed transition or as indicated, with an adjustable time interval between application of reduced and full voltages to motors.

#### 2.14 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single pole designed for surface mounting with overload protection and pilot lights.

##### 2.14.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color: in accordance with NEMA ICS 2. Provide led push to test 30mm lights.

#### 2.15 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303. Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

#### 2.16 GROUNDING AND BONDING EQUIPMENT

##### 2.16.1 Ground Rods

UL 467. Ground rods: cone pointed solid copper, with minimum diameter of 3/4 inch and minimum length 10 feet. Sectional type rods may be used for rods 20 feet or longer.

#### 2.17 WIREWAYS

UL 870. Material: steel 16 gauge for heights and depths up to 6 by 6

inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged cover NEMA 4X enclosure per NEMA ICS 6.

## 2.18 METERING

ANSI C12.1. Provide a self-contained, socket-mounted, electronic programmable outdoor watthour meter. Meter: either programmed at the factory or programmed in the field. Turn field programming device over to the Contracting Officer at completion of project. Coordinate meter to system requirements. Coordinate meter, system components, and meter location to be compatible with the Activity's central advanced metering system.

- a. Design: Provide watthour meter designed for use on a single-phase, three-wire, 240/120 volt system. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).
- b. Class: 200; Form: 2S, accuracy: plus or minus 1.0 percent; Finish: Class II.
- c. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.
- d. Kilowatt-hour Register: five digit electronic programmable type.
- e. Demand Register:
  - (1) Provide solid state.
  - (2) Meter reading multiplier: Indicate multiplier on the meter face.
  - (3) Demand interval length: programmed for 15 minutes with rolling demand up to six subintervals per interval.
- f. Socket: ANSI C12.7. Provide NEMA Type 3R, box-mounted socket, ringless, having manual circuit-closing bypass and having jaws compatible with requirements of the meter. Provide manufacturers standard enclosure color unless otherwise indicated.

## 2.19 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance, panelboards. Provide surge protectors in a NEMA 4X enclosure per NEMA ICS 6. SPD must have the same short-circuit current rating as the protected equipment and must not be installed at a point of system where the available fault current is in excess of that rating. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker. Submit performance and characteristic curves.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

- Phase to phase ( L-L )
- Each phase to neutral ( L-N )
- Neutral to ground ( N-G )
- Phase to ground ( L-G )

FOR DELTA CONNECTIONS-



Phase to phase ( L-L )  
Phase to ground ( L-G )

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs per NFPA 780 for the lightning protection system.

Maximum L-N, and N-G Voltage Protection Rating:

600V for 120V, single phase system  
1,000V for 120/240V, single phase system

Maximum L-G Protection Rating:

700V for 120V, single phase system  
1,000V for 120/240V, single phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120 percent of nominal voltage for 240 volts and below; 115 percent of nominal voltage above 240 volts to 480 volts.

Provide EMI/RFI filtering per UL 1283 for each mode with the capability to attenuate high frequency noise. Minimum attenuation: 20db.

## 2.20 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

- a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.
- b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.
- c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.
- d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.
- e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.
- f. Equipment located outdoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray.
- g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

## 2.21 SOURCE QUALITY CONTROL

### 2.21.1 Transformer Factory Tests

Submittal: include routine NEMA ST 20 transformer test results on each transformer and also provide the results of NEMA "design" and "prototype"

tests that were made on transformers electrically and mechanically equal to those specified.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of NFPA 70 and to requirements specified herein.

##### 3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

##### 3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

###### 3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

##### 3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches.

###### 3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

##### 3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit

parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits under floor slab as if exposed.

#### 3.1.4.1 Restrictions Applicable to Aluminum Conduit

- a. Do not install underground or encase in concrete or masonry.
- b. Do not use brass or bronze fittings.
- c. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

#### 3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

- a. PVC Schedule 80.
  - (1) Do not use where subject to physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, fire pump rooms, and where restrictions are applying to both PVC Schedule 80
  - (2) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.
- b. PVC Schedule 80 .
  - (1) Do not use where subject to physical damage, including but not limited to, hospitals, power plant, missile magazines, and other such areas.
  - (2) Do not use in hazardous (classified) areas.

#### 3.1.4.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

#### 3.1.4.4 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-80;. Convert nonmetallic conduit, to plastic-coated rigid, steel conduit before rising through floor slab. Plastic coating: extend minimum 6 inches above floor.

#### 3.1.4.5 Conduit Installed Under Floor Slabs

Conduit run under floor slab: located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier. Use NECA NEIS 1 Table 2a (Minimum Raceway Spacing) to determine under floor slab conduit spacing unless greater spacing is required elsewhere in this section.

#### 3.1.4.6 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab. Where conduit rises through slab-on grade, seal all electrical penetrations to address radon mitigation

and prevent infiltration of air, insects, and vermin.

#### 3.1.4.7 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; or PVC, Type EPC-80. PVC, Type EPC-40, unless indicated otherwise. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size: installed parallel with or at right angles to main reinforcement; when at right angles to reinforcement, install conduit close to one of supports of slab. Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel before rising above floor, unless specifically indicated.

#### 3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

#### 3.1.4.9 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Plastic cable ties are not acceptable. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

#### 3.1.4.10 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

#### 3.1.4.11 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70. Use conduit hubs in all outdoor or wet locations.

#### 3.1.4.12 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquid tight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections. Plastic cable ties are not acceptable as a support method.

#### 3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lock washers and nuts may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and

support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

#### 3.1.5.1 Boxes

Boxes for use with raceway systems: minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet.

#### 3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above floor or working platform or as allowed in Section 404.8 per NFPA 70. Mount lighting switches 48 inches above finished floor. Measure mounting heights of wiring devices and outlets to center of device or outlet.

#### 3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with

##### 3.1.7.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

- a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.
- b. Use permanent ink for the wire numbers
- c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.
- d. Size marking strips to accommodate the two sets of wire numbers.
- e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.
- f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.
- g. Prints of the marking strips drawings submitted for approval will be so

marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

#### 3.1.1.8 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

#### 3.1.1.9 Grounding and Bonding

Provide in accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Bond additional driven rods together with a minimum of 4 AWG soft bare copper wire buried to a depth of at least 12 inches. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

##### 3.1.1.9.1 Ground Rods

Provide ground rods and measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod, additional rods, spaced on center. Spacing for additional rods must be a minimum of 10 feet. Additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

##### 3.1.1.9.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or high compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

- b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

#### 3.1.9.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.

#### 3.1.9.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

#### 3.1.10 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

#### 3.1.11 Watthour Meters

ANSI C12.1.

#### 3.1.12 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

#### 3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

#### 3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

#### 3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces



or to meet the indicated or specified safety criteria.

### 3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each tests. Where applicable, test electrical equipment in accordance with NETA ATS.

#### 3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

#### 3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring per NETA ATS to provide direct reading of resistance. All existing wiring to be reused must also be tested.

#### 3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

#### 3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.3.5.5

#### Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

#### 3.5.6 Watthour Meter

##### a. Visual and mechanical inspection

- (1) Examine for broken parts, shipping damage, and tightness of connections.
- (2) Verify that meter type, scales, and connections are in accordance with approved shop drawings.

##### b. Electrical tests

- (1) Determine accuracy of meter.

- (2) Calibrate watthour meters to one-half percent.
- (3) Verify that correct multiplier has been placed on face of meter, where applicable.

#### 3.5.7 Phase Rotation Test

Perform phase rotation test to ensure proper rotation of service power prior to operation of new or reinstalled equipment using a phase rotation meter. Follow the meter manual directions performing the test.

-- End of Section --

SECTION 26 29 01.00

ELECTRIC MOTORS, 3-PHASE VERTICAL INDUCTION TYPE  
11/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM B344 (2014) Standard Specification for Drawn or Rolled Nickel-Chromium and Nickel-Chromium-Iron Alloys for Electrical Heating Elements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

1.2 SUMMARY

The work under this section includes providing all labor, equipment, and material and performing all operations required to design, manufacture, assemble, test, and package and deliver the vertical induction motors for driving pumps specified under Section 22 13 29 SANITARY SEWERAGE PUMPS.

- a. These motors shall be supplied complete with all accessories, spare parts, tools, and manufacturer's data and instructions as specified herein.
- b. Submit 6 copies of complete instructions for the proper installation, inspection, and maintenance of the machines provided for this particular service. Instruction manuals shall be submitted to the Contracting Officer not later than the date the equipment is shipped

from the manufacturer's plant. The instructions shall include a cross-sectional drawing indicating the major component parts of the motor and the procedure for disassembly.

- c. Submit 6 copies of a complete list of renewal parts with prices for each different rating of motor. This list shall accompany the instruction manual.

### 1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Motors

#### SD-03 Product Data

Insulated Windings  
Duty Cycle  
Motors  
Government Study  
Spare Parts

#### SD-06 Test Reports

Starting Capabilities  
Factory Tests

#### SD-07 Certificates

Power Factor and Efficiency  
Factory Tests

#### SD-10 Operation and Maintenance Data

Instructions

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Corrosion Prevention and Finish Painting

The equipment provided under these specifications will be subjected to severe moisture conditions and shall be designed to render it resistant to corrosion from such exposure. The general requirements to be followed to mitigate corrosion are specified below. Any additional special treatment or requirement considered necessary for any individual items is specified under the respective item. However, other corrosion-resisting treatments that are the equivalent of those specified herein may, with the approval of the Contracting Officer, be used.

##### 1.4.1.1 Fastenings and Fittings

Where practicable, all screws, bolts, nuts, pins, studs, springs, washers, and other similar fittings shall be of corrosion-resisting material or shall be treated in an approved manner to render them resistant to corrosion.

#### 1.4.1.2 Corrosion-Resisting Materials

Corrosion-resisting steel, copper, brass, bronze, copper-nickel, and nickel-copper alloys are acceptable corrosion-resisting materials.

#### 1.4.1.3 Corrosion-Resisting Treatments

Hot-dip galvanizing shall be in accordance with ASTM A123/A123M or ASTM A153/A153M as applicable. Other corrosion-resisting treatments may be used if approved by the Contracting Officer.

#### 1.4.1.4 Frames

Motor frames, end bells, covers, conduit boxes, and any other parts, if of steel, and if they will be coated during the process of insulating the windings, shall be cleaned of rust, grease, millscale, and dirt, and then treated and rinsed in accordance with manufacturer's standard process. If any of the above-listed parts are not coated during the process of insulating the windings then, in addition to the above, they shall be given one coat of primer and then two coats of manufacturer's standard moisture-resistant coating, processed as required.

#### 1.4.1.5 Cores

The assembled motor core shall be thoroughly cleaned and then immediately primed by applying a minimum of two coats of a moisture-resisting and oil-resisting insulating compound. Air gap surfaces shall be given a minimum of one coat.

#### 1.4.1.6 Shafts

Exposed surfaces of motor shafts shall be cleaned of rust, grease, and dirt and, except for bearing surfaces, given one coat of a zinc molybdate or equivalent primer and two coats of a moisture-proof coating, each cured as required. Shafts of a corrosion-resisting steel may be used in lieu of the above treatment.

#### 1.4.1.7 Finish Painting

Finish painting of all equipment shall be in accordance with the standard practice or recommendation of the manufacturer, as approved by the Contracting Officer.

#### 1.4.2 Government Study

Submit 6 copies of the specified data. Supply to the Government, for completion of its Motor Torque and Accelerating Time Studies (MTATS), the following data:

- a. Complete equivalent circuit data referred to the stator with friction, windage, and stray load losses.
- b. Current, power factor, and torque versus speed (0-100 percent, inclusive, in 1 percent increments up to 95 percent and in 0.1 percent increments above 95 percent) and load (0-125 percent, inclusive, in 25 percent increments) as a function of line voltage (from 80 percent to 110 percent, inclusive, in 5 percent increments), for rated and 90 percent of rated voltage at starter. Only tabulated data will be required.

- c. Load inertia, Wk2 of motor rotating parts, pound-feet.

## PART 2 PRODUCTS

### 2.1 NAMEPLATES

Nameplate data shall include rated voltage, rated full-load amperes, rated horsepower, service factor, number of phases, RPM at rated load, frequency, code letter, locked-rotor amperes, duty rating, insulation system designation, and maximum ambient design temperature.

### 2.2 MOTORS

The motors to be supplied under these specifications shall be of the vertical shaft type as required by the pump manufacturer, normal or low starting torque, low starting current, squirrel-cage induction type, designed for full voltage starting, of drip-proof construction, and shall conform to the applicable requirements of NEMA MG 1, except as hereinafter specified.

- a. Submit 6 copies of equipment foundation dimensions; outline drawings with weights, nameplate data, and details showing method of mounting and anchoring the motor. Contracting Officer's approval shall be obtained in writing prior to the commencement of manufacture of motors.
- b. Six copies of complete descriptive specification of each type and size motor provided, with necessary cuts, photographs, and drawings to clearly indicate the construction of the motor, the materials and treatments used to prevent corrosion of parts, bearing construction, and type of insulation used on all windings.
- c. Submittal shall include all information required for selection of protective and control equipment and for operational setting, such as, but not limited to, normal and maximum operation temperature for windings and bearings, overload trip setting for motor at pump maximum head condition and starting times for starting at rated and 90 percent starter voltage.

#### 2.2.1 Rating

Each motor shall be wound for 3-phase, 60-Hz, alternating current, and for the respective operating voltage as indicated on the drawings or applicable equipment specifications.

The motor shall be designed for operation in a 122 degrees Fahrenheit ambient temperature and all temperature rises shall be above this ambient temperature. The rated horsepower of the motor shall be not less than 110 percent of the determined maximum load requirement of the pump. Motors shall have a service factor of 1.0 or shall be applied using a service factor of 1.0 if standard service factor is greater than 1.0. The temperature rise above the ambient temperature for continuous rated full-load conditions and for the class of insulation used shall not exceed the values given in NEMA MG 1, paragraph 12.42 or paragraph 20.8.

## 2.2.2 Operating Characteristics

### 2.2.2.1 Torques

Starting torque shall be sufficient to start the pump to which the motor will be connected under the maximum conditions specified, but in no case shall the starting torque be less than 60 percent of full-load torque. Breakdown torque shall be not less than 200 percent of full-load torque.

### 2.2.2.2 Locked-Rotor Current

The locked-rotor current shall not exceed 500 percent of normal full-load running current.

### 2.2.2.3 Starting Capabilities

Large motors, on the basis of the load torque characteristics and the load inertia Wk2 listed in NEMA MG 1, paragraphs 20.41 and 20.42, shall as a minimum be capable of making the starts required in NEMA MG 1, paragraph 20.43. Smaller motors shall conform to the requirements in NEMA MG 1, paragraph 12.50. Submit 6 copies of certified test reports, when available, of tests previously performed on motors of each type and size specified or calculated data to substantiate the motor's capability to conform to the specified requirements.

### 2.2.2.4 Duty Cycle

Submit an analysis to verify that the motor, when operated in accordance with the duty cycle specified, will not undergo injurious temperature rise. If the duty cycle cannot be met with a standard NEMA design motor, the motor manufacturer shall provide a description of proposed modifications to provide such compliance. Each motor, when operating at rated voltage and frequency and on the basis of the connected pump load inertia Wk2 and the speed-torque characteristics of the load during starting conditions as furnished by the pump manufacturer, shall be capable of performing on a continuous basis the following motor duty cycle without injurious temperature rise: operation at rated load over a period of approximately 10 hours A starting information nameplate setting forth the starting capabilities shall be provided on each motor. This nameplate shall also include the minimum time at standstill and the minimum running time prior to an additional start.

### 2.2.2.5 Balance

The balance for each motor when measured in accordance with NEMA MG 1, paragraph 12.06 or paragraph 20.53, shall not exceed the values specified.

### 2.2.2.6 Noise

All motors shall operate at a noise level less than 85 decibels A-weighted mean sound pressure level (dBA). The specified noise limit applies for a reference distance of one meter for free-field conditions.

### 2.2.2.7 Power Factor and Efficiency

The power factor and efficiency at full load, 3/4 full load, and 1/2 full load shall be not less than NEMA MG-1 and NEMA premium efficiency requirements. Motors will be rejected if factory tests specified in paragraph FACTORY TESTS do not demonstrate that these values will be met or

exceeded. Submit certification of guaranteed value of power factor and efficiency for full load, 3/4 full load, and 1/2 full load.

### 2.2.3 Frames and Brackets

Frames and end brackets shall be of cast iron, cast steel, or welded steel. The mounting ring, unless otherwise approved, shall be built integral with the frame or lower end bracket and arranged for direct mounting on the pump, or station floor, or as required by the installation conditions. Treatment against corrosion shall be as specified in paragraph GENERAL REQUIREMENTS.

#### 2.2.3.1 Stator Frame

The stator frame shall be rigid and sufficiently strong to support the weight of the upper bearing bracket load, the weight of the stator core and windings, and to sustain the operating torques without perceptible distortion. The stator frame, if not direct mounted on the pump, shall be supported on a motor base or drive pedestal which in turn will be supported on sole plates or other suitable structure installed in the concrete foundation constructed as part of the pumping station structure. The motor base or drive pedestal shall be provided with bolts and dowels for fastening to the sole plates or supporting structure for preserving the alignment.

#### 2.2.3.2 Supporting Bracket

The upper bracket supporting the thrust bearing and upper guide bearings shall have sufficient strength and rigidity to support the weight of the entire rotating element of the motor, together with the pump impeller and shaft, and the hydraulic thrust of the pump impeller.

#### 2.2.3.3 Overspeed Alternate

Each motor shall be designed to withstand indefinitely, without injury, the maximum overspeed to which the motor will be subjected when the pump to which it is connected is acting as a hydraulic turbine under the maximum head with the pump discharge pipe open.

#### 2.2.3.4 Antireverse Device Alternate

A self-actuated backstop device or antireversing ratchet, to prevent reverse rotation of the pump due to loss of power or failure of the electric prime mover, shall be installed as an integral part of the motor. Where indicated in the mechanical specification or drawings. The design of the device shall be submitted to and approved by the Contracting Officer. If the device requires a lubrication system, an oil reservoir independent of the one used for the thrust bearing and complete with visible oil level gauge and 120-volt a.c. rated high and low level contacts shall be provided. All electrical leads shall be terminated in the accessory terminal box specified in paragraph MOTOR TERMINALS AND BOXES. The lubricant for the antireverse device shall contain a corrosion inhibitor whose type and grade shall be shown on a special nameplate attached to the frame adjacent to the lubricating filling device.

#### 2.2.3.5 Eyebolts

Eyebolts, lugs, or other approved means shall be provided for assembling, dismantling, and removing the motor, if required, from above using an



overhead crane. All lifting devices required for use in conjunction with the crane shall be provided with the motor.

#### 2.2.4 Cores

The cores for the stators and rotors shall be built up of separately punched thin laminations of low-hysteresis loss, nonaging, annealed, electrical silicon steel, assembled under heavy pressure, and clamped in such a manner as to insure that the assembled core is tight at the top of the teeth of the laminated core. Laminations shall be properly insulated from each other. Only laminations free from burrs shall be used, and care shall be taken to remove all burrs or projecting laminations from the slots of the assembled cores. Cores shall be keyed, dovetailed, or otherwise secured to the shaft or frame in an approved manner. Treatment against corrosion shall be as specified in paragraph GENERAL REQUIREMENTS.

#### 2.2.5 Insulated Windings

All motors shall have a nonhygroscopic, sealed, fungus-resisting insulation of a type designed and constructed to withstand severe moisture conditions, and insofar as practicable, to operate after long periods of idleness without previous drying out. All windings and connections shall be of the sealed type as defined in NEMA MG 1 paragraph 1.27.2. Submit a detailed description of and specification for the manufacturing process, the materials and the insulating varnish or compound used in insulating the windings shall be submitted to the Contracting Officer for approval before manufacture of the motors is commenced. If, in the opinion of the Contracting Officer, the insulation proposed is not of the quality specified and if the methods of manufacture are not considered to be in accordance with best modern practice, the motors will not be accepted. Submit 6 copies of motor design curves and 6 copies of motor speed-torque curves, as specified. Insulated windings, unless otherwise approved, shall be completely assembled in the motor core before impregnating with the insulating compound. The compound shall consist of 100 percent solid resin.

- a. Impregnation of the windings with the insulating compound shall be by vacuum impregnation method followed by baking. The procedure shall be repeated as often as necessary to fill in and seal over the interstices of the winding, but in no case shall the number of dips and bakes be less than two dips and bakes when the vacuum method of impregnation is used. The completed stator shall be of a type that is capable of passing the submerged or sprayed water test, as applicable, required by NEMA MG 1 paragraph 20.49.
- b. Random wound coils may be used on motors supplied in NEMA frame size 445 TP and smaller. The components of the insulation system and the conductor insulation of the coils shall be Class F insulation with a 110 percent continuous overload factor as defined in NEMA MG 1 paragraph 1.66. After winding, the completely wound stator shall be encapsulated with an insulating resin as defined in NEMA MG 1 paragraph 1.27.1.
- c. Form wound coils shall be used on motors supplied in NEMA frames larger than 445 TP. The components of the insulation system and the coil insulation of the rectangular conductors shall conform to Class F insulation with a 110 percent continuous overload factor as defined in NEMA MG 1, paragraph 1.66. The completed stator windings and connections shall be of the sealed type as defined in NEMA MG 1 paragraph 1.27.2.

- d. Insulation to ground shall be processed on the coil. Slot tubes or cells are not acceptable. The insulation shall be of adequate thickness and breakdown strength throughout the length of the coil. Mica shall be used in the slot portion and shall be of adequate thickness to withstand the dielectric tests specified in paragraph FACTORY TESTS. Form wound coils shall be of such uniformity that the stator windings on motors of equal ratings shall be alike, in shape and size, and be interchangeable.
- e. Submit motor design (characteristic) curves or tabulated data (test or calculated), indicating the speed, power factor, efficiency, current, and kilowatt input, all plotted or tabulated against torque or percent load as abscissa. The base value shall be given whether ANSI or IEEE standard system is used. The maximum allowable reverse rotation speed for the motor shall also be provided.
- f. Submit pump and motor speed-torque curves for the pump starting operation. The motor speed-torque curves shall be plotted for the following values of voltage at the motor terminals: The output of the starter supplied at rated and 90 percent of rated motor voltage .
- g. Coils of all windings shall be fully braced so that vibration is virtually eliminated during repeated starts as required by the duty cycle specified as well as during normal operation. If a tied system is used it shall be such that no tie depends upon the integrity of any other tie within the system.

#### 2.2.6 Thermal Protection

For motors rated 500 hp or greater, resistance temperature detectors (two per phase) shall be provided in accordance with NEMA MG 1, paragraph 20.63. Detectors shall have a copper resistance element having a resistance of 10 ohms at 76 degrees F. Leads shall be terminated on the terminal blocks specified in paragraph MOTOR TERMINALS AND BOXES. For motors rated less than 500 hp, positive-temperature-coefficient thermistors (one per phase) shall be embedded in the windings. The thermistors with all necessary additional equipment, as required, shall open a normally closed contact when the critical temperature is reached. All outgoing wiring shall terminate on the terminal blocks specified in paragraph MOTOR TERMINALS AND BOXES.

#### 2.2.7 Winding Heaters

Heaters shall be wrapped around the winding end turns. They shall be designated for operation on 120 volts, 1-phase, 60 Hz, alternating current and of sufficient capacity or wattage that, when energized, they will hold the temperature of the motor windings approximately 10 degrees C above the ambient temperature. They shall be designed for continuous operation and to withstand at least 10 percent overvoltage continuously. The rate of heat dissipation shall be uniform throughout the effective length of the heater. Heaters installed around the winding end turns shall consist of the required turns of heating cable wrapped around the end turns and secured in place before the winding is impregnated.

##### 2.2.7.1 Heating Element

Heating element shall conform to the requirements of ASTM B344 for an 80 percent nickel and 20 percent chromium alloy.

#### 2.2.7.2 Sheath

Sheath shall be of a corrosion-resisting, nonoxidizing metal and shall have a wall thickness not less than 0.025 inch.

#### 2.2.7.3 Insulation

Insulation shall be a granular mineral refractory material, highly resistant to heat, and shall have a minimum specific resistance of 1,000 megohms per inch cubed at 1,000 degrees F. Insulation for the heating cable (winding wraparound type) type heaters shall be suitable for a conductor temperature of 356 degrees F.

#### 2.2.7.4 Terminals

Terminals of the heater, including the leads, shall be watertight and shall be provided with leads suitable for making connections to the drip-proof terminal box provided in paragraph MOTOR TERMINALS AND BOXES. The terminal box shall be readily accessible through the crating so that winding heaters can be energized while motors are in storage.

#### 2.2.8 Shafts

Shafts shall be made of high grade steel, finished all over, and of ample size to drive the pumps under maximum load conditions. Shafts shall be of solid types as required by the pump manufacturer. See paragraph GENERAL REQUIREMENTS for treatment against corrosion.

#### 2.2.9 Bearings

##### 2.2.9.1 Loading

Bearings shall be capable of withstanding all stresses incidental to the normal operation of the unit .

##### 2.2.9.2 Thrust Bearings

Thrust bearings shall be of the antifriction type of either the ball or roller type. Tandem or series bearing assemblies shall not be used. Antifriction bearings shall conform to the requirements of ABMA 9 and ABMA 11.

##### 2.2.9.3 Guide Bearings

Guide bearings shall be of the sleeve or antifriction type of either the ball or roller type or a combination of sleeve and antifriction bearings.

##### 2.2.9.4 Lubrication

Bearings shall be either oil or grease lubricated and the lubricant used shall contain a corrosion inhibitor. Type and grade of lubricant used shall be shown on a special nameplate which shall be attached to the frame of the motor adjacent to the bearing lubricant filling device. In addition to the quantity of lubricant required to fill the system initially, spare lubricant shall be provided in sufficient quantity to purge and refill the system.

#### 2.2.9.5 Housings

Bearing housings shall be of a design and method of assembly that will permit ready removal of the bearings, prevent escape of lubricant and entrance of foreign matter, and protected by the lubricant when the motor is idle. Except for prelubricated antifriction bearings of an approved type, suitable means shall be provided to apply and drain the lubricant. Oil-lubricated bearing housings shall be provided with oil-level indicator gauges that will be readily visible.

#### 2.2.9.6 Cooling

All bearings shall be self-cooling unless otherwise specifically approved by the Contracting Officer. If the use of cooling is approved, the means employed shall, unless otherwise approved by the Contracting Officer, require no auxiliary pumping equipment; and suitable means shall be provided to indicate the bearing temperature, actuate an alarm when the bearing temperature is above normal, and actuate a device to shut down the motor when the maximum safe operating temperature of the bearing is reached. Cooling coils shall be of copper tubing and designed for the operating pressure used to circulate the cooling water.

#### 2.2.9.7 Rating

Antifriction bearings shall be rated on the basis of a minimum life factor of 8,800 hours, based on the life expectancy of 90 percent of the group, unless otherwise approved by the Contracting Officer.

#### 2.2.9.8 Shaft Currents

Bearings shall be insulated or otherwise protected against the damaging effects of shaft currents.

### 2.3 SURGE PROTECTION

#### 2.3.1 Surge Capacitors

A three-pole capacitor unit, equipped with built-in discharge resistors and using a non-polychlorinated biphenyl (PCB) insulating medium, shall be provided in the main terminal box. Each pole shall be rated 1.0 microfarad and 650 volts line-to-line. Removable bus links shall be provided for motor testing. These links shall be treated to resist corrosion, shall be designed to maintain a positive contact, and shall have low contact resistance.

#### 2.3.2 Surge Arresters

Surge arresters of the station type with porcelain tops shall be provided in the main terminal box. The arresters shall be of the metal-oxide type rated 3,000 volts maximum continuous operating voltage (MCOV) line-to-ground. Removable bus links shall be provided for motor testing. These links shall be treated to resist corrosion, shall be designed to maintain a positive contact, and shall have low contact resistance.

#### 2.3.3 Space Heater

If recommended by the surge protection manufacturer, a space heater of adequate capacity and rated 120 volts shall be provided. Space heaters shall have a maximum watt density of 20 watts per square inch.

## 2.4 MOTOR TERMINALS AND BOXES

### 2.4.1 Stator Terminal Box

Drip-proof cast iron or steel conduit terminal boxes, treated as specified for frames in paragraph GENERAL REQUIREMENTS, shall be supplied for housing the stator lead connections surge capacitors and shall have adequate space to facilitate the installation and maintenance of cables and equipment. Boxes shall have a hinged securable cover providing unrestricted access, be mounted on the motor frame, and shall have an auxiliary floor supporting structure, when required, supplied by the motor manufacturer. Conduit entrance shall be from the bottom. The boxes shall be designed to permit removal of motor supply leads when the motor is removed. A "HIGH VOLTAGE - 480 VOLTS" warning sign shall be provided on the cover of the box.

### 2.4.2 Stator Terminals

Insulated terminal leads shall receive a treatment equal to that of the motor winding. Leads shall be brought out of the stator frame and shall be provided with terminal lugs for connection to the motor supply wiring.

### 2.4.3 Grounding

A ground bus and means for external connection to the station grounding system shall be provided in the stator terminal box when surge protection is provided.

### 2.4.4 Accessory Leads and Boxes

Terminal leads for motor winding space heaters, , thermistors and any other auxiliary equipment shall be brought into conveniently located terminal boxes provided with terminal blocks for extension by others. The terminal boxes shall be drip-proof and treated as specified for frames in paragraph GENERAL REQUIREMENTS. All auxiliary wiring shall be stranded copper conductors with 600-volt flame-retardant insulation, except temperature detector leads may be in accordance with the manufacturer's standard practice. All wiring and terminals shall be properly identified.

## 2.5 WRENCHES, TOOLS, AND SPECIAL EQUIPMENT

Provide all nonstandard and special equipment required for dismantling, reassembly, and general maintenance of the motor units. Provide one complete set of lifting attachments such as detachable eyebolts or special slings for handling various parts with a hoist.

## 2.6 FACTORY TESTS

One motor of each rating type, selected at random by the Contracting Officer, shall be given a complete test. The remainder of the motors shall be given a check test.

- a. Submit 6 copies of test reports recording all data obtained during the tests specified to the Contracting Officer for each motor used. Test reports shall include performance curves indicating the results of subparagraph COMPLETE TEST below.
- b. Submit 6 certified copies of the results of a "Complete Test" for duplicate equipment. It will be accepted in lieu of the "Complete

Test" as specified in subparagraph COMPLETE TEST below for equipment of the respective rating and type.

- c. No substitute will be accepted for the "Check Test." The base value shall be given whether ANSI or IEEE standard system is used. All complete tests shall be witnessed by the Contracting Officer .

#### 2.6.1 Complete Test

A complete test of a motor shall include the following:

##### 2.6.1.1 Excitation Test

Including a plot of volts as abscissa versus amperes and watts as ordinates.

##### 2.6.1.2 Impedance Test

Including a plot of volts as abscissa versus amperes and watts as ordinates.

##### 2.6.1.3 Performance Test

Including a plot of torque or percent load as abscissa versus efficiency, power factor, amperes, watts, and RPM or percent slip as ordinates.

##### 2.6.1.4 Speed-Torque Test

Prony brake or other equivalent method. Including a plot of torque in foot-pounds as abscissa versus speed in RPM as ordinate.

##### 2.6.1.5 Temperature Test

Made on completion of paragraph c above. (If screens are provided over openings, test will be made with screens removed and by thermometer).

##### 2.6.1.6 Insulation Resistance-Temperature Test

Shall be taken following heat run, readings being taken at approximately 10 degrees C intervals. Temperature shall be determined by the resistance method. Test result values shall be plotted on semilogarithmic graphs, the insulation resistance values as logarithmic ordinates and the temperature values as uniform abscissas. For comparison purposes, a curve indicating the safe operating value of insulation resistance shall be plotted on the same sheet with the insulation resistance-temperature test curve.

##### 2.6.1.7 Cold and Hot Resistance Measurement

##### 2.6.1.8 Dielectric Test

##### 2.6.1.9 Vibration Measurement

In accordance with NEMA MG 1 paragraph 20.54.

##### 2.6.1.10 Conformance Tests

In accordance with NEMA MG 1 paragraph 20.47.

#### 2.6.2 Check Test

A check test of a motor shall include the following:

2.6.2.1 Routine Test

Test in accordance with NEMA MG 1 paragraph 12.51 or NEMA MG 1 paragraph 20.47.

2.6.2.2 Cold Resistance Measurement

2.6.2.3 Insulation Resistance and Winding Temperature

Insulation resistance and winding temperature at time the insulation resistance was measured.

2.6.2.4 Conformance Test

In accordance with NEMA MG 1 paragraph 20.47.

2.6.2.5 Vibration

Vibration measurement in accordance with NEMA MG 1 paragraph 12.07 or NEMA MG 1 paragraph 20.54.

2.6.3 Form Wound Coil Test

All form wound coils, either before or after they are placed in the slots, shall be tested for short circuits between turns of the individual coils by applying a high frequency voltage of not less than 75 percent of the voltage for which the machine is insulated, or by applying a surge test voltage of equivalent value to the terminals of each coil. Equivalent surge voltage shall be a wave whose peak value is equal to 1.06 times the voltage for which the motor is insulated.

2.6.4 Winding Space Heater Test

Each winding space heater unit shall be tested at the factory for successful operation and dielectric strength.

PART 3 EXECUTION

NOT USED

... -- End of Section --

SECTION 27 21 10.00

FIBER OPTIC DATA TRANSMISSION SYSTEM

11/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

ANSI/TIA-455-80C (2003) FOTP-80 - IEC 60793-1-144 Optical fibres Part 1-44: Measurement Methods and Test Procedures - Cut-off Wavelength

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-13 (1996a; R 2012) FOTP-13 Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies

TIA-455-78-B (2020c) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation

TIA-455-82 (2020c) FOTP-82 Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable

TIA-455-91 (1986; R 1996) FOTP-91 Fiber Optic Cable Twist-Bend Test

TIA-455-104 (2016b) Standard for FOTP-104 Fiber Optic Cable Cyclic Flexing Test



TIA-455-177	(2020c) FOTP-177 IEC-60793-1-43: Measurement Methods and Test Procedures - Numerical Aperture
TIA-606	(2017c) Administration Standard for the Telecommunications Cabling Infrastructure
TIA/EIA-455-25	(2016d) FOTP-25 Impact Testing of Optical Fiber Cables
TIA/EIA-455-41	(1993a; R 2013) FOTP-41 Compressive Loading Resistance of Fiber Optic Cables
TIA/EIA-455-81	(2000b) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
TIA/EIA-455-88	(2001) FOTP-88 Fiber Optic Cable Bend Test
TIA/EIA-455-171	(2001a) FOTP-171 - Attenuation by Substitution Measurement for Short-Length Multimode Graded-Index and Single-Mode Optical Fiber Cable Assemblies

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices
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UNDERWRITERS LABORATORIES (UL)

UL 1666	(2007; Reprint Jun 2012) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
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1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

SD-03 Product Data

Spare Parts

Enclosures

SD-06 Test Reports

Test Procedures and Reports

Power Attenuation Test

Optical Time Domain Reflectometer Tests

SD-07 Certificates

Optic Cable Assemblies

Labeling Format

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

Manufacturer's Recommendations

SD-10 Operation and Maintenance Data

Operating Instructions

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

#### 1.3.1 Spare Parts

Submit spare parts data for each different item of material and equipment specified and furnished, after approval of detail drawings not later than 3 months prior to the date of beneficial occupancy. Include a list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide a fiber optics (FO) data transmission system (DTS). The data transmission system consists of FO transmission media, transmitter and receiver modules, modems, transceiver modules, repeaters, cable and power line surge protection, terminal devices (such as connectors, patch panels and breakout boxes) and power supplies for operating active components. Interconnect the data transmission system system components as shown. Certify that computing devices comply with the requirements for Class A computing devices and are labeled as set forth in 47 CFR 15.

#### 2.1.1 Environmental Requirements

Rate equipment and cable used indoors for continuous operation under ambient environmental conditions of 32 to 122 degrees F dry bulb and 10 to 95 percent relative humidity, non-condensing. Rate equipment and cables for continuous outdoor operation under ambient environmental conditions of minus 40 to plus 166 and humidity of up to 100 percent condensing or as normally encountered for the installed location. Rate all equipment and cable for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally

encountered for the installed location. Install cables in ducts, plenums, and other air-handling spaces per NFPA 70. Ensure cables installed in plenums are plenum-rated cables listed for the use. Ensure cables installed in risers are riser-rated cables listed for the use, unless the installed cable is identified as a permitted substitution for the required riser-rated cable type.

#### 2.1.2 Hazardous Environment

Rate the system components and wiring located in areas where fire or explosion hazards may exist with the proper Classes, Divisions, and Groups. Also rate the components and wiring for the operating temperatures. Install according to Chapter 5 of NFPA 70 and as shown.

#### 2.1.3 Electrical Requirements

Operate the equipment from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

#### 2.1.4 Input Line Surge Protection

Protect inputs and outputs against surges induced on wiring and cables including wiring and cables installed outdoors. For components requiring protection, select surge protection devices based on voltages and current ratings of components to be protected. Protect communications equipment against surges induced on any communications circuit. Install surge protection circuits at each end of cables and conductors (except non-conductive FO cables which serve as communications circuits from consoles to field equipment and between field equipment). Furnish protection at equipment. Install additional triple electrode gas surge protectors rated for the application on each conductive wire line and coaxial circuit within 3-feet of the building cable entrance. Do not use fuses for surge protection. Test the inputs and outputs in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

#### 2.1.5 Power Line Surge Protection

Protect equipment connected to AC circuits from power line surges. Select surge protection devices based on voltages and current ratings of components to be protected. Provide equipment that meets the requirements of IEEE C62.41.1 and IEEE C62.41.2. Do not use fuses for surge protection.

### 2.2 COMPONENTS

#### 2.2.1 Enclosures

Ensure enclosures conform to the requirements of NEMA 250 for the types specified. Use the manufacturer's standard finish color, unless otherwise indicated. Repair and refinish damaged surfaces using original type finish.

##### 2.2.1.1 Exterior

Ensure enclosures installed outdoors meet the requirements of NEMA 250 Type

4X unless otherwise specified or shown. Enclosures shall be lockable.

## 2.2.2 Optical Fibers

### 2.2.2.1 General

Coat optical fibers with a suitable material to preserve the intrinsic strength of the glass. The outside diameter of the glass-cladded fiber is nominally 125 microns, and concentric with the fiber core. Ensure optical fibers meet TIA-455-78-B, and TIA-455-177.

### 2.2.2.2 8.3 Micron Single-Mode Fibers

Use conductors that are single-mode, solid glass waveguides with a nominal core diameter of 8.3 microns. Ensure the fiber has a transmission windows centered at 1310 and 1550 nanometer wavelengths with a numerical aperture minimum of 0.10. The attenuation for inside cable at 1310 and 1550 nanometers is 1.0 dB/Km or less. The attenuation for outside cable at 1310 and 1550 nanometers is 0.5 dB/Km or less. Certify the fibers to meet ANSI/TIA-455-80C.

### 2.2.3 Cross-Connects

#### 2.2.3.1 Patch Panels

Install patch panels as a complete system of components by a single manufacturer; provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Ensure patch panel connectors and couplers are the same type and configuration as used elsewhere in the system. Patch panels are panel or DIN rail mounted.

#### 2.2.3.2 Patch Cords

Provide patch cord cable assemblies consisting of factory connector-terminated flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber is the same type as used elsewhere in the system. Install patch cords as complete assemblies from manufacturer's standard products.

## 2.3 SYSTEM REQUIREMENTS

### 2.3.1 Signal Transmission Code Format

Ensure FO equipment uses the same transmission code format from the beginning of a circuit to the end of that circuit. Different transmission code formats may be used for different circuits as required to interconnect supported equipment.

### 2.3.2 Flux Budget/Gain Margin

Provide FO links with a minimum gain margin of 6 dB. The flux budget is the difference between the transmitter output power and the receiver input power required for signal discrimination when both are expressed in dBm. Ensure the flux budget is equal to the sum of losses (such as insertion losses, connector and splice losses, and transmission losses) plus the gain margin. When a repeater or other signal regenerating device is inserted to extend the length of an FO circuit, both the circuit between the transmitter and the repeater-receiver, and the circuit between the repeater-transmitter and the receiver are considered independent FO links

for gain margin calculations.

### 2.3.3 Receiver Dynamic Range

Ensure the dynamic range of receivers is large enough to accommodate both the worst-case, minimum receiver flux density, and the maximum possible receiver flux density, with a range of at least 15 dB. Where required, use optical attenuators to force the FO link power to fall within the receiver dynamic range.

## 2.4 ACCESSORIES

### 2.4.1 FO Connectors

Use field installable, self-aligning and centering FO connectors. Match FO connectors with the fiber core and cladding diameters. Provide FO cable connectors at field equipment of the type to match the field equipment connectors. Provide FO connectors at terminal head end equipment of the type to match terminal head equipment connectors. Connector insertion loss is nominally 0.3 dB and maximum loss less than 0.7 dB.

### 2.4.2 Mechanical Splices

Mechanical splices are suitable for installation in the field. External power sources are not required to complete a mechanical splice. Use self-aligning mechanical splices for optimum signal coupling. Do not use mechanical splices for exterior applications where they may be buried underground or laced to aerial messenger cables. Mechanical splices may be used for interior locations and within enclosures. Protect the spliced fibers from moisture and prevent physical damage with splice closures. Use the splice closure to provide strain relief for the cable and the fibers at the splice points.

### 2.4.3 Fusion Splices

Use a portable, fully automatic, and compact fusion splicer, suitable for fusion splicing all types of telecommunication grade optical fibers and individual fibers as well as cables containing multiple optical fibers. Ensure the fusion splicer is capable of operation under various environmental conditions (e.g., temperature, humidity, altitude, etc.) for all types of optical cable deployments. Start the automatic splicing process by pressing one button and can be interrupted at any time. Alternatively, make available semi-automatic (step-by-step) or manual splicing by menu selection. Conduct communication with the fusion splicer through a language unspecific keyboard with universal symbols and display the dialogue with the splicer on the device screen.

### 2.4.4 Conduit, Fittings And Enclosures

Ensure conduit, fittings, and enclosures are as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, and as shown.

### 2.4.5 Fan-Out Kits

For all loose-tube optical fibers, furnish and install fan-out kits using furcating tubes for connectorization. Incorporate strain relief for loose-tube optical fiber furcating tubes if the connectorization is not contained within a protective enclosure such as a patch panel. For tight-buffered optical fibers, furnish and install fan-out kits using

furcating tubes and which incorporate strain relief, if the connectorization is not contained within a protective enclosure such as a patch panel. Furcating tubes required to incorporate strain relief also provide increased pullout protection. Tubes are comprised of an inner tube, surrounded by a layer of nonconductive strength members, then surrounded by an enclosing outer jacket layer. Color code fan-out kits to match the industry fiber color scheme. Length of furcating tube is 24 inches minimum when installation is complete. Rate fan-out kits for the ambient conditions of the location as specified in paragraph ENVIRONMENTAL REQUIREMENTS. Provide terminations for each fiber, regardless whether fiber is active or spare.

## 2.5 CABLE CONSTRUCTION

### 2.5.1 General

Ensure the cable contains a minimum of two FO fibers for each link circuit. The number of fibers in each cable is 24. Protect each fiber by a protective tube. Ensure cables have a jacketed strength member, and an exterior jacket. Ensure cable and fiber protective covering are free from holes, splits, blisters, and other imperfections. Insulation and jacketing material for interior cables cannot contain any polyvinyl chloride (PVC) compounds. Use a covering that is flame retardant, moisture resistant, non-nutrient to fungus, ultraviolet light resistant as specified, and nontoxic. Do not transmit mechanical stress present in cable to the optical fibers. Ensure strength members are non-metallic and an integral part of the cable construction. Ensure the combined strength of all the strength members is sufficient to support the stress of installation and to protect the cable in service. For exterior cables, select a minimum storage temperature range of minus 104 to plus 167 degrees F. A minimum storage temperature of plus 14 to plus 167 degrees F is required for interior cables. Ensure all optical fiber cables and all optical fiber raceways furnished meet the requirement of NFPA 70. Apply a flooding compound into the interior of the fiber tubes, into the interstitial spaces between the tubes, to the core covering, and between the core covering and jacket of all cable to be installed aerially, underground, and in locations susceptible to moisture. Ensure flooded cables comply with TIA/EIA-455-81 and TIA-455-82. Provide cables from the same manufacturer, of the same cable type, of the same size, and of the same optical characteristics. Ensure each fiber and protective coverings is continuous with no factory splices. Certify by the manufacturer, optic cable assemblies, including jacketing and fibers, to have a minimum life of 30 years. Ensure cables meet UL 1666. Certify FO cable to meet the following: TIA-455-13, TIA/EIA-455-25, TIA/EIA-455-41, TIA-455-177, TIA-455-78-B, TIA/EIA-455-88, TIA-455-91, TIA-455-104, and TIA/EIA-455-171.

### 2.5.2 Exterior Cable

#### 2.5.2.1 Duct Cable

Surround the optical fibers by a tube buffer, contained in a channel or otherwise loosely packaged to provide clearance between the fibers and inside of the container, and extruded from a material having a coefficient of friction sufficiently low to allow the fiber free movement. Select cable with the following characteristics:

- a. Cable outer jacket: Medium density polyethylene material with orange pigment added for ease of identification.

- b. Tensile strength: Withstand an installation tensile load of not less than 608 pounds and not less than 135 pounds continuous tensile load.
- c. Impact and Crush resistance: Withstand an impact of 1.7 lbs/in as a minimum, and have a crush resistance of 317 psi as a minimum.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install system components and appurtenances in accordance with the manufacturer's instructions and as shown. Provide interconnections, services, and adjustments required for a complete and operable data transmission system.

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations of the material being installed, submit printed copies of these recommendations prior to installation. Installation of the item is not allowed to proceed until the recommendations are received and approved.

##### 3.1.1 Interior Work

Install conduits, tubing and cable trays for interior FO cable as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and as shown. Ensure cable installation and applications meet the requirements of NFPA 70, Article 770. Properly support and secure cables not installed in conduits or wireways. If installed in plenums or other spaces used for environmental air, comply with NFPA 70 requirements for this type of installation.

##### 3.1.2 Exterior Work Underground

Except as otherwise specified, install conduits, ducts, and manholes for underground FO cable systems as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION and as shown.

- a. Minimum burial depth for cable is 30-inches, but not less than the depth of the frost line. Burial depth specified takes precedence over any requirements specified elsewhere.
- b. Where direct burial cable passes under sidewalks, roads, or other paved areas, place the cable in a 1-inch zinc-coated rigid conduit or larger as required to limit conduit fill to 80 percent or less.
- c. Place buried cables below a plastic warning tape buried in the same trench or slot. Place the warning tape 12-inches above the cable. Continuously imprint the warning tape with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48-inch intervals. Use warning tape that is acid and alkali resistant polyethylene film, 3-inches wide with a minimum thickness of 0.004-inch, with a minimum strength of 1750 psi lengthwise and 1500 psi crosswise.
- d. Transitions from underground cable to aerial cable are as shown.
- e. For cables installed in ducts and conduit, use a cable lubricant compatible with the cable sheathing material on all cables pulled. Attach pulling fixtures to the cable strength members. If indirect attachments are used, match the grip diameter and length to the cable

diameter and characteristics. If an indirect attachment is used on cables having only central strength members, reduce the pulling forces to ensure that the fibers are not damaged from forces being transmitted to the strength member. During pulling, continuously monitor the cable pull line tension using dynamometers or load-cell instruments. Do not exceed the maximum tension specified by the cable manufacturer. Ensure the mechanical stress placed upon the cable during installation is such that the cable is not twisted or stretched. Use a cable feeder guide between the cable reel and the face of the duct or conduit to protect the cable and guide it into the duct or conduit as it is un-spoiled from the reel. As the cable is un-spoiled from the reel, inspect it for jacket defects or damage. Do not kink or crush the cable. Do not exceed the minimum bend radius of the cable during installation. Hand feed and guide cable through each manhole and apply additional lubricant at all intermediate manholes. When practicable, use the center pulling technique to lower pulling tension. That is, pull the cable from the center point of the cable run towards the end termination points. The method may require the cable to be pulled in successive pulls. If the cable is pulled out of a junction box or manhole, protect the cable from dirt and moisture by laying the cable on a ground covering.

### 3.1.1.3 Service Loops

Ensure each FO cable has service loops of not less than 30 ft for every 1000-1200 ft of cable with at least 50 ft slack loop at Comm. HH E2612 for possible future use. House the service loops in a service loop enclosure.

### 3.1.1.4 Splices

#### 3.1.1.4.1 General

No splices are permitted unless the length of cable being installed exceeds the maximum standard cable length available from a manufacturer or unless FO pigtailed are used to connect transmitters, receivers, or other system components for terminations to the fiber. Make splices using the method recommended by the cable manufacturer. Place splices in a splice enclosure and encapsulate with an epoxy, ultraviolet light cured splice encapsulant or otherwise protected against infiltration of moisture or contaminants. Field test FO splices at the time of splicing. Ensure fusion splices have a nominal splice loss of 0.15 dB for multimode and for single mode cable fusion splices and a maximum fusion splice loss not more than 0.3 dB loss.

#### 3.1.1.4.2 Mechanical Splices

Install mechanical splices with a nominal splice loss of 0.15 dB for multimode fiber mechanical splices and 0.2 dB for single mode fiber mechanical splices with a maximum mechanical splice loss not more than 0.3 dB loss for multimode and single mode fiber mechanical splices. Install no more than 1 splice per 0.62 mile in any of the FO cables excluding terminations. Locate field splices in cable boxes. Provide sufficient cable in each splicing location to properly rack and splice the cables, and to provide extra cable for additional splices. Protect cable ends with end caps except during actual splicing. During the splicing operations, provide means to protect the unspliced portions of the cable and its fibers from the intrusion of moisture and other foreign matter.



### 3.1.5 Connectors

Prior to and during installation of connectors, perform appropriate cleaning to ensure that any contaminant particulates larger than 0.06 micron in size are removed. Connectors are as specified in paragraph FO CONNECTORS. Connectors or splices which leave residue on the connector ferrule or optical connector "lens", are not permitted. Ensure fibers at each end of the cable have jumpers or pigtails installed of not less than 3 feet in length. For fibers at both ends of the cable, have connectors installed on the jumpers. Ensure the mated connector pair loss does not exceed 0.7 dB. The pull strength between the connector and the attached fiber cannot be less than 50 pounds.

### 3.1.6 Identification and Labeling

Provide identification tags or labels for each cable. For markers, tags and labels, use indelible ink or etching which does not fade in sunlight, or in buried or underground applications. Use markers, tags, and labels that do not become brittle or deteriorate for a period of 20 years due to moisture, sunlight, soil minerals, chemicals or other environmental elements. Label all termination blocks and panels with cable number or pair identifier for cables in accordance with TIA-606 and as specified on drawings. Identify the labeling format and provide a complete record to the Government with the final documentation. Identify each cable with type of signal being carried and termination points.

### 3.1.7 Enclosure Sizing and Cable

Size termination enclosures to accommodate the FO equipment to be installed. Sizing includes sufficient space for service loops to be provided and to accommodate a neat layout of equipment and the bend radii of fibers and cables terminated inside the enclosure.

### 3.1.8 Enclosure Penetrations

Install enclosure penetrations from the bottom. Seal penetrations with rubber silicone sealant to preclude the entry of water. Internally seal conduits rising from underground.

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 General

Provide personnel, equipment, instrumentation, and supplies necessary to perform testing.

### 3.2.2 Field Test

Verify the complete operation of the data transmission system in conjunction with field testing associated with systems supported by the fiber optic data transmission system as specified in Section 40 60 00 prior to formal acceptance testing. Include a flux density test in field tests. Perform these tests on each link and repeated from the opposite end of each link.

#### 3.2.2.1 Optical Time Domain Reflectometer Tests

Perform optical time domain reflectometer tests using the FO test procedures of TIA-455-78-B. Perform an optical time domain reflectometer

test on all fibers of the FO cable on the reel prior to installation. Calibrate the optical time domain reflectometer to show anomalies of 0.2 dB as a minimum. Furnish photographs of the traces to the Government. Perform an optical time domain reflectometer test on all fibers of the FO cable after it is installed. Calibrate the optical time domain reflectometer to show anomalies of 0.2 dB as a minimum. If the optical time domain reflectometer test results show anomalies greater than 1 dB, the FO cable segment is unacceptable to the Government. Replace the unsatisfactory segments of cable with a new segment of cable. Then test the new segment of cable to demonstrate acceptability. Furnish photographs of the traces to the Government for each link.

#### 3.2.2.2 Power Attenuation Test

Perform power attenuation test at each light wavelength of the transmitter to be used on the circuit being tested. Measure the flux at the FO receiver end and compare to the flux injected at the transmitter end. Add a jumper at each end of the circuit under test so that end connector loss is validated. Rotational optimization of the connectors is not permitted. If the circuit loss exceeds the calculated circuit loss by more than 2 dB, the circuit is unsatisfactory. Examine the circuit to determine the problem. Notify the Government of the problem and propose procedures to eliminate the problem. Prepare and submit a report documenting the results of the test.

#### 3.2.2.3 Gain Margin Test

Test and verify that each circuit has a gain margin which exceeds the circuit loss by at least the minimum gain margin specified in paragraph FLUX BUDGET/GAIN MARGIN.

#### 3.2.2.4 Performance Verification Test and Endurance Test

Test the FO data transmission system as a part of the completed Process Control System during the Performance Verification Test and Endurance Test.

### 3.3 CLOSEOUT ACTIVITIES

#### 3.3.1 Delivery of Technical Data

Delivery computer software and technical data (including technical data which relates to computer software), which are specifically identified in this specification strictly in accordance with the CONTRACT CLAUSES, SPECIAL CONTRACT REQUIREMENTS, and in accordance with the Contract Data Requirements List (CDRL), DD Form 1423, which is attached to and thereby made a part of this contract. Identify by reference all data delivered to the particular specification paragraph against which it is furnished. If the data transmission system (DTS) is being installed in conjunction with another system such as an intrusion detection system, electronic SECURITY system, closed circuit television system, or utility monitoring and control system, submit the Technical Data Packages as part of the Technical Data Package for Section 40 60 00; submit two hard copies and two electronic copies (DC-ROM or DVD-R) of the Technical Data Package(s).

##### 3.3.1.1 Group I Technical Data Package

##### 3.3.1.1.1 System Drawings

Include the following information:

- a. Communications system block diagram.
- b. FO receivers, transmitters, transceivers, multiplexers, and FO modem installation, block diagrams, and wiring and cabling diagrams.
- c. FO receivers, transmitters, transceivers, multiplexers, and FO modem physical layout and schematics.
- d. Details of interfaces with other systems.
- e. Details of connections to power sources, including grounding.
- f. Details of surge protection device installations.
- g. Details of cable splicing and connector installations.
- h. Details of aerial cable and messenger installation on poles, cable entrance to buildings, and termination inside enclosures.
- i. Details of underground cable and duct installation, cable entrance into buildings, and terminations inside enclosures.

Show on the drawings the proposed layout and anchorage of equipment, appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations. Show the proposed configuration on the drawings, including location, type and termination of both interior and exterior FO and showing the location, duct and inner duct arrangement, and fiber assignment. Show the ac power consumption and heat dissipation under both normal and maximum operating conditions.

#### 3.3.1.1.2 Equipment Data

Deliver a complete data package for all material, including field and system equipment.

#### 3.3.1.1.3 Data Transmission System Description and Analyses

Include in the data package a complete system description, and analyses and calculations used in sizing equipment required by these specifications. Descriptions and calculations show how the equipment operates as a system to meet the specified performance. The data package includes the following:

- a. FO receivers, transmitters, transceivers, multiplexers, FO modem transmit and receive levels, and losses in decibels (dB) on each communication link.
- b. Digital transmitter and receiver communication speed and protocol description.
- c. Analog signal transmission method and bandwidth of the transmitter and receiver.
- d. Data transmission system expansion capability and method of implementation.
- e. FO system signal-to-noise ratio calculation for each communication link.
- f. Flux-budget and gain margin calculation for each communication link.

#### 3.3.1.1.4 System Overall Reliability Calculations

The data package includes manufacturers' reliability data and calculations required to show compliance with the specified reliability. Base the calculations on the configuration specified in Section 40 60 00, and as shown on drawings.

#### 3.3.1.1.5 Certifications

Include the specified manufacturers' certifications with the data package.

#### 3.3.1.1.6 Key Control Plan

#### 3.3.1.2 Group II Technical Data Package

The Group II technical data package is specified in Section 40 60 00.

#### 3.3.1.3 Group III Technical Data Package

Prepare test procedures and reports for the factory test in accordance with Section 40 60 00 and this specification. The test procedures describe the applicable tests to be performed, and other pertinent information such as specialized test equipment required, length of test, and location of the test. The procedures explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements of this specification, and the methods for simulating the necessary conditions of operation to demonstrate performance of the system. The test report describes the results of testing to include the date, time, location and system component designations of material and equipment tested. Record testing action whether successful or not. Describe reasons for termination of testing. Include testing work sheets, printouts, strip charts, oscilloscope or optical time domain reflectometer (OTDR) printouts/photographs, raw and analyzed data, and testing conclusions in the report. Deliver the factory test procedures to the Government for approval. After receiving written approval of the test procedures, schedule the factory test. Provide written notice of the test to the Government at least 2 weeks prior to the scheduled start. Deliver the final test reports in booklet form within 15 days after completion of the test.

#### 3.3.1.4 Group IV Technical Data Package

##### 3.3.1.4.1 Performance Verification and Endurance Testing Data

Prepare procedures and reports for the performance verification test and endurance test. Prepare test procedures in accordance with Section 40 60 00 and this specification. Perform testing on an installed system as approved by the Government. Where required and approved by the Government, simulate conditions of operation to demonstrate the performance of the system. The test plan describes the applicable tests to be performed, other pertinent information such as specialized test equipment required, length of performance verification test and endurance test, and location of the performance verification test and endurance test. The procedures explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements of this specification, and the methods for simulating the necessary conditions of operation to demonstrate performance of the system. The test report describes the results of testing to include the date, time, location and system component designations of material and

equipment tested. Record testing action whether successful or not. Record reasons for termination of testing for any reason in the report. Include testing work sheets, printouts, strip charts, oscilloscope or OTDR printouts/photographs, raw data, analyzed data and testing conclusions in the report. Deliver the performance verification test and endurance test procedures to the Government for review and approval. After receipt of written approval of test procedures, schedule the performance verification and endurance tests. Provide written notice of the performance verification test and the endurance test to the Government at least 2 weeks prior to the scheduled start of the test. Deliver the final performance test and endurance test report 30 days after completion of testing.

#### 3.3.1.4.2 Operation and Maintenance Data

Deliver a draft copy of the operation and maintenance data, in manual format, as specified for the Group V technical data package, to the Government prior to beginning the performance verification test for use during site testing.

#### 3.3.1.4.3 Training Data

Deliver lesson plans and training manuals, including the type of training provided, with a list of reference material for approval by the Government prior to starting any training.

#### 3.3.1.5 Group V Technical Data Package

The Group V package consists of the operation and maintenance data, in manual format. Deliver final copies of the manuals bound in hardback, loose-leaf binders, and electronic format to the Government within 30 days after completing the endurance test. Update the draft copy used during site testing with any changes required prior to final delivery of the manuals. Identify each manual's contents on the cover. Include with the manuals, the names, addresses, and telephone numbers of each subcontractor installing the equipment and systems, and of the nearest service representative for each item of equipment and each system. Ensure the manuals have a table of contents and tab sheets. Place tab sheets at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test include all modifications made during installation, checkout, and acceptance. Ensure the delivered manuals include:

- a. Functional Design Manual: two copies 1 hard copies 1 CD-ROM(s).
- b. Hardware Manual: two copies 1 hard copies 1 CD-ROM(s).
- c. Maintenance Manuals: two copies. 1 hard copies 1 CD-ROM(s).
- d. Operator's Manual: six copies 5 hard copies 1 CD-ROM(s).

#### 3.3.1.5.1 Functional Design Manual

The functional design manual identifies the operational requirements for the data transmission system and explain the theory of operation, design philosophy, and specific functions. Include a description of hardware functions, interfaces, and requirements for all system operating modes.

#### 3.3.1.5.2 Hardware Manual

Furnish a manual describing all equipment and devices specified and under PART 2 PRODUCTS. Include the following information:

- a. General description and specifications.
- b. Installation and checkout procedures.
- c. Equipment electrical schematics and layout drawings.
- d. Data transmission systems schematics.
- e. Alignment and calibration procedures.
- f. Manufacturer's repair parts list indicating sources of supply.
- g. Interface definition.

#### 3.3.1.5.3 Maintenance Manual

Include the maintenance descriptions for all equipment including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

#### 3.3.1.5.4 Operator's Manual

Ensure the operator's manual fully explains procedures and instructions for operation of the system. This includes an operator's manual for any FO systems in which system operators control any function of the system.

#### 3.3.1.6 Group VI Technical Data Package

The Group VI Technical Data Package consists of the as-built drawings revised to include system revisions and modifications. Deliver copies of the updated as-built drawings to the Government following approval of the PVT and endurance test.

### 3.3.2 Training

Conduct a training course for designated personnel in the maintenance of the FO system. Orient the training to the specific system being installed under this specification. Furnish all training materials and supplies.

#### 3.3.2.1 System Maintenance Training Course

Provide six copies of operating instructions outlining the step-by-step procedures required for system operation including description of each subsystem in its operating mode. Instructions includes the manufacturer's name, service manual, parts list, and a brief description of equipment, components, and their basic operating features. Provide six copies of the maintenance instructions listing regular maintenance procedures, possible system failures, a troubleshooting guide for repairs, and simplified diagrams for the system as installed. A video describing operating and maintenance instructions may be included.

Provide a system maintenance course taught at the project site after completion of the endurance test for a period of 1 training day. A maximum of five personnel designated by the Government will attend the course. A

training day consists of 8 hours of classroom or lab instruction, including two 15 minute breaks and excluding lunchtime during the daytime shift in effect at the facility. Training includes:

- a. Physical layout of the system and each piece of hardware.
- b. Troubleshooting and diagnostics procedures.
- c. Repair instructions.
- d. Preventative maintenance procedures and schedules.
- e. Calibration procedures.

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION AND FILL

02/11, CHG 2: 08/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2017) Installation of Ductile-Iron Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M (2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM D1140 (2017) Standard Test Methods for Determining the Amount of Material Finer than 75- $\mu$ m (No. 200) Sieve in Soils by Washing

ASTM D1556/D1556M (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2700 kN-m/m<sup>3</sup>)

ASTM D2216 (2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D2321 (2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D2487 (2011) Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D3786/D3786M (2013) Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method

ASTM D4318 (2017) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index



of Soils

ASTM D4533/D4533M	(2015) Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015a) Grab Breaking Load and Elongation of Geotextiles
ASTM D4759	(2011) Determining the Specification Conformance of Geosynthetics
ASTM D4833/D4833M	(2007; E 2013; R 2013) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D6938	(2017) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

## 1.2 DEFINITIONS

### 1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, for general soil types, abbreviated as percent laboratory maximum density.

### 1.2.2 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

### 1.2.3 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

## 1.3 SUBMITTALS

Government approval is required for all submittals. . Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring and Sheet piling Plan

Dewatering work plan

Submit 15 days prior to starting work.

SD-06 Test Reports

Testing

Select material test

Density tests

Moisture Content Tests

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

#### 1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- d. Hard materials and rock will not be encountered.
- e. Borrow material in the quantities required is not available on Government property.
- f. Blasting will not be permitted. Remove material in an approved manner.
- g. Contaminated soil may be encountered at the site. Refer to construction drawings and this section for disposal requirements.

#### 1.6 REQUIREMENTS FOR OFF SITE SOIL

Do not furnish or transport soils onto MCAS Cherry Point or outlying fields when such act would violate the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or the General Statutes of North Carolina.

The Contractor shall provide documentation certifying that all soil furnished under the contract contains no petroleum or hazardous or toxic materials as stated in DoD Instruction 4715.6, which implements 10 U.S.C. 2692. This documentation shall include the Soil Authorization Form (SAF) showing the volume of soil needed, analytical test data to support the environmental condition of the soil, and a copy of the State-issued "mining permit" for the borrow pit source. The MCAS Cherry Point Environmental

Affairs Department (EAD) will review these documents before off site soil is considered approved for use.

The following methods shall be used to determine if soil meets the requirements for off site soil (RFOSS).

If the total amount of soil to be brought onto MCAS Cherry Point for a single contract is less than 200 cubic yards, the Contractor shall certify the soil meets the RFOSS by inspecting for "apparent contamination" as determined by visual or other indications of contamination including abnormal or unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum. If the soil shows no apparent contamination, the Contractor shall provide to EAD a signed SAF certifying the soil contains no apparent contamination. Soil showing apparent contamination shall not be utilized aboard MCAS Cherry Point or outlying fields.

If the total amount of soil to be brought aboard MCAS Cherry Point for a single contract is equal to or greater than 200 cubic yards, the soil shall be analyzed by a North Carolina certified laboratory. The laboratory must be certified by North Carolina in the specific tests to be performed. Sampling must be conducted by qualified personnel following proper field sampling methodology and proper chain-of-custody protocol must be followed. Otherwise, the sampling will be considered invalid. Consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, sample volumes, and timeframes differ depending on the analytical method.

Sampling requirements are summarized below and are for a single soil source only.

- a. One representative sample for soil volumes of 200 cubic yards to 1,000 cubic yards needed.
- b. For soil volumes greater than 1,000 cubic yards, one additional representative sample is required for each additional 2,000 cubic yards or portion thereof.

A representative sample is achieved by collecting multiple samples in a defined area (e.g. soil stockpile or borrow pit) and directing the laboratory to combine them into a "composite sample" for analysis. The composite or representative sample is intended to represent the soil source as a whole.

Samples shall be collected by qualified personnel following proper field sampling methodology. For each representative sample, 3 "primary samples" from each of 2 soil borings (or excavation pits) shall be obtained for a total of 6 primary samples. The 3 primary samples collected from each boring/pit shall be obtained at even intervals throughout the soil column (i.e. upper, middle, lower) and placed into individual sampling containers. Samples shall not be combined in the field. The 6 primary samples shall be sent to the NC certified laboratory where they will be combined into one "composite sample" for analysis.

Soil samples shall be analyzed for Gasoline Range Organics (GRO), Diesel Range Organics (DRO), Oil and Grease (O&G), and eight Metals (Arsenic; Barium; Cadmium; Chromium; Lead; Mercury; Selenium; and Silver). The laboratory method detection limits must be set below the State action levels or the testing will be considered invalid. All units are to be reported in milligrams per kilograms (mg/kg).

Soil samples should be analyzed for the following parameters:

- a. Gasoline Range Organics - use Standard Method 5030
- b. Diesel Range Organics - use Standard Method 5030
- c. Oil & Grease - use EPA Method 9071 with a silica gel wash
- d. Total Metals - use EPA 6010 (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)
- e. Total Metals - use EPA 7471 (Mercury only)

If test results are greater than the allowed detection limits for petroleum constituents (GRO, DRO, O&G) or the standards for the eight metals (as provided by the EPA), the soil from which the sample was taken shall not be approved for use.

#### 1.7 CONTAMINATED SOILS

Select sites are located near or within an area with a history of major POL or chemical spills. Pre-characterization or soil sampling is not required prior to excavation. This information is provided to give the contractor's Industrial Hygiene Department for incorporation into their Health and Safety Plan to ensure worker safety.

If any soil which exhibits an abnormal or unnatural color, a chemical or petroleum odor, or is saturated with a chemical or petroleum is encountered during excavation, Contractor shall immediately stop work in that area, and the Contractor shall advise the Environmental Affairs Department (EAD) of the situation so a course of action can be developed to address the contamination.

All excavated soil may be re-utilized as backfill at the same location from which it was removed unless petroleum contamination is discovered. If petroleum contamination is discovered, the soil shall be segregated by PID ( $\geq 10$  ppm or exhibits staining), properly stockpiled, tested, and disposed. If soil is stockpiled, it shall be stockpiled on plastic, bermed, and covered in accordance with NC DENR Groundwater Section Guidelines for the Investigation and Remediation of Soil and Groundwater, Vol. 1 dated July 2000 (Guidelines), or placed in a rolloff container and covered with plastic.

Any excess soil that cannot be re-utilized as backfill at the same location from which it was removed shall be disposed at a Subtitle D landfill (e.g.; Tuscarora) as a minimum with the understanding that the analytical testing results shall determine the final disposal facility. Contractor shall provide supporting laboratory analysis to the EAD for review. The EAD shall review and sign the waste manifests/bill of lading for the soil disposal prior to any of this soil leaving the Air Station. The manifest shall also contain the amount of soil (weight) and supporting laboratory results for EAD to review. One composite sample shall be taken and analyzed for each 200 cubic yards of the stockpile per DENR Guidelines in order to determine the proper method for disposal.

Use of a North Carolina certified laboratory to perform the specific soil analyses is required. The laboratory shall be certified by North Carolina in the specific tests to be performed. Contractor shall consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, volumes, procedures, and preservation vary among methods. Sampling shall be conducted by qualified personnel and proper chain-of-custody protocol shall be followed. The

stockpile sample(s) shall be analyzed for the following:

Std Method 5030 sample prep with Modified 8015 (CA GC-FID Method) - Gasoline Range Organics,

Std Method 5030 and 3550 sample prep with Modified 8015 - Diesel Range Organics,

EPA Method 9071 - Oil & Grease, with silica gel wash

Full TCLP

All disturbed areas shall also be capped topping the excavated area with 12 inches of compacted, clean fill. Capping is required to prevent an increased exposure risk from both surficial exposure and contaminant leaching. Therefore, backfilled soils shall be compacted to minimize infiltration of surface water through the soil column.

See Section 01 14 00 for permitting requirements when excavating into the groundwater table in an OU area.

#### 1.8 CONTAMINATED GROUNDWATER

In contaminated areas, if dewatering is required during excavation, the groundwater shall not be discharged to the ground surface or storm sewer. The Contracting Officer shall make arrangements with the IWTP for disposal of contaminated groundwater. A chit shall be obtained from EAD (Timothy Lawrence 466-2754) prior to sending contaminated water to the IWTP.

#### 1.9 QUALITY ASSURANCE

##### 1.9.1 Shoring and Sheet Piling Plan

Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

##### 1.9.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

### 1.9.3 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

#### 2.1.1 Select Material

Provide materials classified as GW, GP, SW, SP, or by ASTM D2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D1140.

#### 2.2 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Provide ASTM D2321 materials as follows:

- a. Class I: Angular, 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

#### 2.3 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property, at Contractor's cost.

#### 2.4 FILTER FABRIC

Provide a pervious sheet of polyester, nylon, glass or polypropylene, filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D4759:

	<u>Class A</u>	<u>Class B</u>
a. Grab tensile strength (ASTM D4632/D4632M) ) machine and transversed direction	min. 180	80 lbs.
b. Grab elongation (ASTM D4632/D4632M) machine and transverse direction	min. 15	15 percent
c. Puncture resistance (ASTM D4833/D4833M)	min. 80	25 lbs.
d. Mullen burst strength (ASTM D3786/D3786M) )	min. 290	130 psi
e. Trapezoidal Tear (ASTM D4533/D4533M)	min. 50	25 lbs.

## 2.5 MATERIAL FOR RIP-RAP

Filter fabric and rock conforming to these requirements for construction indicated.

### 2.5.1 Rock

Rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. The size of the fragments shall be such that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Specific gravity of the rock shall be a minimum of 2.50. The inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines will not be permitted.

## 2.6 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes	
Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Potable Water Systems

Warning Tape Color Codes	
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air
Purple:	Non Potable, Reclaimed Water, Irrigation and Slurry lines

#### 2.6.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

#### 2.6.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

#### 2.7 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

### PART 3 EXECUTION

#### 3.1 PROTECTION

##### 3.1.1 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

##### 3.1.1.1 Drainage

See paragraph 1.7 for Contaminated Soils.

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and



ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

#### 3.1.1.2 Dewatering

See paragraph 1.8 for Contaminated Groundwater.

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least two feet below the working level.

Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.

#### 3.1.2 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

#### 3.1.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

### 3.2 SURFACE PREPARATION

#### 3.2.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

#### 3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated

and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

### 3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

## 3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with select material and compact to 100 percent of ASTM D1557 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with select material and compact to 100 percent of ASTM D1557 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

### 3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

### 3.3.2 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.

### 3.3.3 Hard Material Excavation

Remove hard material to elevations indicated in a manner that will leave foundation material in an unshattered and solid condition. Roughen level surfaces and cut sloped surfaces into benches for bond with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other types of erosion. Removal of hard material beyond lines and grades indicated will not be grounds for a claim for additional payment unless previously authorized by the Contracting Officer. Excavation of the material claimed as rock shall not be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer. Common excavation shall consist of all

excavation not classified as rock excavation.

#### 3.3.4 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

#### 3.3.5 3.3.5 Stockpile

Any soil that is excavated during construction that shows contamination by visible sight, smell or pid detection shall be segregated and stockpiled for testing prior to removal from the project site. Temporary stockpile shall be constructed and maintained in accordance with EOA, EPA, and NCDENR standards and specification.

#### 3.3.6 3.3.6 Soil and Water Testing

The Contractor shall test all soil and water for contaminants indicated prior to removal from site. The Contractor shall be responsible for all labor, materials, equipment necessary to test and control soil and water on-site. Soil and water testing shall be performed by a certified laboratory and written reports provided to the Contracting Officer.

- a. Std. Method 5030 Sample Prep with modified 8015 - gasoline range organics
- b. Std Method 5030 and 3550 Sample Prep with modified 8015 - diesel range organics
- c. EPA Method 9071 - oil & grease with silica gel wash
- d. Full TCLP

All contaminated soil and water removed from site shall be treated and/or disposed of at a NCDENR permitted site.

Water determined by testing to be free of contamination shall be released from the site in accordance with NCDENR sediment and erosion control regulations and permits.

#### 3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers,

pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

#### 3.4.1 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade of the building and paved areas with six passes of a dump truck loaded with 6 cubic meters of soil. Operate the truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. When proof rolling under buildings, the building subgrade shall be considered to extend 5 feet beyond the building lines, and one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer.

#### 3.5 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

##### 3.5.1 Placement of Flowable Cement Fill

Pump flowable fill to completely fill utility pipes with no voids.

##### 3.5.2 Select Material Placement

Place in 6 inch lifts. Do not place over wet or frozen areas. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

##### 3.5.3 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe outside structures and paved areas.

#### 3.6 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

#### 3.7 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

#### 3.8 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to

exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

### 3.9 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

#### 3.9.1 General Site

Compact underneath areas designated for vegetation and areas outside the 10 foot line of the paved area or structure to 90 percent of ASTM D1557.

#### 3.9.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact select material to 95 percent of ASTM D1557.

#### 3.9.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D1557.

#### 3.9.4 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact fill and backfill materials to 95 percent of ASTM D1557.

### 3.10 PIPELINE CASING UNDER PAVEMENT

Provide new smooth wall steel pipeline casing under existing pavement by the boring and jacking method of installation. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated.

#### 3.10.1 Earthwork for Pipeline Casings

Provide excavation, sheet piling, shoring, dewatering, and backfilling for pipeline casings under this section.

#### 3.10.2 Steel Cased Pipelines

Install pipeline casing by dry boring and jacking method as follows:

##### 3.10.2.1 Hole for Pipeline Casing

Mechanically bore holes and case through the soil with a cutting head on a continuous auger mounted inside the casing pipe. Weld lengths of pipe together in accordance with AWS D1.1/D1.1M. Do not use water or other fluids in connection with the boring operation.

##### 3.10.2.2 Cleaning

Clean inside of the pipeline casing of dirt, weld splatters, and other

foreign matter which would interfere with insertion of the piped utilities by attaching a pipe cleaning plug to the boring rig and passing it through the pipe.

#### 3.10.2.3 Piped Utilities

Provide in casing using wood supports adjusted to obtained grades and elevations indicated.

#### 3.10.2.4 End Seals

After installation of piped utilities in pipeline casing, provide watertight end seals at each end of pipeline casing between pipeline casing and piping utilities. Provide watertight segmented elastomeric end seals.

### 3.11 FINISH OPERATIONS

#### 3.11.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

#### 3.11.2 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

### 3.12 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

### 3.13 FIELD QUALITY CONTROL

#### 3.13.1 Sampling

Take the number and size of samples required to perform the following tests.

#### 3.13.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

##### 3.13.2.1 Select Material Testing

Test select material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D1557 for moisture density relations, as applicable.

##### 3.13.2.2 Density Tests

Test density in accordance with ASTM D1556/D1556M, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556/D1556M density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556/D1556M

density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations every 500 square feet of existing grade in fills for structures and concrete slabs, and every 1000 square feet for other fill areas and every 1000 square feet of subgrade in cut. Include density test results in daily report.

Bedding and backfill in trenches: One test per 50 linear feet in each lift.

#### 3.13.2.3 Moisture Content Tests

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216. Include moisture content test results in daily report.

-- End of Section --

# SOIL AUTHORIZATION FORM (SAF)

Based upon Requirements for Off Site Soil (RFOSS)

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

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

Base Contract Officer (e.g. ROICC/FSC): \_\_\_\_\_

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

Amount of soil required (in cubic yards): \_\_\_\_\_

**--- Check the applicable box below and sign/date in the appropriate section ---**

Amount of soil needed for project is:

☐ Up to 200 cubic yards (No analytical data required; Include NC mining permit)

I \_\_\_\_\_  
(print name)  
certify the soil contains No apparent contamination  
as determined by visual or other indications of contamination including abnormal or  
unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

☐ More than 200 to 1000 cubic yards. (Requires 1 representative sample)

☐ More than 1000 to 3000 cubic yards. (Requires 2 representative samples)

☐ More than 3000 to 5000 cubic yards. (Requires 3 representative samples)

☐ More than 5000 cubic yards. (Requires 4 or more representative samples)

I \_\_\_\_\_  
(print name)  
have enclosed analytical testing data, completed  
SAF, an NC mining permit as outlined in the RFOSS and followed the guidance for proper  
sampling to ensure accurate data collection for the soil.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



SECTION 32 31 13

CHAIN LINK FENCES AND GATES

11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A392	(2011a; R 2017) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A824	(2001; R 2017) Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a; R 2019) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014; R 2019) Standard Specification for Fence Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191/1	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
FS RR-F-191/2	(Rev E) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
FS RR-F-191/3	(Rev E; Am 1) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Location of Gate, Corner, End, and Pull Posts

Gate Assembly

Gate Hardware and Accessories

Erection/Installation Drawings

SD-03 Product Data

Gate Assembly

Gate Hardware and Accessories

Zinc Coating

Fabric

Stretcher Bars

Concrete

SD-04 Samples

Fabric

Posts

Braces

Line Posts

Sleeves

Top Rail

Tension Wire

Stretcher Bars

Gate Posts

Gate Hardware and Accessories

Wire Ties

SD-07 Certificates

Certificates of Compliance

SD-08 Manufacturer's Instructions

Gate Assembly

Hardware Assembly

Accessories

### 1.3 QUALITY CONTROL

#### 1.3.1 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

- a. Zinc coating
- b. Fabric
- c. Stretcher bars
- d. Gate hardware and accessories
- e. Concrete

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Submit reports of listing chain-link fencing and accessories regarding weight in ounces for zinc coating.

Submit manufacturer's catalog data for complete gate assembly, hardware assembly and accessories.

### 2.2 FENCES

#### 2.2.1 Fabric

FS RR-F-191/1; Type I, zinc-coated steel, 9 gauge conforming to ASTM A392, with 2.0 ounces per square foot of coated surface. Provide selvage knuckled at one selvage and twisted and barbed at the other. Height of fabric, as indicated.

Provide fabric consisting of wires woven into a 2 inch diamond mesh. Provide one-piece fabric widths for fence heights up to 12 feet.

##### 2.2.1.1 Top and Bottom Selvages

Provide knuckled selvages at top and bottom for fabric with 2 inch mesh and up to 60 inches high, and if over 60 inches high, provide twisted and barbed top selvage and knuckled bottom selvage.

Knuckle top and bottom selvages for 1-3/4 inch and 1 inch mesh fabric.

##### 2.2.2 Posts

###### 2.2.2.1 Metal

###### 2.2.2.1.1 Line Posts

Provide line posts complying with FS RR-F-191/3. Provide Class 1, steel

pipe, Grade A Regular Strength, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

#### 2.2.2.1.2 End, Corner and Pull Posts

Provide end, corner, and pull posts in minimum sizes listed in FS RR-F-191/3 for each class and grade. Provide Class 1, steel pipe, Grade A Regular Strength.

#### 2.2.2.2 Post Tops

Provide steel, wrought iron, or malleable iron tops and designed as a weathertight closure cap. Post top to have finish and coating matching rails and posts. Steel type to be pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 ounces per square foot. Provide one cap for each post, unless equal protection is provided by a combination post-cap and wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

#### 2.2.3 Braces and Rails

Class 1, steel pipe, Grade A Regular Strength, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

##### 2.2.3.1 Top Rail

Provide top rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized. Provide expansion couplings 6 inches long at each joint in top rails.

##### 2.2.3.2 Center Rails Between Line Posts

Provide center rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized.

##### 2.2.3.3 Post-Brace Assembly

Provide bracing conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade, and 3/8 inch adjustable truss rods and turnbuckles.

#### 2.2.4 Wire Ties

Provide 9-gauge wire for tying fabric to line posts, spaced 12 inches on center. For tying fabric to rails and braces, space wire ties 24 inches on center. For tying fabric to tension wire, space 0.105-inch hog rings 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.

FS RR-F-191/4. Provide wire ties constructed of the same material and coating as the fencing fabric.

#### 2.2.5 Sleeves

Provide sleeves for setting into concrete construction of the same material as post sections, sized 1 inch greater than the diameter or dimension of the post. Weld flat plates to each sleeve base to provide anchorage and prevent intrusion of concrete.

#### 2.2.6 Stretcher Bars

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM F626.

#### 2.2.7 Stretcher Bar Bands

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

#### 2.2.8 Tension Wire

Provide metallic coated steel marcelled tension wire, ( No. 7-gauge) complying with ASTM A824. Provide zinc-coated steel wire with zinc coating that weighs not less than 2.0 ounces per square foot.

#### 2.2.9 Miscellaneous Hardware

Provide miscellaneous hot-dip galvanized hardware as required.

### 2.3 GATES

FS RR-F-191/2; Type III, single cantilever sliding, wheel sliding gate. Shape and size of gate frame, as indicated. Framing and bracing members, round of steel alloy. Steel member finish, zinc-coated. Provide gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade, except that steel pipe frames are a minimum of 1.90 inches o.d., 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces are 1.869 inches o.d. minimum, 0.940 lb/ft of length. Provide intermediate members as necessary for gate leaves more than 8 feet wide, to provide rigid construction, free from sag or twist.

#### 2.3.1 Gate Posts

Provide gate posts for supporting each gate leaf in minimum sizes listed in FS RR-F-191/3 for each material class and grade. Gate post material class, grade and finish to match other fence posts. Existing gate posts, if adequately sized, may be reused for the new gate.

#### 2.3.2 Gate Fabric

Gate fabric, is as specified for fencing fabric. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding is not permitted.

#### 2.3.3 Gate Frame

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

#### 2.3.4 Gate Bracing

Provide diagonal cross-bracing, consisting of 3/8 inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

#### 2.3.5 Gate Hardware and Accessories

Provide gate hardware and accessories that conforms to ASTM A392 and ASTM F626, and as specified. Coating for steel latches, stops, hinges, keepers, and accessories, is galvanized.

- a. Provide forged steel hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening. Provide hinge with stainless steel pin.
- b. Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

### 2.4 MATERIALS

#### 2.4.1 Zinc Coating

Provide zinc-coated ferrous metal components and accessories that are factory coated after fabrication, except as otherwise specified.

For galvanizing field repairs, provide material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

#### 2.4.2 Concrete

Provide concrete conforming to ASTM C94/C94M, and obtaining a minimum 28-day compressive strength of 3,000 psi.

#### 2.4.3 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

### PART 3 EXECUTION

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Provide complete installation conforming to ASTM F567.

#### 3.1 PREPARATION

Ensure final grading and established elevations are complete prior to commencing fence installation.

#### 3.2 INSTALLATION

##### 3.2.1 Security

Install new chain link fencing, remove existing fencing, and perform

related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer and cognizant Security Officer.

### 3.2.2 Fence Installation

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

#### 3.2.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Submit drawings showing location of gate, corner, end, and pull posts.

### 3.2.3 Excavation

Provide excavations for post footings which are drilled holes in virgin or compacted soil, of minimum sizes as indicated. Space footings for line posts 10 feet on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 3 inches below the bottoms of the posts. Set bottom of each post not less than 36 inches below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads. Remove excavated soil from Government property.

When solid rock is encountered near the surface, drill into the rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill holes at least 1 inch greater in diameter than the largest dimension of the placed post. If solid rock is below the soil overburden, drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

#### 3.2.4 Setting Posts

Remove loose and foreign materials from holes and moisten the soil prior to placing concrete. Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices, sleeves, and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved. Grout all posts set into sleeved holes in concrete with an approved grouting material. Maintain vertical alignment of posts in concrete construction until concrete has set.

##### 3.2.4.1 Earth and Bedrock

Provide concrete bases of dimensions indicated on the manufactures installation drawings. Compact concrete to eliminate voids, and finish to a dome shape.

#### 3.2.4.2 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal tension rod.

#### 3.2.4.3 Tolerances

Provide posts that are straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 1/2 inch deviation from the established centerline between line posts. Repair defects as directed.

#### 3.2.5 Concrete Strength

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wire, or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

Sample and test concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

#### 3.2.6 Top Rails

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

#### 3.2.7 Brace Assembly

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension. Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

#### 3.2.8 Tension Wire Installation

Install tension wire by weaving them through the fabric and tying them to each post with not less than 7-gauge galvanized wire or by securing the wire to the fabric with 10-gauge ties or clips spaced 24 inches on center.

#### 3.2.9 Fabric Installation

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 1-1/2 inches above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed. Ensure fabric remains under tension after the pulling force is released.

#### 3.2.10 Stretcher Bar Installation

Thread stretcher bars through or clamped to fabric 4 inches on center and secured to posts with metal bands spaced 15 inches on center.



### 3.2.11 Gate Installation

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

### 3.2.12 Tie Wires

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

### 3.2.13 Fasteners

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

### 3.2.14 Zinc-Coating Repair

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

### 3.2.15 Accessories Installation

#### 3.2.15.1 Post Caps

Install post caps as recommended by the manufacturer.

### 3.2.16 Grounding

Ground fencing as indicated on drawings and specified.

Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations can not exceed 650 feet. Bond each gate panel with a flexible bond strap to its gate post. Provide copper-clad steel rod grounding electrodes 3/4 inch by 10 foot long. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence, with top of the electrode not less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Total resistance of the fence to ground cannot exceed 25 ohms.

## 3.3 CLOSEOUT ACTIVITIES

Remove waste fencing materials and other debris from the work site.

-- End of Section --

SECTION 32 92 19

SEEDING

08/17, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2020) Agricultural Liming Materials
ASTM D4427	(2018) Standard Classification of Peat Samples by Laboratory Testing
ASTM D4972	(2018) Standard Test Methods for pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 23 00.00 20 EXCAVATION AND FILL, Section 32 92 23 SODDING, applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil Composition Tests (reports and recommendations).

SD-07 Certificates

State Certification and Approval for Seed

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron, and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulphur, iron, and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Gypsum, Sulfur, Iron, and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert

material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer .

### 2.1.2 Planting Dates

<u>Planting Season</u>	<u>Planting Dates</u>
Temporary Seeding	See drawings

### 2.1.3 Seed Mixture by Weight

<u>Planting Season</u>	<u>Variety</u>	<u>Percent (by Weight)</u>
Temporary Seeding	See drawings	See drawings

Proportion seed mixtures by weight. Temporary seeding must later be replaced by sod for a permanent stand of grass. The same requirements of turf establishment apply for temporary seeding.

## 2.2 TOPSOIL

### 2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

### 2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor .

### 2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials. Other components must conform to the following limits:

pH	5.5 to 7.0
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## 2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 80 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427 . Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 80 percent, calcium 18 percent, sulfur 14 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

#### 2.3.10 Calcined Clay

Calcined clay must be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent must pass a No. 8 sieve; a minimum 99 percent must be retained on a No. 60 sieve; and material passing a No. 100 sieve must not exceed 2 percent. Bulk density: A maximum 40 pounds per cubic foot.

#### 2.4 FERTILIZER

##### 2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

- 10 percent available nitrogen
- 10 percent available phosphorus
- 10 percent available potassium

#### 2.5 MULCH

Mulch must be free from noxious weeds, mold, and other deleterious materials.

##### 2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw must contain no fertile seed.

##### 2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay must be sterile, containing no fertile seed.

##### 2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent post-consumer content) or wood-based (100 percent total recovered content) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

#### 2.6 WATER

Source of water must be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

#### 2.7 EROSION CONTROL MATERIALS

Erosion control material must conform to the following:

##### 2.7.1 Erosion Control Net

Net must be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately one inch square.

## 2.7.2 Erosion Control Material Anchors

Erosion control anchors must be as recommended by the manufacturer.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 EXTENT OF WORK

Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

##### 3.1.1.1 Topsoil

Provide 4 inches of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters, and/or soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

##### 3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

### 3.2 SEEDING

#### 3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen or snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

#### 3.2.2 Seed Application Method

Seeding method must be broadcasted and drop seeding or drill seeding.

##### 3.2.2.1 Broadcast and Drop Seeding

Seed must be uniformly broadcast at the rate indicated on the drawings. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

#### 3.2.2.2 Drill Seeding

Seed must be drilled at the rate indicated on the drawings. Use grass seed drills. Drill seed uniformly to average depth of 1/2 inch.

#### 3.2.3 Mulching

##### 3.2.3.1 Hay or Straw Mulch

Hay or straw mulch must be spread uniformly at the rate of 2 tons per acre. Mulch must be spread by hand, blower-type mulch spreader, or other approved method. Mulching must be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch must not be bunched or clumped. Sunlight must not be completely excluded from penetrating to the ground surface. All areas installed with seed must be mulched on the same day as the seeding. Mulch must be anchored immediately following spreading.

##### 3.2.3.2 Mechanical Anchor

Mechanical anchor must be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

##### 3.2.3.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier must be sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight must not be completely excluded from penetrating to the ground surface.

#### 3.2.4 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

#### 3.2.5 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

### 3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

### 3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --



SECTION 32 92 23

SODDING

04/06, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2020) Agricultural Liming Materials
ASTM D4427	(2018) Standard Classification of Peat Samples by Laboratory Testing
ASTM D4972	(2018) Standard Test Methods for pH of Soils

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

TPI GSS	(1995) Guideline Specifications to Turfgrass Sodding
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U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0
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1.2 DEFINITIONS

1.2.1 Stand of Turf

100 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 23 00.00 20 EXCAVATION AND FILL and Section 32 92 19 SEEDING applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

Sod farm certification for sods. Indicate type of sod in accordance with TPI GSS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Sod Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron, and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulphur, iron, and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Sod

Place sod a maximum of thirty six hours after initial harvesting, in accordance with TPI GSS as modified herein.

## PART 2 PRODUCTS

### 2.1 SODS

#### 2.1.1 Classification

Nursery grown, certified as classified in the TPI GSS. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected. Wood pegs and wire staples for anchorage shall be as recommended by sod supplier.

#### 2.1.2 Purity

Sod species shall be genetically pure, free of weeds, pests, and disease.

#### 2.1.3 Planting Dates

Lay sod within dates indicated on the drawings.

#### 2.1.4 Composition

##### 2.1.4.1 Proportion

Proportion grass species as follows.

Botanical Name	Common Name	Percent
Eremochloa ophiuroides	Centipede	100

### 2.2 TOPSOIL

#### 2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

#### 2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

#### 2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

pH	5.5 to 7.0
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## 2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

### 2.3.1 Lime

Commercial grade limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 80 percent.

### 2.3.2 Aluminum Sulfate

Commercial grade.

### 2.3.3 Sulfur

100 percent elemental

### 2.3.4 Iron

100 percent elemental

### 2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

### 2.3.6 Sand

Clean and free of materials harmful to plants.

### 2.3.7 Perlite

Horticultural grade.

### 2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

#### 2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

#### 2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

#### 2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

#### 2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

### 2.4 FERTILIZER

#### 2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

- 5 percent available nitrogen
- 10 percent available phosphorus
- 10 percent available potassium

### 2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation containing no element toxic to plant life.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Extent Of Work

Provide soil preparation (including soil conditioners), fertilizing, and sodding of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

#### 3.1.2 Soil Preparation

Provide 4 inches of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters, and/or soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

##### 3.1.2.1 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

### 3.2 SODDING

#### 3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove from the surface debris and stones over a minimum 5/8 inch in any dimension.

#### 3.2.2 Placing

Place sod a maximum of 36 hours after initial harvesting, in accordance with TPI GSS as modified herein.

#### 3.2.3 Sodding Slopes and Ditches

For slopes 2:1 and greater, lay sod with long edge perpendicular to the contour. For V-ditches and flat bottomed ditches, lay sod with long edge perpendicular to flow of water. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center. On slope areas, start sodding at bottom of the slope.

#### 3.2.4 Finishing

After completing sodding, blend edges of sodded area smoothly into surrounding area. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed and holes and missing corners shall be patched with sod.

#### 3.2.5 Rolling

Immediately after sodding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

#### 3.2.6 Watering

Start watering areas sodded as required by daily temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to minimum depth of 6 inches. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

### 3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

### 3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

WO# 7217368 Repairs to Wastewater Treatment Plant, B4376P

-- End of Section --

SECTION 33 30 00

SANITARY SEWERAGE  
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
AWWA C508	(2017) Swing-Check Valves for Waterworks Service, 2 In. Through 48-In. (50-mm Through 1,200-mm) NPS
AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A536	(1984; R 2014) Standard Specification for



Ductile Iron Castings

ASTM C12	(2017) Standard Practice for Installing Vitrified Clay Pipe Lines
ASTM C1244	(2011; R 2017) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C1644	(2006; R 2017) Standard Specification for Resilient Connectors Between Reinforced Concrete On-Site Wastewater Tanks and Pipes
ASTM C270	(2014a) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2012; R 2017) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2018) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C972	(2000; R 2011) Compression-Recovery of Tape Sealant
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe

Fittings, Schedule 80

ASTM D3034	(2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2012) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27	(N0v 2016) Scaffolds and Roope Descent Systems
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-78	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Precast Concrete Manholes

Frames, Covers, and Gratings

Gravity Pipe

Pressure Pipe

#### SD-06 Test Reports

Precast Concrete Sewer Manhole Test

Hydrostatic Pressure Test

Infiltration Tests And Exfiltration Tests

Negative Air Pressure Test

Low-Pressure Air Tests; G

#### SD-07 Certificates

Gaskets

### 1.3 QUALITY CONTROL

#### 1.3.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Verify installing Contractor's License is current and state certified or state registered.

### 1.4 DELIVERY, STORAGE, AND HANDLING

#### 1.4.1 Delivery and Storage

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

##### 1.4.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

#### 1.4.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe in accordance with the manufacturer's recommendation and discard those materials if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

##### 2.1.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals 18-24 inch lines of ductile-iron pipe for the replacement of the piping between the headworks, equalization tank, and BNR.

#### 2.2 MATERIALS

Provide materials conforming to the respective specifications and other requirements specified below. Submit manufacturer's product specification, standard drawings or catalog cuts.

##### 2.2.1 Gravity Pipe

###### 2.2.1.1 Ductile Iron Gravity Sewer Pipe and Associated Fittings

###### 2.2.1.1.1 Ductile Iron Gravity Pipe and Fittings

Provide ductile iron pipe conforming to AWWA C151/A21.51. All ductile iron piping and fittings for this project shall be coated with P401 ceramic epoxy lining system.

###### 2.2.2 Pressure Pipe2.2.2.1 Ductile Iron Pressure Piping2.2.2.1.1 Ductile Iron Pressure Pipe and Fittings

Provide ductile-iron pipe conforming to AWWA C151/A21.51, Pressure Class 200. Provide fittings conforming to AWWA C110/A21.10 or AWWA C153/A21.53.

Use fittings which have a pressure rating at least equivalent to that of the pipe. Pipe and fittings are to have P401 ceramic epoxy lining.

###### 2.2.2.1.2 Ductile Iron Pressure Joints and Jointing Materialsb. Push-on joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly are to conform to AWWA C111/A21.11.c. Mechanical joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets are to conform to AWWA C111/A21.11.

###### 2.2.2.2 PVC Pressure Pipe and Associated FittingsPipe, couplings and fittings are to be manufactured of materials conforming to ASTM D1784, Class 12454B.

###### 2.2.2.2.1 Pipe and Fittings Less Than 4 inch Diameter

###### 2.2.2.2.1.1 Screw-Joint

Provide pipe conforming to dimensional requirements of ASTM D1785,

Schedule 40 or 80 as shown on the drawings, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Provide fittings for threaded pipe conforming to requirements of ASTM D2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 40 or 80 pipe and fittings. Pipe couplings when used, are to be tested as required by ASTM D2464.

2.2.2.2.1.2 Push-On Joint

ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints are to be iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and AWWA C111/A21.11 with a cement-mortar lining conforming to AWWA C104/A21.4, standard thickness.

2.2.2.2.1.3 Solvent Cement Joint

Provide pipe conforming to dimensional requirements of ASTM D1785 or ASTM D2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing are to conform to ASTM D2466 or ASTM D2467.

2.2.3 Cement Mortar

Provide cement mortar conforming to ASTM C270, Type M with Type II cement.

2.2.4 Precast Concrete Manholes

Provide precast concrete manholes, risers, base sections, and tops conforming to ASTM C478.

2.2.5 Gaskets and Connectors

Provide gaskets for joints between wastewater tanks sections conforming to ASTM C443. Resilient connectors for making joints between and wastewater tanks and pipes entering manhole are to conform to ASTM C1644.

2.2.6 External Preformed Rubber Joint Seals

An external preformed rubber joint seal is an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" are to be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal is to be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit is to consist of a top and bottom section and have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic is to be a non-hardening butyl rubber sealant and seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections are to cover up to two more adjusting rings. Properties and values are listed in the following table:

Properties, Test Methods and Minimum Values for Rubber used in Preformed Joint Seals				
Physical Properties	Test Methods	EPDM	Neoprene	Butyl Mastic
Tensile, psi	ASTM D412	1840	2195	--
Elongation, percent	ASTM D412	553	295	350
Tear Resistance, ppi	ASTM D624 (Die B)	280	160	--
Rebound, percent, 5 minutes	ASTM C972 (mod.)	--	--	11
Rebound, percent, 2 hours	ASTM C972	--	--	12

#### 2.2.7 Frames, Covers, and Gratings for Manholes

Submit certification on the ability of frame and cover to carry the imposed live load. Frame and cover are to be cast gray iron, ASTM A48/A48M, Class 35B, cast ductile iron, ASTM A536, Grade 65-45-12, or reinforced concrete, ASTM C478 ASTM C478M. Frames and covers are to be circular with vent holes. Size are to be as indicated on the plans. Stamp or cast the words "Sanitary Sewer" into covers so that it is plainly visible.

#### 2.2.8 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

#### 2.2.9 Manhole Ladders

Provide a steel ladder where the depth of a manhole exceeds 12 feet. The ladder is not to be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers are to be a minimum 3/8 inch thick and 2 inches wide. Galvanize ladders and inserts after fabrication in conformance with ASTM A123/A123M.

#### 2.2.10 Link-Seal

For locations of concrete wall coring to install a new pipe connection, provide a link seal in order to provide a water tight connection. Grout filling the opening alone will not be acceptable. The seal element shall be made of EPDM. Nuts and bolts will be 316SS. Bolts and nuts to have an average tensile strength of 85,000 psi. Service temperature range should be -40 to 250 degrees Fahrenheit.

#### 2.2.11 Valves

##### 2.2.11.1 Check Valves

Provide iron-bodied check valves that permit free flow of sewage forward and provide a positive check against backflow. Design check valves for a

minimum working pressure of 150 psi or as indicated. Directly cast the manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow on the body.

#### 2.2.11.1.1 Swing Check Valves

Comply with AWWA C508. Provide with iron body, bronze mounted, and flanged ends. Provide 125 pound type flanges, complying with ASME B16.1.

#### 2.2.11.2 Plug Valves

Provide cast iron valves complying with MSS SP-78. 6" and smaller exposed valves shall be provided with wrench actuators. 8" and larger exposed valves shall be provided with worm gear type manual actuators.

#### 2.2.12 Pipe Hangers, Inserts and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58.

#### 2.2.13 Expansion Joint

Provide expansion couplings that provide for a minimum of 2" of expansion and contraction. Body to be ASTM A36 Carbon Steel and slip pipe to be type 304 stainless steel. Bolts and nuts to be trackhead bolts, heavy hex nuts, 5/8" UNC rolled thread, high strength, low alloy, corrosion resistant steel per AWWA C111. Stainless steel available on request. Packing to be alternating combination of rubber and wax impregnated flax packing compounded for water service. Ends to be flanged. Expansion joint shall be Romac EJ400 or approved equal.

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Installation Drawings

Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

#### 3.2 INSTALLATION

Backfill after inspection by the Contracting Officer. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

##### 3.2.1 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

##### 3.2.2 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in

the following paragraphs entitled "Special Requirements."

3.2.2.1 Location

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.

3.2.2.1.1 Sanitary Sewer Manholes

No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.2.2.2 Earthwork

Perform earthwork operations in accordance with Section .

3.2.2.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Construct branch connections by use of regular fittings or solvent cemented saddles as approved. Provide saddles for PVC pipe conforming to Table 4 of ASTM D3034.

3.2.3 Special Requirements

3.2.3.1 Installation of Clay Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM C12 for pipe laying. Make joints with a compression joint material specified for clay pipe joints and assemble in accordance with the recommendations of the manufacturer of the pipe.

3.2.3.2 Installation of Ductile Iron Gravity Sewer Pipe

Unless otherwise specified, install pipe and associated fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of AWWA C600 for pipe installation and joint assembly.

- a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.
- b. Exterior protection: Completely encase buried ductile iron pipelines



with polyethylene tube or sheet in accordance with AWWA C105/A21.5, using Class A polyethylene film.

#### 3.2.3.3 Installation of PVC Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

#### 3.2.4 Miscellaneous Construction and Installation

##### 3.2.4.1 Connecting to Existing Manholes

Connect pipe to existing manholes such that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. Center the connection on the manhole. Holes for the new pipe are to be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cut the manhole in a manner that will cause the least damage to the walls.

##### 3.2.4.2 Metal Work

###### 3.2.4.2.1 Workmanship and Finish

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

###### 3.2.4.2.2 Field Painting

After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal, remove mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

#### 3.3 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

##### 3.3.1 Tests

Perform field tests and provide labor, equipment, and incidentals required for testing.

#### 3.3.1.1 Leakage Tests for Nonpressure Lines

Test lines for leakage by either negative air pressure tests or by low-pressure air tests. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

##### 3.3.1.1.1 Infiltration Tests and Exfiltration Tests

##### 3.3.1.1.2 Negative Air Pressure Test

###### 3.3.1.1.2.1 Precast Concrete Manholes

Test precast concrete sewer manhole test in accordance with ASTM C1244. The allowable vacuum drop is located in ASTM C1244 Make calculations in accordance with the Appendix to ASTM C1244.

##### 3.3.1.1.3 Low-Pressure Air Tests

###### 3.3.1.1.3.1 PVC Pipelines

Test PVC pipe in accordance with UBPPA UNI-B-6. The allowable pressure drop is located in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

#### 3.3.1.2 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

##### 3.3.2 Inspection

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; the light must show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION

08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th  
Edition) Standard Specifications for  
Highway Bridges

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318M (2014; ERTA 2015) Building Code  
Requirements for Structural Concrete &  
Commentary

ACI SP-66 (2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for  
Hard-Drawn Copper Wire

ASTM B3 (2013) Standard Specification for Soft or  
Annealed Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for  
Concentric-Lay-Stranded Copper Conductors,  
Hard, Medium-Hard, or Soft

ASTM B496 (2016; R 2021) Standard Specification for  
Compact Round Concentric-Lay-Stranded  
Copper Conductors

ASTM C32 (2013; R 2017) Standard Specification for  
Sewer and Manhole Brick (Made from Clay or  
Shale)

ASTM C309 (2019) Standard Specification for Liquid  
Membrane-Forming Compounds for Curing  
Concrete

ASTM C478 (2018) Standard Specification for Circular  
Precast Reinforced Concrete Manhole  
Sections

ASTM C857 (2016) Standard Practice for Minimum

Structural Design Loading for Underground  
Precast Concrete Utility Structures

ASTM C990 (2009; R 2019) Standard Specification for  
Joints for Concrete Pipe, Manholes, and  
Precast Box Sections Using Preformed  
Flexible Joint Sealants

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81 (2012) Guide for Measuring Earth  
Resistivity, Ground Impedance, and Earth  
Surface Potentials of a Ground System

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017)  
National Electrical Safety Code

IEEE Stds Dictionary (2009) IEEE Standards Dictionary: Glossary  
of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2021) Standard for Acceptance Testing  
Specifications for Electrical Power  
Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1 (2016) Electric Connectors - Sealed  
Insulated Underground Connector Systems  
Rated 600 Volts

ANSI/NEMA WC 71/ICEA S-96-659 (2014) Standard for Nonshielded Cables  
Rated 2001-5000 Volts for use in the  
Distribution of Electric Energy

NEMA C119.4 (2011) Electric Connectors - Connectors  
for Use Between Aluminum-to-Aluminum or  
Aluminum-to-Copper Conductors Designed for  
Normal Operation at or Below 93 Degrees C  
and Copper-to-Copper Conductors Designed  
for Normal Operation at or Below 100  
Degrees C

NEMA RN 1 (2005; R 2013) Polyvinyl-Chloride (PVC)  
Externally Coated Galvanized Rigid Steel  
Conduit and Intermediate Metal Conduit

NEMA TC 2 (2020) Standard for Electrical Polyvinyl  
Chloride (PVC) Conduit

NEMA TC 9 (2020) Standard for Fittings for Polyvinyl  
Chloride (PVC) Plastic Utilities Duct for  
Underground Installation

NEMA WC 74/ICEA S-93-639 (2012) 5-46 kV Shielded Power Cable for  
Use in the Transmission and Distribution  
of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)  
National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77 (2013) Specification for Underground  
Enclosure Integrity

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758 (2012b) Customer-Owned Outside Plant  
Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644 (2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005 (Basic; Notice 2) Frames, Covers,  
Gratings, Steps, Sump And Catch Basin,  
Manhole

UNDERWRITERS LABORATORIES (UL)

UL 6 (2007; Reprint Sep 2019) UL Standard for  
Safety Electrical Rigid Metal Conduit-Steel

UL 83 (2017; Reprint Mar 2020) UL Standard for  
Safety Thermoplastic-Insulated Wires and  
Cables

UL 94 (2013; Reprint May 2021) UL Standard for  
Safety Tests for Flammability of Plastic  
Materials for Parts in Devices and  
Appliances

UL 467 (2013; Reprint Jun 2017) UL Standard for  
Safety Grounding and Bonding Equipment

UL 486A-486B (2018; Reprint May 2021) UL Standard for  
Safety Wire Connectors

UL 510 (2020) UL Standard for Safety Polyvinyl  
Chloride, Polyethylene and Rubber  
Insulating Tape

UL 514A (2013; Reprint Aug 2017) UL Standard for  
Safety Metallic Outlet Boxes

UL 514B (2012; Reprint May 2020) Conduit, Tubing  
and Cable Fittings

UL 651 (2011; Reprint Mar 2020) UL Standard for  
Safety Schedule 40, 80, Type EB and A  
Rigid PVC Conduit and Fittings

UL 854 (2020) Standard for Service-Entrance Cables

UL 1072 (2006; Reprint Apr 2020) Medium-Voltage  
Power Cables

## 1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.
- b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.
- c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

## 1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast Underground Structures

SD-03 Product Data

Medium Voltage Cable Precast Concrete Structures

Sealing Material

Pulling-In Irons

Manhole Frames and Covers

Handhole Frames and Covers

Composite/Fiberglass Handholes

Cable Supports (racks, arms and insulators)

SD-06 Test Reports

Field Acceptance Checks and Tests

SD-07 Certificates

Cable Installer Qualifications

## 1.4 QUALITY ASSURANCE

### 1.4.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

- a. Material description (i.e., f'c and Fy)
- b. Manufacturer's printed assembly and installation instructions
- c. Design calculations
- d. Reinforcing shop drawings in accordance with ACI SP-66
- e. Plans and elevations showing opening and pulling-in iron locations and details

#### 1.4.2 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

#### 1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site

are not acceptable, unless specified otherwise.

## PART 2 PRODUCTS

### 2.1 CONDUIT, DUCTS, AND FITTINGS

#### 2.1.1 Rigid Metal Conduit

UL 6.

#### 2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

#### 2.1.2 Plastic Conduit for Direct Burial and Riser Applications

UL 651 and NEMA TC 2, EPC-80.

#### 2.1.3 Plastic Duct for Concrete Encasement

Provide Type EPC-40 per UL 651 and NEMA TC 2.

#### 2.1.4 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

#### 2.1.5 Fittings

##### 2.1.5.1 Metal Fittings

UL 514B.

##### 2.1.5.2 PVC Conduit Fittings

UL 514B, UL 651.

##### 2.1.5.3 PVC Duct Fittings

NEMA TC 9.

##### 2.1.5.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit must be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and must conform to UL 514A.

### 2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site are



not acceptable. Service entrance conductors must conform to UL 854, type USE.

#### 2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and XHHW-2 unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded. All conductors must be copper.

#### 2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

#### 2.2.3 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Color code conductors. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves, or colored electrical tape. Properly identify control circuit terminations. Color must be green for grounding conductors. Color of ungrounded conductors in different voltage systems are as follows:

a. 208/120 volt, three-phase

- (1) Phase A - black
- (2) Phase B - red
- (3) Phase C - blue
- (4) Neutral - white

b. 480/277 volt, three-phase

- (1) Phase A - brown
- (2) Phase B - orange
- (3) Phase C - yellow
- (4) Neutral - gray

c. 120/240 volt, single phase: Black and red

### 2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

- a. For use with copper conductors: UL 486A-486B.

### 2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

#### 2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

#### 2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

### 2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated. refer to section 260513.00 40 Medium Voltage Cables for additional requirements.

#### 2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications. Cable must be rated 15 kV percent insulation level.

#### 2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B compact round conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

#### 2.5.3 Insulation

Provide ethylene-propylene-rubber (EPR) insulation conforming to the requirements of ANSI/NEMA WC 71/ICEA S-96-659.

#### 2.5.4 Shielding

Cables rated for 2 kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape or wire shield for each phase.

#### 2.5.5 Neutrals

Neutral conductors must be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable. All 600V cables shall be type XHHW-2.

#### 2.5.6 Jackets

Provide cables with a PVC jacket.

#### 2.6 TAPE

##### 2.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

##### 2.6.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with the drawings.

#### 2.7 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

#### 2.8 GROUNDING AND BONDING

##### 2.8.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

##### 2.8.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

#### 2.9 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other

built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable.

#### 2.9.1 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

##### 2.9.1.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

##### 2.9.1.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

- a. Angle of Internal Friction ( $\phi$ ) = 30 degrees
- b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf
- c. Coefficient of Lateral Earth Pressure ( $K_a$ ) = 0.33
- d. Ground Water Level = 3 feet below ground elevation
- e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.
- f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.
- g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

- h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

#### 2.9.1.3 Construction

Provide a uniform thickness for structure top, bottom, and wall not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

#### 2.9.1.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

#### 2.9.2 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the top face of power and telecommunications manhole covers, respectively.

#### 2.9.3 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Provide rolled-steel floor plate covers having an approved antislip surface. Hinges must be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

#### 2.9.4 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

#### 2.9.5 Composite/Fiberglass Handholes and Covers

ANSI/SCTE 77. Provide handholes and covers of polymer concrete, reinforced

with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface which must not exceed the design load of the box.

## 2.10 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

Zinc coat the metal portion of racks and arms after fabrication.

### 2.10.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long (minimum) in manholes. Space slots for mounting cable rack arms at 8 inch intervals.

### 2.10.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

### 2.10.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

## 2.11 CABLE TAGS IN MANHOLES

Provide polyethylene tags for each power cable located in manholes. Do not provide handwritten letters. The first position on the power cable tag denotes the voltage. The second through sixth positions on the tag identifies the circuit. The next to last position denotes the phase of the circuit and include the Greek "phi" symbol. The last position denotes the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

### 2.11.1 Polyethylene Cable Tags

Provide tags of polyethylene having an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag, having a minimum loop tensile strength of 175 pounds and black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

## 2.12 LOW VOLTAGE ABOVE GROUND TERMINATION PEDESTAL

Provide copolymer polypropylene, low voltage above ground termination pedestal manufactured through an injection molding process. Pedestals must resist fertilizers, salt air environments and ultra-violet radiation. Pedestal top must be imprinted with a "WARNING" and "ELECTRIC" identification. Pedestal must contain four lay-in six port connectors,

NEMA C119.4, Class "A", dual rated for aluminum or copper, and capable of terminating conductors ranging from 10 AWG to 500 kcmil. Protect each connector with a clear, hard lexan (plastic) cover. Provide pedestal with rust-free material and stainless steel hardware that is lockable.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

### 3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

### 3.3 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

#### 3.3.1 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

#### 3.3.2 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor, locate the irons a minimum of 6 inches from the edge of the sump, and in the walls, locate the irons within 6

inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 4 inches and must be designed to withstand a minimum pulling-in load of 6000 pounds. Hot-dip galvanize irons after fabrication.

### 3.3.3 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 3 feet apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks are as follows:

- a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.
- b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel must be steel of the same length as "vertical rack channel;" and cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.
- c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

### 3.3.4 Field Painting

Clean cast-iron frames and covers not buried in concrete or masonry of mortar, rust, grease, dirt and other deleterious materials, and coat with bituminous paint.

### 3.4 DIRECT BURIAL CABLE SYSTEM

Direct-bury cables in the earth below the frostline to the requirements of NFPA 70 and IEEE C2, whichever is more stringent.



### 3.4.1 Trenching

Excavate trenches for direct-burial cables to provide a minimum cable cover of 24 inches below finished grade for power conductors operated at 600 volts or less, and 30 inches below finished grade for over 600 volts in accordance with IEEE C2. When rock is encountered, remove to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch. Bottoms of trenches must be smooth and free of stones and sharp objects. Where materials in bottoms of trenches are other than sand, a 75 mm 3 inch layer of sand must be laid first and compacted to approximate densities of surrounding firm soil. Trenches must be not less than 8 inches wide, and must be in straight lines between cable markers. Bends in trenches must have a radius of not less than 36 inches.

### 3.4.2 Cable Installation

Unreel cables along the sides of or in trenches and carefully place on sand or earth bottoms. Pulling cables into direct-burial trenches from a fixed reel position is not permitted, except as required to pull cables through conduits under paving or railroad tracks.

Where two or more cables are laid parallel in the same trench, space cables laterally at not less than 3 inches apart, except that communication cable must be separated from power cable by a minimum distance of 12 inches.

Where direct-burial cables cross under roads or other paving exceeding 5 feet in width, install such cables in ducts. Extend ducts at least 5 feet beyond each edge of any paving. Cables may be pulled into duct from a fixed reel where suitable rollers are provided in the trench. Where direct burial cable transitions to duct-enclosed cable, center direct-burial cables in duct entrances, and a waterproof nonhardening mastic compound must be used to facilitate such centering. If paving or railroad tracks are in place where cables are to be installed, coated rigid steel conduits driven under the paving or railroad tracks may be used in lieu of concrete-encased ducts. Prevent damage to conduit coatings by providing ferrous pipe jackets or by predrilling. Where cuts are made in any paving, restore the paving and subbase to their original condition. Where cable is placed in duct (e.g. under paved areas, roads, or railroads), slope ducts to drain.

## 3.5 UNDERGROUND CONDUIT AND DUCT SYSTEMS

### 3.5.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor above medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Terminate all PVC conduit end points in utility holes, switching cabinets, transform handholes and buildings with end bells. The bell end of the conduits that enter manholes and handholes must be flush with the wall.

Perform changes in ductbank direction as follows:

- a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.
- b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.
- c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections allowed for use in field manufactured longsweep bend: 30 degrees.

### 3.5.2 Treatment

Keep ducts clean of concrete, dirt, or foreign substances during construction. Make field cuts requiring tapers with proper tools and match factory tapers. Use a coupling recommended by the duct manufacturer whenever an existing duct is connected to a duct of different material or shape. Store ducts to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Thoroughly clean ducts before being laid. Store plastic ducts on a flat surface and protected from the direct rays of the sun.

### 3.5.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

### 3.5.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, must be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, install rigid steel conduit because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks must be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers.

### 3.5.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

### 3.5.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

### 3.5.7 Conduit Plugs and Pull Rope

Provide new conduit indicated as being unused or empty with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

### 3.5.8 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 24 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified on the drawings.

#### 3.5.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Extend concrete encasement at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 24 inches below finished grade.

### 3.5.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 18 inches below finished grade, except under roads and pavement, concrete envelope must be not less than 24 inches below finished grade. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies, prevent floating during concrete pouring by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide steel reinforcing in the concrete envelope as indicated.

#### 3.5.9.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

#### 3.5.9.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

#### 3.5.9.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

#### 3.5.9.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks. Abandon in place those no longer used ducts and cables which do not interfere with the work.

#### 3.5.9.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

#### 3.5.9.6 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

#### 3.5.10 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air,

insects, and vermin.

### 3.6 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with wire shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

#### 3.6.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

### 3.7 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

#### 3.7.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

### 3.8 CONDUCTORS INSTALLED IN PARALLEL

Group conductors such that each conduit of a parallel run contains one Phase A conductor, one Phase B conductor, one Phase C conductor, and one neutral conductor.

### 3.9 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

#### 3.10 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in

water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

#### 3.10.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

### 3.11 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 20 ohms.

#### 3.11.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 12 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded. If the specified ground resistance is not met, provide an additional ground rod in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

#### 3.11.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

#### 3.11.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

#### 3.11.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of

installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

#### 3.11.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

#### 3.12 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70.

##### 3.12.1 Reconditioning of Surfaces

###### 3.12.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

#### 3.13 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

##### 3.13.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Place slab on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

##### 3.13.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

### 3.14 FIELD QUALITY CONTROL

#### 3.14.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

##### 3.14.1.1 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

###### a. Visual and Mechanical Inspection

- (1) Inspect exposed cable sections for physical damage.
- (2) Verify that cable is supplied and connected in accordance with contract plans and specifications.
- (3) Verify tightness of accessible bolted electrical connections.
- (4) Inspect compression-applied connectors for correct cable match and indentation.
- (5) Visually inspect jacket and insulation condition.
- (6) Inspect for proper phase identification and arrangement.

###### b. Electrical Tests

- (1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.
- (2) Perform continuity tests to insure correct cable connection.

##### 3.14.1.2 Grounding System

###### a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

###### b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.



3.14.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 40 60 00

PROCESS CONTROL  
05/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 (2014; Errata 2016) Electric Meters - Code for Electricity Metering

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.8 (2018; Supplement 2018) Gas Transmission and Distribution Piping Systems

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142 (2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book

IEEE C37.90 (2005; R 2011) Standard for Relays and Relay Systems Associated With Electric Power Apparatus

IEEE C37.90.1 (2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61131-3 (2013) Programmable Controllers - Part 3: Programming Languages

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 3	(2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 79	(2015) Electrical Standard for Industrial Machinery

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250	(1991) Calibration Services Users Guide
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices
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UNDERWRITERS LABORATORIES (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 1059	(2019; Reprint Jun 2021) UL Standard for Safety Terminal Blocks
UL 508A	(2018; Reprint Jul 2018) UL Standard for Safety Industrial Control Panels

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Contractor Design Drawings

Draft As-Built Drawings

SD-03 Product Data

Control Drawings

Sensors and Meters

Performance Verification Test (PVT)

SD-06 Test Reports

Testing, Adjusting and Commissioning

Performance Verification Test (PVT)

Endurance Test

SD-07 Certificates

Control and Sensor Wiring

Ground Rods

Wiring

Installation

SD-10 Operation and Maintenance Data

Training Manual

Control System

SD-11 Closeout Submittals

Final As-Built Drawings

1.3 SITE ENVIRONMENTAL CONDITIONS

The expected site environmental conditions are a minimum of 25 degrees F and a maximum of 110 degrees F.

1.4 SEQUENCING

TABLE I: PROJECT SEQUENCING specifies the sequencing of submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column) and activities as specified in PART 3 EXECUTION (denoted by an 'E' in the 'TYPE' column).

1.5.1 Sequencing for Submittals

The sequencing specified for submittals is the deadline by which the submittal must be initially submitted to the Government. Following submission there will be a Government review period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within 14 days of notification that the submittal has been rejected. Upon re-submittal there will be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

### 1.5.2 Sequencing for Activities

The sequencing specified for activities indicates the earliest the activity may begin.

### 1.5.3 Abbreviations

In TABLE I the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

The Contractor shall provide, through the services of a single Control Systems Integrator (also referred to as CSI), all components, system installation services, as well as all required and specified ancillary services, in connection with expanding and modifying the existing Process Instrumentation and Control System as specified herein. The Contractor shall be ultimately responsible for the installation; however, the Control System Integrator (CSI) shall include such services as to ensure that the system is installed as specified while also meeting the quality practices of the CSI. The Control System Integrator shall also coordinate this work with the Contractor to ensure that the proper control system interfaces, site preparation, and equipment installation and testing services are provided. The Contractor's responsibilities, as distinct from the Control System Integrator's responsibilities, shall be to provide all additional materials and work necessary to supplement the materials and work provided by the Control System Integrator; thereby satisfying all requirements specified within this section. The Contractor shall be responsible for coordinating interfaces between Process Instrumentation and Control System equipment provided under the Process Control specification section and the equipment provided under other sections of the specifications. The Contractor shall verify and coordinate space requirements, process equipment power supply and voltage, process equipment control power supply and voltage, compatibility of control signals, details of equipment installation and interconnection. Coordination shall include distribution of approved shop drawings to all vendors, subcontractors, etc., involved in the control interface. Likewise, the Contractor shall ensure that instrumentation and control devices provided under other sections of the specifications are compatible and of the same quality and characteristics as similar devices specified herein.

The process control system must be expanded/modified to monitor and control the operation of process equipment as specified herein as shown on the drawings and described in the specifications. The process control system must provide for operator interaction, overall process control system supervision, and process equipment control and monitoring. The system must adhere to Section 25 05 11 CYBERSECURITY OF FACILITY-RELATED CONTROL SYSTEMS. Provide hardware configured and sized to support expansion as specified and shown on the drawings. The existing process instrumentation and control system work stations and OITs shall be purged of all screens no longer in use.

The process control system must be complete including sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, engineering units conversions and algorithms for the applications; and must maintain the specified end-to-end process control loop accuracy from the sensor to

display and final control element. Connecting conductors must be suitable for installed controls. Enclosures must be rated for NEMA 4X.

#### 2.1.1.1 General Requirements

Control System Integrator Qualifications: Control System Integrators shall meet or exceed the following qualifications. Upon request by the Contracting Officer and prior to award of the contract, the Contractor shall be required to demonstrate compliance with the stated qualification requirements:

- a. Organization that has been established for a minimum of five years and actively involved in the business of process control and instrumentation systems integration and has adequate plant facilities, organization structure, manpower, and technical and managerial expertise to properly perform the work under and in conformance with these specifications.
- b. Involvement in five (minimum) projects of similar scope and size involving the design, integration, installation, testing and commissioning of process instrumentation, control equipment, and software currently used by the existing process instrumentation and control system at the wastewater treatment plant. One of these projects shall have been within 100 road miles of the MCAS Cherry Point industrial treatment plant.
- c. The Control System Integrator shall have field service staff located within 175 road miles from the MCAS Cherry Point wastewater treatment plant.

The existing plant process instrumentation and control system consists of various PLC control panels with local Operator Interface Terminals (OITs) and two PC based operator workstations (OWSs) all interconnected by a fiber optic and Cat 5E Ethernet network. Existing PLCs are Allen-Bradley SLC 5/05s with the following I/O modules: 1746-IA16 AC Input Module, 1746-OW8 or 16 Relay Output Modules, 1746-NI4 or 8 Analog Input Modules, and 1746-NO4I or 8 Analog Output Modules. PLCs are to be replaced with updated Allen Bradley models. Existing OITs are Red Lion Model G310S000. The OWSs are PC based computers running VT SCADA HMI software. Network process device communications is provided over the Ethernet network using Allen-Bradley's Ethernet IP communications protocol. Existing Ethernet switches are either Phoenix Contact Model 2891453 (1 FL port, 4 RJ45 ports) in small PLCs or Phoenix Contact Model 2832328 with associated modules for fiber and RJ-45 ports.

PLC, OIT, and network components shall be upgraded in place with components as specified herein, and as shown on the contract drawings.

#### 2.1.2 1.3.2.1 Process Controller Programming Functional Requirements

The following paragraphs describe general configuration tasks that are required for the system process controller(s) (PAC, PLC, etc.) also referred to as PLC(s). These tasks shall be programmed in any applicable PLC. Each PLC may have multiple instances of each of these tasks, or may have no instances of some or all of these tasks.

Available Process Values. All PLC-generated process alarm, equipment status, and process variable values shall be available at any operator workstation HMI. If provided, all local PLC-generated process alarm,

equipment status, and process variable values shall be available at the local operator interface terminal (OIT) HMI.

Flow Values. All flow values shall be integrated, totalized, and stored in the PLC registers so the values displayed on the HMI and on the field processor will be identical. Flow totals shall reset daily unless specifically stated otherwise in the control description. Daily flow totals shall be logged historically prior to reset.

System Failure. Failure of a PLC shall result in safe shutdown of associated process equipment. Interposing relays shall be provided where required to assure that equipment will revert to its fail-safe condition. Failure of any PLC or its communication shall be alarmed on the HMI.

PLC Variable Definition. The PLC memory shall include both field I/O points and internally generated points required for programming. All field I/O points and internal programming points shall be fully defined according to variable naming conventions approved by Owner. As a minimum, each variable shall be provided with a tag name, description, and variable memory type.

Analog Scaling. Each analog input and output will be appropriately scaled for use in internal PLC programming, monitoring by the HMI, or transmission to other PLCs. Requirements for raw value scaling shall be coordinated with the HMI software to ensure compatibility.

Equipment Runtimes. Each PLC shall accumulate a runtime value in hours for each equipment "run status" monitored by the respective PLC. The runtime calculation shall have a minimum resolution of 3.6 seconds and shall be provided with sufficient significant digits to accumulate for a minimum period of 5 years before resetting to zero. The accumulated value shall be available for display on the HMI and it shall be possible to reset the runtime value to an entered non-zero value by staff at a supervisor level or higher. Equipment runtime values shall be provided with high value alarm notification for maintenance notification and historically logged at the end of each day.

Control Failure Alarms. When equipment is controlled from the PLC, discrete output commands (e.g. start, stop, open, close, etc.) shall be compared to their respective process feedback status signal (e.g. run, open, close, flow, etc.) when available to verify proper execution. If the feedback status does not match the most recent output command (after an adjustable 2 to 300 second time delay), a control failure or discrepancy alarm shall be annunciated on the HMI, requiring operator acknowledgment. The alarm shall remain energized until the proper discrete condition is sensed or until the operator resets the alarm through the HMI.

Equipment Failure Counters. Equipment failures shall be counted and historically logged. An automatic reset shall reset this value to zero monthly after it has been recorded historically by the system.

#### 2.1.3 1.3.2.2 Human Machine Interface (HMI) Programming Functional Requirements

The following paragraphs describe general configuration tasks that are required for the system HMI software at the operator workstations (OWSs) and operator interface terminals (OITs).

Supervisory and Local HMIs. Computer based operator workstations or panel

mounted operator interface terminals shall provide HMI access to all processes monitored and controlled by the individual Control Panel. Locally mounted operator interface terminals shall provide HMI access to the local processes monitored and controlled by the associated local PLC and shall have additional functionality if specified elsewhere. Locally mounted operator interface terminals shall have their own SCADA database to provide local monitoring and control even if network access to remote equipment is interrupted.

All process parameters shall be historically trended with predefined trend screens/groups configured for easy viewing. As a minimum this shall include all analog inputs, calculated variables, and PID control process setpoints. Trend pens shall be grouped logically per process and control loop. Trends shall be provided for each PID control process with process, setpoint, and output displayed together for ease of loop tuning.

Alarms. Complete system alarming shall be configured. OIT alarm summaries shall be provided with and acknowledge all action. All process or system alarms shall appear on an alarm summary screen and the alarm banner of each process graphic. Alarms and events shall be color coded on the alarm summary screen, with initial colors based on Owner conventions or the default colors associated with the graphics package. The colors may be adjusted after meeting with Government. Alarm prioritizing and area assignments (if any) shall be coordinated with Government at the first configuration meeting. Additional alarms may be requested during construction and startup for any analog process value in addition to what is shown on the P&IDs or specified herein to include low-low, low, high, and high-high alarm values. Nuisance alarms shall be suppressed for process values that may spike or be irregular by providing an adjustable time delay (1-99 seconds) before alarming. At a minimum, all pressure nuisance alarms shall be suppressed. All alarms/events shall be time stamped when displayed or printed. Unacknowledged alarms shall not automatically clear from the alarm summary if they return to normal before being acknowledged.

Process screens shall be drawn similar to P&ID diagrams. All equipment monitored or controlled shall be shown as well as any valves, gates, pumps, motorized equipment, chemical injection points, within the process piping. Small and otherwise insignificant non monitored equipment may be excluded at the owner's approval. Process lines shall be shown as solid lines of varying thickness to coincide with pipe or channel size with color matching as possible the pipe and structure painting in the 10 States Standards for water and wastewater.

All process I/O and calculated variables shall be displayed on screens. Where timers are used for control functions their count and preset shall be displayed. Where a PID is used for control of a process the process value and setpoint shall be displayed. All totalizers shall be displayed with their associated flows. All runtimes shall be displayed near their associated equipment or within the equipment popup screen.

The following OWS HMI screens shall be provided or modified if existing for the new process and equipment.

Menu Screen - Update navigation links for new screens.

Plant Overview - Show new PLC's, provide screen navigation links.

Electronic Online O&M Manuals - Update with new electronic O&M



files and provide links for viewing.

Communications Overview - Add new equipment and remove demolished equipment. Provide existing PLC screen functionality for new PLCs.

Provide new PLC status screens for each new PLC with functionality like existing PLC status screens.

Runtimes - Add new equipment runtimes. Remove demolished equipment.

Reports - Add new process values to reports per Government. Removed demolished equipment values. Correct any report calculations due to changes.

Equipment Overview - update all equipment, valves, structures and devices to reflect changes made through demolition or completion of new work.

#### 2.1.4 1.3.2.3 Typical Motorized Equipment Control Description

These control requirements are in addition to those in process specific control descriptions unless stated otherwise.

DERIVED ALARMS: Discrepancy Alarm (Fail to Run or Stop when controlled in Remote after an adjustable timer), Common Failure (if multiple failure signals are provided for equipment).

DERIVED INDICATIONS: Runtime, Start Counter, Fail Counter, Interlock Timer: If equipment is not starting or stopping on an operators command due to a timed interlock, a timer shall be displayed letting the operator know the action has been delayed.

PLC POWERUP: On PLC powerup, control of the equipment shall be set to Remote Manual mode.

POWER FAILURE: Control of the equipment shall resume with the control mode established prior to the power failure.

HMI REQUIREMENTS: The equipment shall be depicted on the process HMI display. The display layout shall be similar to the P&ID. The equipment symbol shall be a selectable target that retrieves the respective control overlay display.

#### 2.1.5 1.3.3 Process Instrumentation

Process instruments shall be as specified herein with options provided, in accordance with the Process Instrumentation Schedule appended to the end of this specification and as shown on the drawings.

#### 2.1.6 Operation

The process control system provided under this specification must operate using a combination of sequential function charts, function block diagrams, structured text, instruction, and ladder logic type as defined in IEC 61131-3 and supervisory control to provide the required sequences of operation. Input data to the controller must be obtained by using

instruments and controls interfaced to mechanical, electrical, utility systems and other systems as shown and specified. All required setpoints, settings, alarm limits, and sequences of operation must be as identified in section 3.3 below.

#### 2.1.7 Points

Provide inputs to and outputs from the process control system in accordance with the Input/Output (I/O) Summary Table indicated. Each connected analog output (AO), analog input (AI), binary output (BO), binary input (BI), pulse accumulator (PA) input and other input or output device connected to the control system must represent a "point" where referred to in this specification.

#### 2.1.8 System Reliability

The system must be designed for maximum reliability, safety and integrity while maintaining an availability of 99.99% or better.

### 2.2 MATERIALS AND EQUIPMENT

#### 2.2.1 Product Certifications

Computing devices, as defined in FCC Part 15, supplied as part of the process control system must be certified to comply with the requirements of Class B computing devices.

#### 2.2.2 Standard Products

Materials and equipment must be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment must be products of a single manufacturer. Items of the same type and purpose must be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Government.

#### 2.2.3 Nameplates

Each major component of equipment must have the manufacturer's name and address, and the model and serial number in a conspicuous place. Laminated plastic nameplates must be provided for equipment devices and panels furnished. Each nameplate must identify the device, such as pump "P-1" or valve "VLV-402". Labels must be coordinated with the schedules and the process and instrumentation drawings. Laminated plastic must be 1/8 inch thick, white with black center core. Nameplates must be a minimum of 1 by 3 inches with minimum 1/4 inch high engraved block lettering. Nameplates for devices smaller than 1 by 3 inches must be attached by a nonferrous metal chain. All other nameplates must be attached to the device.

### 2.3 GENERAL REQUIREMENTS

Equipment located outdoors, not provided with climate controlled enclosure, must be capable of operating in the ambient temperature range. Equipment and wiring must be in accordance with NFPA 70, with proper consideration given to environmental conditions such as moisture, dirt, corrosive agents, and hazardous area classification.

## 2.4 SENSORS

### 2.4.1 Transmitter

Unless indicated otherwise, each sensor must be provided with a transmitter, selected to match the sensor. Except where specifically indicated otherwise on the drawings, the transmitter must be provided with a four digit or analog visual display of the measured parameter and shall must a 4 to 20 mAdc output signal proportional to the level of the measured parameter. Accuracy must be plus or minus percent of full scale reading with output error not exceeding plus or minus 0.25 percent of the calibrated measurement. Transmitter must be located where indicated, mounted integrally with the sensor, pipe mounted, wall mounted or installed in the control panel. The distance between the sensor and transmitter must not exceed the manufacturer's recommendation. Field preamplifiers and signal conditioners must be included when necessary to maintain the accuracy from sensor to the programmable logic controller or recorder.

### 2.4.2 Off-Gas or Vapor Service

Sensors and meters in off-gas or vapor service shall be rated for continuous duty service at fluid approach velocities from 500 to 5000 fpm with correspondingly higher constriction velocities over a fluid temperature range from minus 0 degrees F to 105 degrees F at pressures from minus 7.2 psi gage up to 15 psi gage.

### 2.4.3 Liquid Service

Sensors and meters in liquid service shall be rated for continuous duty service at fluid approach velocities from 2.5 ft/s to 15 ft/s with correspondingly higher constriction velocities over a fluid temperature range from 32 degrees F to 105 degrees F at pressures up to 50 psi gage.

### 2.4.4 Flow Rate Sensors and Meters

Liquid flow indication must be provided in gpm. Off-gas or Vapor flow indication must be provided in cubic feet per minute. Pressure taps must incorporate appropriate snubbers. Unless indicated otherwise, the flow transmitter must produce a signal that is proportional to the volumetric flow rate, compensated for fluid temperature, and must have an accuracy of plus or minus 1 percent of full flow. Flow transmitter must be located within 15 feet of the flow element. The flow transmitter must include a digital readout of the volumetric flow rate to 3 significant figures. The controller must be provided with a minimum of three sets of dry contacts rated in accordance with NEMA ICS 1. The first set of contacts must close when the lower (warning) detection level has been exceeded. The second set of contacts must close when the upper (alarm) detection level has been exceeded. The third set of contacts must close when a controller malfunction has occurred, including loss of power or loss of sensor input. The alarm levels must be individually adjustable. The controller must be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller must provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller must be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost. Flow rate must be controlled to within plus or minus 3 percent of the design flow.

#### 2.4.4.1 Magnetic Flowmeter

Magnetic flowmeter must be non-intrusive, DC pulse type and must measure fluid flow through the use of a self-generated magnetic field. The meter must have automatic zeroing circuitry. The magnetic flow element must be encapsulated in type 300 stainless steel. Flowmeter must be capable of measuring up to a maximum flow velocity of 10 fps. The metering tube must be constructed of 316 stainless steel. The meter must be rated for a process temperature range of 32 to 212 F ambient. The maximum pressure drop across the meter and appurtenances must be 5 psi at the maximum flow rate.

#### 2.4.4.2 Turbine Meters

Turbine meters wetted metal components must be series 316 stainless steel with an accuracy of plus or minus 1 percent from 30 percent to 100 percent of actual flow. Meter shall have an integral digital display capable of indicating instantaneous and totalized flow. The meter must provide a 4-20 mA dc output signal to the programmable logic controller, proportional to the flow.

#### 2.4.5 Level Instrumentation

Pressure taps must incorporate appropriate snubbers. Relays and housing must be intrinsically safe or explosion proof as required by the NFPA hazard rating for compatibility with the contents of the tank or sump.

##### 2.4.5.1 Submersible Level (Pressure) Transducer

The level transducer shall consist of a non-fouling type submersible pressure sensor that is suitable for direct submersion into the thickened solids wastewater process. Sensor diaphragm shall be 1 inch diameter minimum. The sensor shall be a solid-state variable capacitance or diffused silicon semiconductor type that shall provide an output signal directly proportional to the sensed pressure over a factory-calibrated range. The sensor assembly shall have a stainless steel or titanium housing and shall be supported by a Teflon, polyethylene or urethane jacketed cable with a minimum 200 pound test strength. The sensor cable shall be of sufficient length so that no splice or connector is required in a wet, hazardous, or inaccessible area. The vent tube termination point shall be protected from dirt and moisture by a NEMA 4X termination box that includes a bellows or bladder bag and signal surge protection as required.

The transmitter shall have a two-wire type 4-20 mA dc current output that is proportional to level. The output shall have surge protection, and shall not be damaged by reverse polarity. The transmitter shall be suitable for an operating temperature range of 0° to +50°C. Accuracy of the level transmitter shall be  $\pm 0.25$  percent "best straight line", with an overall combined accuracy of  $\pm 1$  percent over the entire operating temperature/pressure range.

Submersible pressure transmitters provided to measure level in tanks or wetwells indicating "scum" or "sludge" shall be provided with an integral large shielded diaphragms specifically designed for sludge and high viscous materials. All submersible pressure transmitters shall be rated for Class 1 Division 1 service.

Acceptable Manufacturers: Contegra or equal as provided by Measurement Specialties (KPSI), Keller, Endress + Hauser, or Siemens.

#### 2.4.5.2 Displacement Type Level Switch

Liquid level switch must be displacement type, having a minimum of two tandem floats with each float independently activating a set of Form C contacts at two different level settings. Each switch must have an adjustable differential band. The mounting connections must be threaded, flanged or surface mounted to suit the application. All surfaces in contact with the tank contents must be austenitic stainless steel. The switch enclosure must be explosion proof for use in a hazardous environment, complete with a sealed water tight junction box, terminal block, and mounting plate. Each set of contacts must be snap action, dry contact type with one normally open and one normally closed, contact rated in accordance with NEMA ICS 1. The switch must be actuated by a magnetically equipped stainless steel displacer. Repetitive accuracy must be plus or minus 1/4 inch of actual displacer setting.

#### 2.4.5.3 Sludge Blanket Level Probe

In the upflow clarifiers, there will be sludge level monitors provided in each tank. The monitors shall be ultrasonic and transmit a 4-20 mAc signal to the PLC for display at the Operator's Workstation. The probes shall be provided with large shielded diaphragms specifically designed for activated wastewater and high viscous materials. The unit shall also be supplied with a local controller that displays the sludge blanket level in the respective tank. Measurement range of the unit shall be 0.6 to 40 feet. Resolution of the unit shall be 0.09 feet. Accuracy shall be +/- 0.33 feet. Operating Temperature of 35 to 122 degrees Fahrenheit. The materials of construction shall be a silicon wiper, stainless steel body, and polyoxymethylene face. Cable length is 33 feet. Units shall be factory calibrated. A lever type sensor support shall be provided that will allow for the sensor to lift out of the water and lower back into position with each pass of the clarifier scum arm without any damage to the mount or level probe.

#### 2.4.6 Pressure Instrumentation

Pressure taps shall incorporate appropriate snubbers.

##### 2.4.6.1 Pressure Controller

The controller must be provided with a minimum of three sets of dry contacts rated in accordance with NEMA ICS 1. The first set of contacts must close when the lower (warning) detection level has been exceeded. The second set of contacts must close when the upper (alarm) detection level has been exceeded. The third set of contacts must close when a controller malfunction has occurred, including loss of power or loss of sensor input. The alarm levels must be individually adjustable. The controller must be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller must provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller must be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost. Pressures must be controlled to within plus or minus 5 percent of design pressures.

##### 2.4.6.2 Pressure Sensor and Transducer

The sensing element must be either capsule or diaphragm type. The pressure transducer must withstand up to 150 percent of rated pressure, with an

accuracy of plus or minus 1 percent of full scale selected to put the design range of the measured pressure in the middle third of the transducer's range. Pressure must be measured in psi gage with a range, plus or minus 10 percent of design range and must be furnished with display to the nearest 0.1 psi. The transmitter output error must not exceed 0.1 percent of calibrated span.

#### 2.4.6.3 Pressure Switch

Sensors must be diaphragm or Bourdon tube and must be constructed of 316 stainless steel. Pressure switch must have a repetitive accuracy of plus or minus 5 percent of the operating range and must withstand up to 150 percent of rated pressure.

Switch actuation set point must be adjustable over the operating pressure range with a differential adjustment span of 20 to 40 percent of the range of the switch. The switch must have Form C snap-action contacts rated in accordance with NEMA ICS 1.

#### 2.4.7 Process Analytical Instrumentation

Probes must be easily removable without interrupting service. Sensor and controller construction must be suitable for operation in the monitored medium. The controller must be provided with a minimum of three sets of dry contacts rated in accordance with NEMA ICS 1. The first set of contacts must close when the lower (warning) detection level has been exceeded. The second set of contacts must close when the upper (alarm) detection level has been exceeded. The third set of contacts must close when a controller malfunction has occurred, including loss of power or loss of sensor input. The alarm levels must be individually adjustable. The controller must be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller must provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller must be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost.

##### 2.4.7.1 Oxygen Reduction Potential (ORP)

The sensor must be submersible type. Sensor must have a redox potential range of plus or minus 1500 mV and must have an accuracy of plus or minus 1 percent of sensor span. The sensor must automatically compensate for temperature over the temperature range. The sensor body must be PVC, CPVC, Liquid Crystal Polymer (LCP) or epoxy and suitable for installation in the environment.

##### 2.4.7.2 pH Monitoring

The sensor shall be submersible. Sensor shall have a range of -2 pH units to 14 pH units and shall have an accuracy of plus or minus 0.01 pH unit. The sensor shall automatically compensate for temperature over the temperature range. All mounting and retrieval hardware shall be provided by the manufacturer and made of corrosive resistant materials. Each new pH and ORP sensor shall have a new Hach sc200 Universal Controller. These units are used throughout the WWTP and alternates will not be accepted.

#### 2.4.8 Emergency Stop

Emergency stop pushbutton must have red mushroom actuator and yellow background. Actuator must be self-latching and manually reset. Contacts shall be NEMA ICS A600 and directly opened. Pushbutton must meet NFPA 79

## SECTION 10.7.

### 2.5 PROGRAMMABLE LOGIC CONTROLLER (PLC)

#### 2.5.1 PLC General Requirements

PLCs must be micro-processor based, capable of receiving binary and analog inputs and, through programming, must be able to control binary and analog output functions, perform data handling operations and communicate with external devices. PLCs must meet the requirements of Class A computing devices, and must be labeled as set forth in 47 CFR 15 and must be able to withstand conducted susceptibility test as outlined in NEMA ICS 1, NEMA ICS 2, NEMA ICS 3, and IEEE C37.90.1. PLCs must function properly at temperatures between 32 and 122 degrees F at 5 to 95 percent relative humidity non-condensing and must tolerate storage temperatures between minus 40 and plus 140 degrees F at 5 to 95 percent relative humidity non-condensing. PLCs shall be Allen Bradley Series Compact Logix (1769-L3xER) for the WWTP and Micrologix 1400 for the post aeration facility near the golf course . Alternates will not be accepted.

#### 2.5.2 Modular PLC

PLCs must be based on a modular, field expandable design allowing the system to be tailored to the process control application. The system must be expandable through the use of additional hardware and/or user software. As a minimum, the PLC must include a mounting backplane, power supply module, central processing unit (CPU) module, communications module, and input/output (I/O) module. The modules must be grouped together in a mounting rack or cabinet. The mounting rack backplane must provide the communications mechanism to fully integrate the individual modules located within the rack. Modules other than I/O modules must plug directly into the backplane. The use of wire connectors between modules will not be allowed except for expansion of the system to include multiple backplanes. The rack size must be as needed to hold the equipment necessary while performing the required control functions.

##### 2.5.2.1 Central Processing Unit (CPU) Module

The CPU module must be a self-contained, microprocessor based unit that provides time of day, scanning, application program execution, storage of application programs, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self-diagnostics. The scan time must be 250 milliseconds or better including spare I/O channels. CPU modules shall be sized for each PLC cabinet to include all existing I/O modules, as well as any additional I/O modules required under this scope of work

##### 2.5.2.2 Communications Module

The communications module must allow peer-to-peer communication with other existing PLCs and must allow the PLC to communicate with the Operator's Workstation. The communication module must utilize the manufacturer's standard communication architecture and protocol, ethernet architecture and protocol or a combination of these. The communication module must allow programming of the PLC to be done locally through the use of a laptop computer or from the central station or remote workstation.

#### 2.5.2.3 Power Supply Module

One or more power supply modules must be provided as necessary to power other modules installed in the same cabinet. Power supply modules must plug directly into the backplane. Auxiliary power supplies may be used to supply power to remote cabinets or modules.

- a. Power supply modules must use AC power with a nominal voltage of 120 VAC plus or minus 5 percent. The power supply module must monitor the incoming line voltage level and must provide over current and over voltage protection. If the voltage level is detected as being out of range the power supply module must continue to provide power for an adequate amount of time to allow for a safe and orderly shutdown. Power supply modules must be capable of withstanding a power loss for a minimum of 20 milliseconds while still remaining in operation and providing adequate power to all connected modules.
- b. Each power supply module must be provided with an on-off switch integral to the module. If the manufacturer's standard power supply module is not provided with an on-off switch, a miniature toggle type switch must be installed near the PLC and must be clearly labeled as to its function..
- c. Provide power supply modules with an indicating light which must be lit when the module is operating properly.

#### 2.5.2.4 Input/Output (I/O) Modules

Modules must be self-contained, microprocessor based units that provide an interface to field devices. The modules must be located in the same cabinet as the other PLC components. Each module must contain visual indication to display the on-off status of individual inputs or outputs. Each I/O must be protected against reversal of polarity of the signal. Analog inputs and analog outputs must have 'open, short and out of range circuit' detection. It must be configurable per channel. I/O modules shall have similar performance characteristics to the existing modules.

#### 2.5.3 Program Storage/Memory Requirements

The CPU must utilize the manufacturer's standard non-volatile memory for the operating system. The controller must have electronically readable and writable nonvolatile memory (EPROM, EEPROM, or Flash PROM) for storage of user programs. The user programs must be loaded through the controller keypad, central station or through the use of a laptop computer. The CPU memory capacity must be based on the system's control requirements. The memory capacity must be sized such that, when the system is completely programmed and functional, no more than 50 percent of the memory allocated for these purposes is used.

#### 2.5.4 Input/Output Characteristics

Each controller shall allow for analog input, analog output, discrete input and discrete output. The number and type of inputs and outputs for the system shall be as shown on the drawings and shall comply with the sequence of control. The system capacity shall include a minimum of 20 percent spare input and output points (no less than two points) for each point type provided. During normal operation, a malfunction in any input/output channel shall affect the operation of that channel only and shall not affect the operation of the CPU or any other channel. Analog input



circuits shall be available in 4-20 mA. Discrete input circuits shall be available in 79-132 VAC. All input circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices. Analog output circuits shall be available in 4-20 mA. Discrete output circuits shall be available in relay contact outputs suitable for 18-26 VDC and 24-132 VAC circuits. All output circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices.

All analog I/O with signal wiring extending outside of a building shall be provided with signal surge protection devices at the PLC. Surge protection devices shall be as manufactured by Dehn, Phoenix Contact, Edco, PolyPhasor, or approved equal.

#### 2.5.4.1 Analog Inputs

Analog input circuits must be available in 4-20 mA.

#### 2.5.4.2 Binary Inputs

Binary input circuits must be available in 10-30 VDC or 79-132 VAC as required.

#### 2.5.4.3 Analog Outputs

Analog output circuits must be available in 4-20 mA.

#### 2.5.4.4 Binary Outputs

Binary output circuits must be available in 79-132 VAC relay configuration. Interposing relays shall be used to interface between PLC binary outputs and field equipment.

#### 2.5.5 Wiring Connections

Wiring connections must be heavy duty, self-lifting, pressure type screw terminals to provide easy wire insertion and secure connections. The terminals must accept two #14 AWG wires. A hinged protective cover must be provided over the wiring connections. The cover must have write-on areas for identification of the external circuits.

#### 2.5.6 On-Off Switch

Each controller must be provided with an integral on-off power switch. If the controller is not provided with a manufacturer's standard on-off switch, a miniature toggle type switch must be installed in the control panel near the controller and must be clearly labeled as to its function.

#### 2.5.7 Diagnostics

Each PLC must have diagnostic routines implemented in firmware. The CPU must continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications and input/output. The diagnostic routines must be regularly performed during normal system operation. A portion of the scan time of the controller must be dedicated to performing these housekeeping functions. In addition, a more extensive diagnostic routine must be performed at power up and during normal system shutdown. The CPU must log

input/output and system faults in fault tables which must be accessible for display. When a fault affects input/output or communications modules the CPU must shut down only the hardware affected and continue operation by utilizing the healthy system components. All faults must be annunciated at the PLC and the central station. Diagnostic software must be useable in conjunction with the portable tester. The following diagnostics must be performed:

- a. Analog Inputs: Sensor out of range, open or shorted loop, analog-to-digital converter check
- b. Analog Outputs: Open or shorted loop
- c. Configuration: Check compatibility and availability of selected I/O hardware and software
- d. Memory: Checksum, parity check End-to End CPU memory

#### 2.5.8 Accuracy

Controllers shall have an accuracy of plus or minus 0.25 percent of input span.

### 2.6 PLC SOFTWARE

All PLC software described in this specification shall be furnished as part of the complete control system unless the existing site PLC programming software is fully capable of programming the system.

#### 2.6.1 Operating System

Each PLC must be provided with the manufacturer's standard operating system software package. The PLC must maintain a point database in its memory that includes all parameters, constraints and the latest value or status of all points connected to the PLC. Execution of the PLC application programs must use the data in memory resident files. The operating system must support a full compliment of process control functions. It must be possible to define these functions using a mix of ladder logic diagrams, function blocks, sequential function charts and text programming. Programming methods and interactions must be based on IEC 61131-3. A combination of the programming methods must be possible within a single controller. The operating system must allow loading of control logic locally or from the central station in which case it shall require a password to do so and data files from the portable tester. It must also support data entry and diagnostics using an operator interface panel attached directly to the PLC. Each PLC must be capable of operating in stand alone mode.

##### 2.6.1.1 Startup

The PLC must have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A PLC restart program based on detection of power failure at the PLC must be included in the PLC software. The restart program must include start time delays between successive commands to prevent demand surges or overload trips.

#### 2.6.1.2 Failure Mode

Upon failure for any reason, each PLC must perform an orderly shutdown. Systems which are not Primary/Secondary must force all PLC outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device. Primary/Secondary systems must transfer I/O scan and control to the PLC not currently failed.

#### 2.6.2 Functions

The controller operating system must be able to scan inputs, control outputs, and read and write to its internal memory in order to perform the required control as indicated in the sequence of control on the drawings. The controller must periodically perform self diagnostics to verify that it is functioning properly.

##### 2.6.2.1 Analog Monitoring

The system shall measure and transmit all analog values including calculated analog points.

##### 2.6.2.2 Logic (Virtual)

Logic (virtual) points must be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points must be analog or binary points created by calculation from any combination of binary and analog points, or other data having all the properties of real points, including alarms, without the associated hardware. Logic (virtual) points must be defined or calculated and entered into the database. The calculated analog point must have point identification in the same format as any other analog point.

##### 2.6.2.3 State Variables

If an analog point represents more than two (up to 8) specific states, each state must be nameable. For example, a level sensor must be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

##### 2.6.2.4 Analog Totalization

Any analog point must be operator assignable to the totalization program. Up to eight analog values must be totalized within a selectable time period.

#### 2.6.3 Constraints

##### 2.6.3.1 Equipment Constraints Definitions

Each control point in the database must have PLC resident constraints defined and entered by the Contractor, including as applicable: maximum starts (cycles) per hour; minimum off time; minimum on time; high limit (value in engineering units); and low limit (value in engineering units).

##### 2.6.3.2 Constraints Checks

All control devices connected to the system must have the PLC constraints checked and passed before each command is issued. Each command point must have unique constraints assigned. High and low "reasonableness" values or

one differential "rate-of-change" value must be assigned to each AI. Each individual point must be capable of being selectively disabled by the operator from the central station.

#### 2.6.4 Command Priorities

A scheme of priority levels must be provided to prevent interaction of a command of low priority with a command of higher priority. Override commands entered by the operator must have higher priority than those emanating from applications programs.

### 2.7 CONTROL PANELS

All control panels shall be UL 508A labeled.

#### 2.7.1 Components

##### 2.7.1.1 Enclosures

The enclosure for each control panel must conform to the requirements of NEMA 250 for the types specified. Finish color must be the manufacturer's standard, unless otherwise indicated. Enclosures for installation in mechanical equipment rooms must be Type 12; those for installation in clean, dry indoor occupied space may be Type 12; other locations must be as otherwise specified or shown. Enclosures for equipment installed outdoors must be Type 4X and be stainless steel or as shown. Enclosures for installation in a corrosive environment must be Type 4X and must be constructed of stainless steel. Painted steel must not be allowed for use in a corrosive environment. Enclosure must be provided with a single, continuously hinged exterior door with print pocket, 3-point latching mechanism and key lock and a single, continuously hinged interior door.

##### 2.7.1.2 Operator Interface Terminals (OITs)

Operator Interface Terminals shall be shall be microprocessor-based flat panel type. The unit shall have data entry capabilities and shall include a password security function. The unit shall be connected to the PLC and shall display status, alarm, and diagnostic information. The unit shall provide a nominal diagonal display area dimension of 10", with a minimum resolution of 640x480, 32k color support, and an active TFT LCD display with back-light capability. The OIT shall be furnished with a minimum of 32 MB of onboard user non-volatile flash memory. The operator interface unit shall be provided with an Ethernet port for communications, and one serial RS-232 or RS-485 port for programming. The OIT shall be rated NEMA 4X / IP66, suitable for panel face mounting. Terminals shall be powered from 120 V ac, 60Hz, single phase. Terminals shall be suitable for ambient temperatures of -32 to +130°F and a relative humidity of 5 to 80 percent. One licensed copies of the OIT software used to create the screens shall be installed on the facilities existing PLC programming laptop and existing operator workstation unless the facilities existing programming software is capable of fully programming the unit.

Acceptable Operator Interface Terminal manufacturers are Red Lion, Allen-Bradley, GE, or approved equal.

OIT shall provide graphic screens that shall be used by the operators to access all functions and setpoints necessary for comprehensive control of the process whether connected to the PLC or existing PLCs. Each piece of major process equipment that is monitored and controlled by the Control

Panel shall be displayed on the graphic screens at a minimum. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. The system programmer shall use the configuration standards and conventions to be established by direct coordination with the Government that shall describe and define such items as proposed graphic display process line colors/representations; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. The OIT graphic displays and functionality shall be configured to mimic the operator controls at the operator workstation HMI package as close as possible within the constraints of the OIT's capabilities.

#### 2.7.1.3 Standard Indicator Light

Indicator lights showing on, off, stand-by, automatic, manual depending on the application must comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Lights must be heavy duty, round and must mount in a 0.875 inch mounting hole. Indicator lights must be LED type and must operate at 120 VAC or 24 VDC. Long life bulbs must be used. Indicator light must be provided with a legend plate labeled as shown on the drawings. Lens color must be as indicated on the drawings. Lights must be push to test (lamp) type.

#### 2.7.1.4 Selector Switches

Selector switches must comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Selector switches must be heavy duty, round and must mount in a 0.875 inch mounting hole. The number of positions must be as indicated on the drawings. Switches must be non-illuminated or as indicated on the drawings. Switches must be rated for 600 volts, 10 amperes continuous. Selector switches must be provided with a legend plate labeled as shown on the drawings. Where indicated or required, dual auxiliary contacts must be provided for the automatic position to provide position sensing at the central station or workstation. Auxiliary contacts must be rated for 120 VAC, 1A as a minimum. Where indicated on the drawings, switches must be key operated. All keys must be identical.

#### 2.7.1.5 Push Buttons

Push buttons must comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Push buttons must be heavy duty, round and must mount in a 22.5 mm 0.875 inch mounting hole. The number and type of contacts must be as indicated on the drawings or required by the Sequence of Control. Push buttons must be rated for 600 volts, 10 amperes continuous. Push buttons must be provided with a legend plate labeled as shown on the drawings.

#### 2.7.1.6 Relays

Relays shall comply with IEEE C37.90 and derated for altitude above 1,500 m. Relays shall be single-pole, double-throw (SPDT) double-pole, double-throw (DPDT) as required by the Sequence of Control. Relay coil shall be 120 vAc or 24 vDc and shall be provided with matching mounting socket. Power consumption shall not be greater than 3 watts.

#### 2.7.1.7 Terminal Blocks

Terminal blocks must comply with NEMA ICS 4 and UL 1059. Terminal blocks

for conductors exiting control panels must be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks must be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip must form part of the terminal block and each terminal must be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

#### 2.7.1.8 Alarm Horns

Alarm horns must be provided where indicated on the drawings. Horns must be vibrating type and must comply with UL 508. Horns must provide 100 dB at 10 feet. Exterior mounted horns must be weather proof by design or must be mounted in a weather proof enclosure that does not reduce the effectiveness of the horn.

#### 2.7.2 Panel Assembly

Control panels shall be factory assembled and shipped to the jobsite as a single unit. Panels shall be fabricated as indicated and devices shall be mounted as shown or required. Each panel shall be fabricated as a bottom or top-entry connection point for control system electrical power, control system wiring, communications system wiring. Top entry conduits must first be routed to a pull box with drain and conduit seals to prevent moisture intrusion into enclosure.

#### 2.7.3 Uninterruptable Power Supply (UPS)

Each PLC control panel shall be provided with UPS plugged into a dedicated receptacle inside the panel with UPS circuits plugged into the UPS allowing bypass of the UPS via the plug and receptacles. The unit shall be sized to provide a minimum of 10 minutes of operation of the control panel. The UPS shall incorporate surge suppression, noise filtering (normal and common mode) short circuit protection and voltage regulation (brownout and overvoltage protection). UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of low battery power. The UPS shall comply with the Federal Communications Commission Standard 15J part A for radio noise emissions. The following control panel circuits shall not be powered by the UPS: panel light, heater, and convenience receptacle.

#### 2.7.4 Grounding

Control panel enclosures must be equipped with a solid copper ground bus or equivalent. The ground bus must be securely anchored to the enclosure so as to effectively ground the entire structure. Clamp-type terminals sized large enough to carry the maximum expected current must be provided on the ground bus for grounding cables. Where a definite circuit ground is required, a single wire not less than #6 AWG must run independently to the panel ground bus and must be fastened to the ground bus with a bolted terminal lug. Cases of instruments, relays and other devices must be effectively grounded through the enclosures steel structure unless otherwise indicated. Insulated wiring having a continuous rated current of not less than the circuit fuse rating must be used for grounding. Grounding terminals of power receptacles must be solidly grounded to the panel enclosure.

#### 2.7.5 Convenience Outlet

A 120 volt ac, 20 amp, ground fault interruption (GFI) type duplex convenience outlet must be provided inside the panel. The outlet circuit must be separate from the panel power circuit.

#### 2.7.6 Panel Interior Light

Each control panel must be provided with a 15 watt LED light. The light must be operated by a manual on-off switch mounted on the interior door of the enclosure. The light must be powered by the same circuit as the convenience outlet.

#### 2.7.7 Fiber Patch Panels

Control panels shall be provided with DIN Rail mountable Fiber optic patch panels where indicated on the Drawings. All fiber optic cabling entering a control panel shall terminate within a fiber patch panel. Patch panels shall be supplied with termination panels to accept the quantity and type of fiber as shown on the Drawings.

Preterminated fiber optic patch cables shall be used to connect the patch panel to the fiber switch. Patch cables shall be no shorter than three (3) feet in length.

Fiber patch panels shall be as manufactured by Corning, Optical Cable Corporation (OCC), Black Box or Engineer approved equal.

### 2.8 COMPUTER HARDWARE

#### 2.9 OPERATOR INTERFACE TERMINALS (OITs)

Operator Interface Terminals shall be shall be microprocessor-based flat panel type. The unit shall have data entry capabilities and shall include a password security function. The unit shall be connected to the PLC and shall display status, alarm, and diagnostic information. The unit shall provide a nominal diagonal display dimension of 10", with a minimum resolution of 800x600, 16M color support, and an active TFT LCD display with back-light capability. The OIT shall be furnished with a minimum of 512 MB of onboard user non-volatile flash memory. The operator interface unit shall be provided with a minimum of One (1) 10/100Base-T Ethernet port for communications, and USB port for programming. The OIT shall be rated NEMA 4X / IP66, suitable for panel face mounting. OIT's shall be 24VDC powered. Terminals shall be suitable for ambient temperatures of -32 to +130°F and a relative humidity of 5 to 80 percent. One licensed copies of the OIT software used to create the screens shall be installed on the facilities existing PLC programming laptop and existing operator workstation unless the facilities existing programming software is capable of fully programming the unit.

Acceptable Operator Interface Terminal manufacturers are Red Lion, Allen-Bradley, Schneider Electric, or approved equal.

##### 2.9.1 OIT Display Layout

OIT shall provide graphic screens that shall be used by the operators to access all functions and setpoints necessary for comprehensive control of

the process whether connected to the PLC or existing PLCs. Each piece of major process equipment that is monitored and controlled by the Control Panel shall be displayed on the graphic screens at a minimum. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. The system programmer shall use the configuration standards and conventions to be established by direct coordination with the Government that shall describe and define such items as proposed graphic display process line colors/representations; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. The OIT graphic displays and functionality shall be configured to mimic the operator controls at the operator workstation HMI package as close as possible within the constraints of the OIT's capabilities.

## 2.10 MONITORING AND CONTROL SOFTWARE

The Contractor is to provide updates as shown on the Drawings and specified herein to the existing site Trihedral VTScada SCADA system. The Contractor is to assume the existing system has capacity to add all additional monitoring and control signals added under this scope of work.

### 2.10.1 Graphical Operations

#### 2.10.1.1 Graphical User Interface

The two existing operator workstations shall have their software modified to support the functions specified herein and to provide the like in kind functionality for the process controls that the existing plant process system provides.

#### 2.10.1.2 Display Information

The central station must display information necessary to support all requirements specified, including: operator commands; alarm notification; reports; system graphics as specified and as shown, incorporating dynamic data; and curve plotting.

#### 2.10.1.3 System Graphics Implementation

System graphics displays must be hierarchical displays which integrate dynamic data into the display. System graphics must reflect actual system configuration. Each system schematic must be included as a separate display. Different colors, textures, and use of inverted video must be used for various components and dynamic data. The displays must include standard and/or custom symbols. Any dynamic data which is not current, due to PLC communications failure, PLC failure, or point out of service, must be highlighted or flagged.

### 2.10.2 Real Time Clock Synchronization

The system must synchronize the PLC to the Operator's Workstation, real time clock, within one second and at least once per day automatically, without operator intervention and without requiring system shutdown.



### 2.10.3 Control Panel Alarms

The system must supervise each control panel, I/O function and DTS circuit for alarm reporting, including: control panel not responding; control panel responding (return to normal); control panel to central station DTS circuit high error rate; control panel to control panel DTS circuit high error rate; control panel/central station real time clock error more than 15 seconds (adjustable); control panel intrusion alarm; control panel offline; control panel online (return to normal); control panel failure (self-diagnostics); point not responding to command; and point change of state without command.

### 2.10.4 Trending

Any analog or calculated point shall be operator assignable to an HMI trend screen. Points shall be sampled at individually assigned intervals, selectable between one minute and 24 hours.

- a. The M&C Software must include a graphical display for trend configuration, creation and deletion accessible through the graphical user interface. Each trend must be user-configurable for:

- (1) Point to trend.
- (2) Sampling interval: adjustable between 1 second and 1 hour.
- (3) Start and Stop Time of Trend: Start and stop times determined by one or more of the following methods:
  - (a) Start time and stop time
  - (b) Start time and duration
  - (c) Start time and number of samples

- b. The software must be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software must be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, provide a means to export or convert the file to plain ASCII text in a CSV format.

### 2.10.5 Analog Monitoring

The system must measure, transmit, and display analog values, including calculated analog points.

### 2.10.6 Analog Totalization

Any analog or calculated point must be operator assignable to the totalization program. The analog totalization time period must be defined uniquely for each point. At the end of the period, totals must be stored on disk for future reference. Totalization must then restart from zero for the next time period. The program must keep track of the peak and total value measured during the current period and for the previous period. The operator must be able to initiate a summary of totalization information on a point, unit, sub-system or system. The operator must be able to set or reset each totalized value individually. The operator must be able to define, modify, or delete the time period online.

## 2.11 ETHERNET NETWORK SWITCHES

Industrial Ethernet Network Switches shall be furnished as shown on the Drawings for connection to the Control system network. All Ethernet network switches shall be IEEE 802.3 compliant, and sized as required to include all connections shown on the Drawings. Ethernet network switches shall be provided with all cabling and accessories required for a complete installation.

### 2.11.1 MANAGED NETWORK SWITCHES

Managed network switches shall be the DIN rail mountable industrial type, designed to operate in harsh environments, -40 to 75°C. Managed network switch base modules shall consist of a minimum of eight (8) 10/100/1000Base-TX Ethernet and two (2) 100/1000 SFP ports. Managed network switch capacity shall be expandable by means of adding an expansion module to the base module to include the total system capacity and type as shown on the contract drawings. SFP modules shall be provided as required for the type and quantity of connections required as shown on the contract drawings. Network switches shall be powered by redundant 24VDC inputs.

Managed network switches shall support Layer 2 switching, IP- and MAC-based port security, and be password protected. Switches shall support SNMP v3 management. Switches shall be DISA approved. Switches shall have diagnostic LED's for device status and individual channel status.

Managed network switches shall be Cisco Catalyst IE3300 Series, or Engineer approved equal.

### 2.11.2 MEDIA CONVERTORS

Media Convertors shall be DIN Rail mounted, 24VDC powered, provided with a minimum of one (1) 10/100 Ethernet ports for communications, and one (1) 100/1000 Fiber port suitable for the type shown on the contract drawings. Switches shall be suitable for ambient temperatures of 0 to +60°C and a relative humidity of 5 to 80 percent.

Media Convertors shall be Phoenix Contact, Red Lion, or Engineer approved equal.

## 2.12 DATA COMMUNICATION REQUIREMENTS

Control system data communications shall support the specified functions and control system configuration specified and shown on the drawings.

The workstation shall be able to initiate uploads or downloads of programs and resident data, including parameters of connected systems PLCs and devices, constraints and programs in the workstation.

### 2.12.1 Error Detection and Retransmission

Error detection and retransmission shall comply with current Ethernet standards.

## 2.13 FACTORY TEST

The process control system must be tested at the factory prior to shipment. Written notification of planned testing must be given to the Government at least 21 days prior to testing, and in no case must notice be given until after the Contractor has received written Government approval of the test procedures.

## 2.13.1 Factory Test Setup

Assemble and integrate the factory test setup as specified to prove that performance of the system satisfies all requirements of this project, including system communications requirements in accordance with the approved test procedures. The factory test must take place during regular daytime working hours on weekdays. Equipment used must be the same equipment that is to be delivered to the site. The factory test setup must include the following:

Factory Test	
central station equipment	one each of the components
workstation	one of each type
control panel	not less than two control panels: at least one of each type used in the system plus
test set	one of each type
portable tester	one of each type
communications circuits	one of each type and speed to be utilized in the proposed system including bridges, modems, encoder/decoders, transceivers and repeaters
surge protection equipment	for power, communications, I/O functions and networks
I/O functions	sufficient to demonstrate the I/O capability and system normal operation
software	software required for proper operation of the proposed system including application programs and sequences of operation

## PART 3 EXECUTION

## 3.1 FACTORY TEST

Perform factory testing of the System as specified. The Contractor is responsible for providing personnel, equipment, instrumentation, and supplies necessary to perform required testing. Provide written notification of planned testing to the Government at least 21 days prior to

testing, and do not give this notice until after receiving written Government approval of the specific Factory Test Procedures. Provide Factory Test Procedures which define the tests required to ensure that the system meets technical, operational, and performance specifications. Within the Procedures define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. Provide procedures which test all capabilities and functions specified and indicated. Perform the Factory Test using equipment and software of the same manufacturer, model and revision as will be used for the specified project. Include detailed instructions for test setup, execution, and evaluation of test results in the Procedures. Upon completion of the test, prepare a Factory Test Report, documenting the results of the Test, and submit it as specified. This report must be approved before any equipment is shipped.

Perform the Factory Test and provide Factory Test Submittals as shown in TABLE II. FACTORY TEST SEQUENCING.

### 3.2 EQUIPMENT INSTALLATION REQUIREMENTS

#### 3.2.1 Installation

Install system components and appurtenances in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Adjust or replace devices not conforming to the required accuracies. Replace factory sealed devices, rather than adjusting. Installation, adjustment, and operation of the equipment specified must be supervised by a manufacturer's representative experienced in the installing, adjusting, and testing of the equipment.

- a. Install instrumentation and communication equipment and cable grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
- b. Install wiring in exposed areas, including low voltage wiring, in metallic raceways or EMT conduit as specified on the drawings.
- c. Submit detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Piping and Instrumentation (P&ID) drawings (prepared using industry recognized device symbols, clearly defined and describing piping designations to define the service and materials of individual pipe segments and instrument tags employing Instrument Society of America suggested identifiers). Include in the Drawings, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of drawings for each process control system using abbreviations, symbols, nomenclature and identifiers as shown; valve schedules; compressed instrument air station schematics and ASME air storage tank certificates for each type and make of compressed instrument air station.

##### 3.2.1.1 Isolation, Penetrations and Clearance from Equipment

Dielectric isolation must be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the

building exteriors must be made watertight. Holes in concrete, brick, steel and wood walls must be drilled or core drilled with proper equipment; conduits installed through openings must be sealed with materials which are compatible with existing materials. Openings must be sealed with materials which meet the requirements of NFPA 70. Installation must provide clearance for control-system maintenance. Process control system installation must not interfere with the clearance requirements for mechanical and electrical system maintenance.

#### 3.2.1.2 Device Mounting

Devices must be installed in accordance with manufacturers' recommendations and as shown. Control devices to be installed in piping must be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Any deviations must be documented and submitted to the Government for approval prior to mounting. Damaged insulation must be replaced or repaired after devices are installed to match existing work. Damaged galvanized surfaces must be repaired by touching up with zinc paint.

#### 3.2.2 Sequences of Operation

Study the operation and sequence of local equipment controls, as a part of the conditions report, and note any deviations from the described sequences of operation on the contract drawings. Perform necessary adjustments to make the equipment operate in an optimum manner and must fully document changes made.

### 3.3 SCADA PLC Control

The contractor is responsible for updating all existing OIT and SCADA screens to communicate to the updated PLC programs as required for a completely functional system, in addition to providing any additional programming as outlined below.

#### 3.3.1 Headworks Sensors

##### 3.3.1.1 Local Control

Each of the new analytical instruments at the headworks, will have local readout via an SC200 analyzer (new).

##### 3.3.1.2 SCADA Automated Controls

There shall be an operator selectable low level and high level alarm for each of the devices.

##### 3.3.1.3 Signals

Signals are as shown on the Contract P&IDs.

##### 3.3.1.4 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

##### 3.3.1.5 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs pH (0-100%)
2. Date/Time vs Conductivity
3. Date/Time vs ORP

### 3.3.2 Headworks Weir Gates (SUG-100/101)

#### 3.3.2.1 Local Control

Each valve actuator is equipped with a Local-Off-Remote selector switch. When the selector switch is in the Local position, the operator shall be able to use the Open-Stop-Close positioning buttons to control the position of the weir gate levels.

#### 3.3.2.2 SCADA Automated Controls

When the selector switch for the actuator is in the Remote position, the operator shall be able to enter position setpoint for the associated gate, from 0 - 100%. When the actuator is in the Local position, the PLC shall track the current position, and provide bumpless transfer between the Local and Remote positions.

#### 3.3.2.3 Interlocks

Interlocks shall be provided as recommended by the equipment manufacturer for proper protection and operation. The operator shall not be able to enter a manual position setpoint if the actuator is in the local position.

#### 3.3.2.4 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.2.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

#### 3.3.2.6 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs SUG-100 Position (0-100%)
2. Date/Time vs SUG-101 Position (0-100%)

### 3.3.3 EQ Tank Effluent Pump Station

The existing primary clarifier sludge pump station will be repurposed as an effluent pump station for the equalization tank. This pump station will pump to either the BNR or sludge holding tank depending on the new manual valves installed on the forcemain near the new 24" line to the BNR.

#### 3.3.3.1 Local Control

The pump station has local hand/off/auto switches for each of the screw pumps. These will normally be in automatic and controlled by the PLC. When

in hand, the pumps will run. When off, the pumps will not run. The Operators may choose to leave this pump station off remotely and turn on after the tank has been filled due to a release of contaminated wastewater.

#### 3.3.3.2 SCADA Automated Controls

Automated pumping level control pumping will be performed by the effluent pump station based on the level signal from the local submersible level transducer sending a signal to the PLC. When in automatic mode, the pumps will operate via set level elevations detected by the submersible level transducer. The pumps will operate via a Lead, Lag 1, and Lag 2 arrangement. Each time the water surface level reaches the pump off elevation and all three pumps turn off, the lead pump will be alternated to the Lag 1 pump and the Lag 2 pump will be rotated to the Lead pump. If the lead pump has an alarm condition that causes the pump to shut off (seal or motor overtemp) the lead pump shall rotate to the Lag 2 Pump. The PLC shall send a start signal to the Lag 1 pump and it shall become the lead pump. The stopped pump shall remain the Lag 2 pump until the alarm condition is resolved and it is placed back into service. The two other pump shall then alternate between Lead and Lag 1. The wet well also has level switches for high and low level alarms. If either switch is engaged, an alarm shall be signalled at the Operator's Workstation. The elevations of pumping for this station shall be selectable by the Operators.

#### 3.3.3.3 Interlocks

No interlocks for this pump station.

#### 3.3.3.4 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.3.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation. From the Workstation, the Operator's can select to run the pumps and select setpoints for pump on, off, alarms, etc.

#### 3.3.3.6 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs Level
2. Date/Time vs Pump 1 Run Status ("ON/OFF")
3. Date/Time vs Pump 2 Run Status ("ON/OFF")
4. Date/Time vs Pump 3 Run Status ("ON/OFF")

#### 3.3.4 BNR DO Control

By utilizing the additional 40 hours of required integration work, the Integrator must meet with the Operators and the Engineer to discuss potential control updates to better regulate swings in DO in each of the aeration zones.

### 3.3.5 Polymer Feed System

#### 3.3.5.1 Local Control

New controls will consist of a local control panel with integrated controller and HMI which allows operation of the chemical feed pumps in the polymer feed building. The pumps controls will include H/O/A control logic programmed into the local control panel's controller. Included with each pump is a contact closure which will indicate an alarm when a tube failure is detected or the flow verification system fails. System control logic is to be provided by the Manufacturer to be included in the chemical feed pump skid control system. The feed control system will be paced with the influent flow meter signal to achieve a desired polymer dose.

#### 3.3.5.2 PLC Automatic Control

When in automatic mode, the PLC will pace the single feed pump. The polyblend system will monitor the flow rate from the influent flow meter from the PLC network. The polyblend will have a dosing rate setpoint that can be controlled from the Operator's Workstation. SCADA controls shall provide remote monitoring of the chemical feed system.

If one of the system pumps stop operation due to an alarm condition that is sent to the PLC, then the PLC shall send a start signal to the redundant chemical feed pump and day tank mixer to start up. The redundant pump shall remain in operation until the alarm condition is resolved for the polyblend system. The redundant pump shall continue to operate until either the Operator selects from the Workstation that the switchover shall occur, or when the redundant pump shuts off due to a stoppage of flow to the secondary clarifiers. Upon restarting of the polymer feed system when a flow is seen by the meter at the CTF building, then the PLC shall send a start signal polyblend system. The PLC shall not send a start signal to the polymer feed system until a minimum threshold of flow has been seen by the secondary clarifier pump station. This threshold shall be an operator setpoint at the Operator's Workstation (initially set to 25 gpm).

#### 3.3.5.3 Interlocks

Interlocks are limited to those provided in the Manufacturer's standard local control logic. No additional interlocks will be provided.

#### 3.3.5.4 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.5.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

#### 3.3.5.6 Trend Plots

The following trend plots shall be provided at the Operator's Workstation:

1. Date/Time vs Polyblend Feed Pump Speed
2. Date/Time vs Redundant Pump Run Status ("ON/OFF")
3. Date/Time vs Day Tank Mixer Run Status ("ON/OFF")



### 3.3.6 Alum Feed System

Hand, Off, and Automatic controls currently exist in the alum feed building. Existing signals and controls are already installed in the local PLC. The scope of this project, is to integrate the current controls in the local PLC with the VT SCADA system. A meeting shall be conducted with the Head Operator and staff to ensure existing functionality is retained for future operation. Existing functionality from the current PLC shall be transferred to the new PLC.

#### 3.3.6.1 Local Control

Hand, Off, and Automatic controls currently exist in the alum feed building.

#### 3.3.6.2 PLC Automatic Control

The system will normally be in automatic which will be controlled by the PLC. Existing control logic shall be incorporated into the VT SCADA program for setpoint control.

#### 3.3.6.3 Interlocks

Interlocks are limited to those provided in the Manufacturer's standard local control logic. No additional interlocks will be provided.

#### 3.3.6.4 Signals

Signals are existing and will remain in place. All signals shall be tied into the VT SCADA system.

#### 3.3.6.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

#### 3.3.6.6 Trend Plots

The following trend plots shall be provided at the Operator's Workstation:

1. Date/Time vs Polyblend Feed Pump Speed
2. Date/Time vs Redundant Pump Run Status ("ON/OFF")
3. Date/Time vs Day Tank Mixer Run Status ("ON/OFF")

### 3.3.7 RAS Pump Station

#### 3.3.7.1 Local Control

Each pump is equipped with a local hand/off/auto switch. In hand, the pump shall run continuously at the speed set within the VFD. Mag meters will be added to the discharge of each RAS pump. Local readout of the flow rate is to be provided.

#### 3.3.7.2 PLC Automatic Control

In Automatic, the PLC shall call each of the RAS pumps to run. The existing call to run logic shall remain in place. The following control strategies shall be provided in the PLC for controlling the RAS pumps. The control strategy selected shall apply to all three (3) pumps.

1. Fixed Speed Control Mode

a. In Fixed Speed Control Mode, when the RAS pump is called to run, the PLC will run the pump at an operator adjustable Fixed Speed Setpoint, adjustable from 70 - 100%. The pump shall run a constant speed until it is called to stop from the PLC.

2. RAS Flow Control Mode

a. In RAS Flow Control Mode, the PLC shall adjust the speed of the RAS pumps to maintain an operator adjustable RAS Flow Setpoint based on a running average of the effluent flow, as seen by the flow meter on the effluent line of the respective pump. Effluent flow rate shall fall within plus or minus 3 percent of the RAS Flow Setpoint.

3. Plant Influent Control Mode

a. In Plant Influent Control Mode, the operator shall input a setpoint, 0 - 100%, for total RAS flow as a percentage of the plant influent flow. The PLC shall calculate the total RAS flow setpoint as a percent of plant effluent flow. The PLC shall average and update the total RAS flow setpoint once per an adjustable time period (15 to 60 minutes), initially set at 30 minutes, for this calculation. The flow setpoint shall be limited by an operator adjustable minimum and maximum RAS Flow rate.

Total RAS Flow = Inputted Percentage of Effluent Flow \* Influent Flow

3.3.7.3 Interlocks

Any existing interlocks will remain.

3.3.7.4 Signals

Signals are as shown on the Contract P&IDs.

3.3.7.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation. From the Workstation, the controlling factor of speed (60-100%), flow (900-1600 gpm), or flow pacing (percentage off influent flow meter), shall be selectable and adjustable. The Operator shall also be able to select the run and off time for these pumps in automatic mode. The run time will initially be set at 10 minutes and remain off for 15 minutes. Minimum value for each will be 5 minutes.

3.3.7.6 Trend Plots

The following trend plots shall be provided at the Operator's Workstation:

1. Date/Time vs Pump Discharge Rate (gpm) (typical of 3)

3.3.8 Cloth Media Filters

The Cloth Media Filters currently have local control via an HMI. Signals are currently ran to the Operator's Workstation for monitoring of the system. This project will add the capability to trigger a backwash and what the time setpoints are for a backwash for each filter.

#### 3.3.8.1 Local Control

The tertiary filters have local control capability.

#### 3.3.8.2 SCADA Automated Controls

From the Operator's Workstation, the Operators can trigger a backwash, and also can adjust the time period between backwashes for each filter remotely. If one filter is currently in backwash mode, the next backwash shall not start until the other filter is back online.

#### 3.3.8.3 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.8.4 Operator Workstation

From the Operator's Workstation, the Operators can trigger a backwash via remote hand, and also can select the time period between backwashes for each filter remotely. If one filter is currently in backwash mode, the next backwash shall not start until the other filter is back online.

#### 3.3.8.5 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Time since last filter backwash (hours:minutes:seconds) (typical of 3)

### 3.3.9 Chlorine Feed System

#### 3.3.9.1 Local Control

The chlorine feed system has a local control capability. The pumps have a hand/off/auto. When in hand, the pumps shall run. When off, the pumps shall not run. When in auto, the pumps shall run based on the SCADA Automated Controls below. Normally the pumps will be in auto. The plants main source of disinfection is via UV. Chlorine is a backup system incase of interruption of the UV treatment system.

#### 3.3.9.2 SCADA Automated Controls

If the Operator's have selected for the chlorine feed system to be the lead disinfection system, then the pumps will run and be flow paced based on the effluent flow meter and calculations provided by the feed pump manufacturer.

#### 3.3.9.3 Interlocks

Interlocks shall be provided as recommended by the equipment manufacturer for proper protection and operation.

#### 3.3.9.4 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.9.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System

database and displayed at the Operator's Workstation.

#### 3.3.9.6 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs Chlorine Feed Pumps ("ON"/"OFF")

#### 3.3.10 Reclaim Truck Fill Station

##### 3.3.10.1 Local Control

The fill station is a manual operation. There will be a local digital readout for a flow meter. The local plug valve will be used to throttle the flow rate manually.

##### 3.3.10.2 SCADA Automated Controls

There are no automated controls for this system.

##### 3.3.10.3 Interlocks

No interlocks for this system

##### 3.3.10.4 Signals

Signals are as shown on the Contract P&IDs.

##### 3.3.10.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

##### 3.3.10.6 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs Flow Totalizer (day, week, month, year) in gallons
2. Date/Time vs Instantaneous Flow Rate (gpm)

#### 3.3.11 Dechlorination Feed System

##### 3.3.11.1 Local Control

The dechlorination feed system (located at the post aeration facility) has a local control capability. The pumps have a hand/off/auto. When in hand, the pumps shall run. When off, the pumps shall not run. When in auto, the pumps shall run based on the SCADA Automated Controls below. Normally the pumps will be in auto. The plants main source of disinfection is via UV. Chlorine is a backup system incase of interruption of the UV treatment system.

##### 3.3.11.2 SCADA Automated Controls

If the Operator's have selected for the chlorine feed system to be the lead disinfection system, then the pumps will run and be flow paced based on the effluent flow meter and calculations provided by the feed pump manufacturer.

#### 3.3.11.3 Interlocks

Interlocks shall be provided as recommended by the equipment manufacturer for proper protection and operation.

#### 3.3.11.4 Signals

Signals are as shown on the Contract P&IDs.

#### 3.3.11.5 Operator Workstation

All signals brought back to the PLC shall be stored within the System database and displayed at the Operator's Workstation.

#### 3.3.11.6 Trend Plots

The following daily trend plots shall be generated and stored daily:

1. Date/Time vs Dechlorination Feed Pumps ("ON"/"OFF")

### 3.4 INSTALLATION OF EQUIPMENT

Install equipment as specified, as shown and as required in the manufacturer's instructions for a complete and fully operational control system.

#### 3.4.1 Control Panels

Control panels must be located as indicated on the drawings. Devices located in the control panels must be as shown on the drawings or as needed to provide the indicated control sequences.

#### 3.4.2 Flow Measuring Device

Fluid flow instruments must be installed in accordance with manufacturer's recommendations, unless otherwise indicated in the specification. The minimum straight unobstructed piping for the flowmeter installation must be 10.0 pipe diameters upstream and 5.0 pipe diameters downstream. Meters for gases and vapors must be installed in vertical piping, and meters for liquids must be installed in horizontal piping, unless otherwise recommended by the manufacturer or indicated in the specifications.

##### 3.4.2.1 Flow Nozzle

Flow nozzle flanges must be installed so that the pressure taps are in a horizontal plane with the centerline of the pipe. Flow nozzles must be installed for ease of accessibility for periodic maintenance. Differential pressure sensors must be installed as close to the flow nozzle as possible.

##### 3.4.2.2 Flow Switch

Flow switches must be installed in such a manner as to minimize disturbance of the flow of fluid while maintaining reliable operation of the switch.

#### 3.4.2.3 Magnetic Flowmeter

Meter must be installed in vertical piping so that the flow tube remains full of the process fluid under all operating conditions. A minimum of ten pipe diameters straight run upstream of the flowmeter and five pipe diameters straight run downstream of the flowmeter must be provided. The flowmeter and piping system must be grounded to earth ground.

#### 3.4.2.4 Natural Gas or Propane Flowmeter

Meters shall be installed in accordance with ASME B31.8. Permanent gas meters must be installed with provisions for isolation and removal for calibration and maintenance, and must be suitable for operation in conjunction with an energy monitoring and control system.

#### 3.4.2.5 Orifice Plates

Orifice plates must be installed for ease of accessibility for periodic maintenance. Differential pressure sensors must be as close to the orifice plates as possible. Orifice plates for liquid measurement must be located in horizontal pipe runs with the orifice plate flanges installed so that the pressure taps are in the horizontal plane with the centerline of the pipe. For liquid, the differential pressure transmitter must be installed below the orifice taps. For gas measurement, the orifice plate flanges must be installed so that the pressure taps are 45 degrees or more above the horizontal plane with the centerline of the pipe. For gas measurement the required differential pressure transmitter must be physically installed above the orifice taps.

#### 3.4.2.6 Paddle Flowmeter

Meter must be installed using manufacturer's published procedures. Installers must be trained for such installations in the pipes encountered. Provide certificates demonstrating installer's qualifications.

#### 3.4.2.7 Annular Pitot Tubes

Annular pitot tubes must be installed so that the total head pressure ports are set-in-line with the pipe axis upstream and the static port facing downstream. The total head pressure ports must extend diametrically across the entire pipe. Annular pitot tubes must not be used where the flow is pulsating or where pipe vibration is allowed.

#### 3.4.2.8 Positive Displacement Flow Meters

Flow meters must be installed horizontally, and aligned correctly in the direction of flow.

#### 3.4.2.9 Turbine Meters

Turbine meters must be installed so that the sensor is located in the center of the fluid flow pipe on the main axis. Turbine meters must be installed without interruption to service. Install a welded flanged riser of appropriate pipe line rating, with a full opening valve bolted to it. Sensor must be located in accordance with the manufacturer's instructions for the specified flow rates and installation conditions. Reduced diameter pipe sections must be provided as necessary to achieve required flow velocities. Meters must be installed using the hot-tap method with tools

recommended by the manufacturer. The minimum straight unobstructed piping for the flow meter installation must be 10 pipe diameters upstream and 5 pipe diameters downstream. The meter must be installed in a horizontal section unless manufacturer specifically allows otherwise.

#### 3.4.2.10 Ultrasonic Flowmeter

Meter must be installed using manufacturer's published procedures for installation. Installers must be trained for such installations in the pipes encountered. Provide certificates demonstrating installer's qualifications.

#### 3.4.2.11 Variable Area Flowmeter

Meters must be installed in a vertical piping section with full flow through the meter.

#### 3.4.2.12 Venturi Flowmeter

The flowmeter must be installed with its top above the pipeline in horizontal pipe run installations. The direction of flow must be upward in vertical pipe run installations. The flowmeter must be aligned to the direction of the flow and must be rigidly mounted and vibration free. The minimum straight unobstructed piping for the flow meter installation must be 10 pipe diameters upstream and 5 pipe diameters downstream.

#### 3.4.2.13 Vortex Shedding Flowmeters

The flowmeter must be installed with its top above the pipeline in horizontal pipe run installations. The direction of flow must be upward in vertical pipe run installations. The flowmeter must be aligned to the direction of the flow and must be rigidly mounted and vibration free. The minimum straight unobstructed piping for the flow meter installation must be 10 pipe diameters upstream and 5 pipe diameters downstream.

#### 3.4.3 Level Instruments

##### 3.4.3.1 Liquid Level Sensor (Bubble Type)

The air pressure regulating valve, air filter, moisture trap, air flow adjustment valve, level gauge, air isolation valve and pressure transducer must be mounted on a panel where indicated on the drawings. The level gauge must be labeled to identify the tank being measured. The isolation valve must be located in the air supply line upstream of the moisture trap, air filter and pressure regulator. The air inlet line to the dip tube and the dip tube must be mounted to a flange at the top of the tank. The dip tube must extend to the bottom of the tank, leaving the manufacturer's recommended clearance between the dip tube and tank bottom. The dip tube material must be compatible with the tank contents. The pressure regulating valve must be adjusted to the outlet pressure recommended by the manufacturer. Where exposed, the air supply line to the tank and from the tank to the level gauge and pressure transducer must be protected from damage.

##### 3.4.3.2 Capacitance Liquid Level Sensors

The sensing probes must be located close to, and parallel with, the tank or sump wall.

#### 3.4.3.3 Conductivity Level Switch

Level switches must be installed vertically and in accordance with the manufacturer's instructions. Switches must be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket must be provided for connection to the inside tank wall, maintaining the minimum recommended distance from the tank fill opening.

#### 3.4.3.4 Displacement Type Liquid Level Switch

Level switches must be installed in accordance with the manufacturer's instructions. Switches must be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket must be provided for connection to the inside tank wall.

#### 3.4.3.5 Mercury Float Switches

Switches must be mounted in accordance with manufacturer's published instructions. Procedures must be those used for equipment in hazardous locations.

#### 3.4.3.6 Ultrasonic Level Sensor

Sensor must be installed vertically in the top of the tank and in accordance with the manufacturer's instructions. Switches must be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket must be provided for connection to the inside tank wall. Sensor must be positioned to maximize the return echo signal and minimize vessel obstructions in the sensors line of sight. The minimum recommended distance from the tank fill opening and from the side of the tank must be maintained.

#### 3.4.4 Process Analytical Instrumentation

##### 3.4.4.1 PH and ORP Sensor

Pipe mounted flow sensor must be located in a threaded tee or fitting to allow removal from the pipe. Submersible sensor must be completely immersed in the fluid being monitored using an ensemble that will allow for removal of the sensor from the fluid for replacement. The sensor must be located in an area of continuous flow. The transmitter must be located as shown on the Drawings. The transmitter must be mounted to allow the digital readout to be easily viewed.

#### 3.4.5 Electric Power Devices

##### 3.4.5.1 Potential and Current Transformers

Install potential and current transformers in enclosures unless otherwise shown. Current transformer leads must be shorted when they are not connected to the measurement circuits.

##### 3.4.5.2 Hour Meters

Meters must be located in the control panel or as otherwise shown. Power to the meter must be connected to the motor starter auxiliary contacts for



pumps, blowers and other motor driven devices. For devices without motor starters, the meter must be connected in parallel with the load. Where the meter voltage differs from the metered devices voltage, transformer must be provided as necessary.

#### 3.4.5.3 Watt-hour Meters

Install watt-hour meters and transducers in enclosures unless otherwise shown.

#### 3.4.5.4 Transducers

Transducers must be wired in accordance with the manufacturer's instructions, and installed in enclosures.

#### 3.4.5.5 Current Sensing Relays and Current Transducers for Motors

When used to sense meter/fan/pump status, current sensing relays must be used for applications under 5 hp. Applications over 5 hp must use a current transducer.

#### 3.4.6 Output Devices

Output devices (transducers, relays, contactors, or other devices) which are not an integral part of the control panel, must be mounted in an enclosure mounted adjacent to the control panel, unless otherwise shown. Where H-O-A and/or override switches on the drawings or required by the control sequence, the switches must be installed so that the process control system controls the function through the automatic position and other controls work through the hand position.

#### 3.4.7 Enclosures

All enclosure penetrations must be from the bottom of the enclosure, and must be sealed to preclude entry of water using a silicone rubber sealant.

#### 3.4.8 Transformers

Transformers for control voltages below 120 VAC must be fed from the nearest power panel or motor control center, using circuits provided for the purpose. Provide a disconnect switch on the primary side and a fuse on the secondary side. Transformers must be enclosed in a steel cabinet with conduit connections.

### 3.5 WIRE, CABLE AND CONNECTING HARDWARE

#### 3.5.1 Metering and Sensor Wiring

Metering and sensor wiring must be installed in accordance with the requirements of ANSI C12.1, NFPA 70, Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

##### 3.5.1.1 Power Line Surge Protection

Control panels must be protected from power line surges. Protection must meet the requirements of IEEE C62.41.1 and IEEE C62.41.2. Fuses must not be used for surge protection.

#### 3.5.1.2 Sensor and Control Wiring Surge Protection

Digital and analog inputs must be protected against surges induced on control and sensor wiring. Protect binary and analog outputs against surges induced on control and sensor wiring installed outdoors and as shown. Fuses must not be used for surge protection. Test the inputs and outputs in both the normal and common mode using the following two waveforms: The first waveform must be 10 microseconds by 1000 microseconds with a peak voltage of 1500 volts and a peak current of 60 amperes. The second waveform must be 8 microseconds by 20 microseconds with a peak voltage of 1000 volts and a peak current of 500 amperes. Submit certified test results for surge protection.

### 3.6 SOFTWARE INSTALLATION

Load software required for an operational process control system, including databases (for points specified and shown), operational parameters, and system, command, and application programs. Adjust, tune, debug, and commission all software and parameters for controlled systems to assure proper operation in accordance with the sequences of operation and database tables.

### 3.7 CONTROL DRAWINGS

#### 3.7.1 Control

Control drawings, must be provided for equipment furnished and for interfaces to equipment at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually must be prepared in typed form, framed as specified for the instrumentation and control diagrams and posted beside the diagrams. Diagrams and instructions must be submitted prior to posting. The framed instructions must be posted before acceptance testing of the system.

#### 3.7.2 Contractor Design Drawings

Contractor Design Drawings as a single complete package: 3 hard copies and a pdf copy. As a minimum they must include wiring, logic, and layout. Submit hardcopy drawings on 11"x17" sheets, and electronic drawings in PDF and in AutoCAD format. In addition, submit electronic drawings in editable Excel format for all drawings that are tabular, including but not limited to the Point Schedule and Equipment Schedule. Contractor Design Drawings must be approved prior to any fabrication.

##### 3.7.2.1 Draft As-Built

Draft As-Built Drawings as a single complete package: 3 hard copies and 1 copies in electronic form. Submit hardcopy drawings on ISO A1 841 by 594 mm 34 by 22 inches sheets, and electronic drawings in PDF and in format. In addition, submit electronic drawings in editable Excel format for all drawings that are tabular, including but not limited to the Point Schedule and Equipment Schedule.

##### 3.7.2.2 Final As-Built

Draft As-Built Drawings as a single complete package: 3 hard copies and 1 copies in electronic form. Submit hardcopy drawings on ISO A1 841 by 594 mm

34 by 22 inches sheets, and electronic drawings in PDF and in format. In addition, submit electronic drawings in editable Excel format for all drawings that are tabular, including but not limited to the Point Schedule and Equipment Schedule.

### 3.7.3 Points Schedule

Provide a Points Schedule in tabular form for each system, with the indicated columns and with each row representing a hardware point, network point or configuration point in the system.

- a. When a Points Schedule was included in the Contract Drawing package, use the same fields as the Contract Drawing with updated information in addition to the indicated fields.
- b. When Point Schedules are included in the contract package, items requiring contractor verification or input have been shown in angle brackets ("<" and ">"), such as <\_\_\_> for a required entry or <value> for a value requiring confirmation. Complete all items in brackets as well as any blank cells. Do not modify values which are not in brackets without approval. Points Schedule Columns must include:

#### 3.7.3.1 Point Name

The abbreviated name for the point using the indicated naming convention.

#### 3.7.3.2 Description

A brief functional description of the point such as "Supply Air Temperature".

#### 3.7.3.3 DDC Hardware Identifier

The Unique DDC Hardware Identifier shown on the DDC Hardware Schedule and used across all drawings for the DDC Hardware containing the point.

#### 3.7.3.4 Settings

The value and units of any setpoints, configured setpoints, configuration parameters, and settings related to each point.

#### 3.7.3.5 Range

The range of values, including units, associated with the point, including but not limited to setpoint adjustment range, a sensor measurement range, or the status of a safety.

#### 3.7.3.6 Input or Output (I/O) Type

The type of input or output signal associated with the point. Use the following abbreviations for entries in this column:

- a. AI: The value comes from a hardware (physical) Analog Input
- b. AO: The value is output as a hardware (physical) Analog Output
- c. BI: The value comes from a hardware (physical) Binary Input
- d. BO: The value is output as a hardware (physical) Binary Output

e. PULSE: The value comes from a hardware (physical) Pulse Accumulator Input

f. NET-IN: The value is provided from the network (generally from another device). Use this entry only when the value is received from another device as part of scheduling or as part of a sequence of operation, not when the value is received on the network for supervisory functions such as trending, alarming, override or display at a user interface.

g. NET-OUT: The value is provided to another controller over the network. Use this entry only when the value is transmitted to another device as part of scheduling or as part of a sequence of operation, not when the value is transmitted on the network for supervisory functions such as trending, alarming, override or display at a user interface.

#### 3.7.3.7 Network Data Exchange Information

(Gets Data From, Sends Data To) Provide the DDC Hardware Identifier of other DDC Hardware the point is shared with.

#### 3.7.3.8 Override Information

For each point requiring an Override, indicate if the Object for the point is Commandable.

#### 3.7.3.9 Trend Object Information

For each point requiring a trend, indicate if the trend is Local or Remote. For remote trends provide the DDC Hardware Identifier for the device performing the trend.

#### 3.7.3.10 Alarm Information

Indicate the Alarm Generation Type.

### 3.8 FIELD TESTING AND ADJUSTING EQUIPMENT

Provide personnel, equipment, instrumentation, and supplies necessary to perform site testing. The Government will witness the PVT, and written permission must be obtained from the Government before proceeding with the testing. Original copies of data produced, including results of each test procedure, during PVT must be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test. The test procedures must cover actual equipment and functions specified for the project.

#### 3.8.1 Testing, Adjusting and Commissioning

After successful completion of the factory test as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, tested, adjusted, and commissioned each control loop and system in accordance with NIST SP 250 and must verify proper operation of each item in the sequences of operation, including hardware and software. Calibrate field equipment, including control devices, adjust control parameters and logic (virtual) points including control loop setpoints,

gain constants, constraints, and verify data communications before the system is placed online. Test installed ground rods as specified in IEEE 142 and submit certification stating that the test was performed in accordance with IEEE 142. Calibrate each instrumentation device connected to the process control system control network by making a comparison between the reading at the device and the display at the workstation, using a standard at least twice as accurate as the device to be calibrated. Check each control point within the process control system control network by making a comparison between the control command at the central station and field-controlled device. Deliver trend logs/graphs of all points showing to the Government that stable control has been achieved. Points on common systems must be trended simultaneously. One log must be provided showing concurrent samples taken once a minute for a total of 4 hours. One log must be provided showing concurrent samples taken once every 30 minutes, for a total of 24 hours. Verify operation of systems in the specified failure modes upon Process control system network failure or loss of power, and verify that systems return to process control system control automatically upon a resumption of process control system network operation or return of power. Deliver a report describing results of functional tests, diagnostics, calibrations and commissioning procedures including written certification to the Government that the installed complete system has been calibrated, tested, adjusted and commissioned and is ready to begin the PVT. The report must also include a copy of the approved PVT procedure.

### 3.8.2 Performance Verification Test (PVT)

Submit test procedures for the PVT. The test procedure must describe all tests to be performed and other pertinent information such as specialized test equipment required and the length of the PVT. The test procedures must explain, in detail, step-by-step actions and the expected results, to demonstrate compliance with all the requirements of the drawings and this specification. The test procedure must be site specific and based on the inputs and outputs, required calculated points and the sequence of control. Refer to the actions and expected results to demonstrate that the process control system performs in accordance with the sequence of control. Include a list of the equipment to be used during the testing plus manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

Demonstrate that the completed Process control system complies with the contract requirements. All physical and functional requirements of the project including communication requirements must be demonstrated and shown. Demonstrate that each system operates as required in the sequence of operation. The PVT as specified must not be started until after receipt of written permission by the Government, based on the written report including certification of successful completion of testing, adjusting and commissioning as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, furnish test reports and other documentation.

### 3.8.3 Endurance Test

Use the endurance test to demonstrate the overall system reliability of the completed system. The endurance test must be conducted in phases. The endurance test must not be started until the Government notifies the Contractor in writing that the PVT is satisfactorily completed, training as specified has been completed, outstanding deficiencies have been satisfactorily corrected, and that the Contractor has permission to start

the endurance test. Provide an operator to man the system during Phase I endurance testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, commence an assessment period as described for Phase II. Upon successful completion of the endurance test, deliver test reports and other documentation, as specified, to the Government prior to acceptance of the system.

#### 3.8.3.1 Phase I (Testing)

The test must be conducted 24 hours per day, 7 days per week, for 3 consecutive calendar days, including holidays, and the system must operate as specified. Make no repairs during this phase of testing unless authorized by the Government in writing.

#### 3.8.3.2 Phase II (Assessment)

After the conclusion of Phase I, identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report must explain in detail the nature of each failure, corrective action taken, results of tests performed, and must recommend the point at which testing should be resumed. After delivering the written report, convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting must not be scheduled earlier than 5 business days after receipt of the report by the Government. As a part of this test review meeting, demonstrate that failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Government will determine if retesting is necessary and the restart point. The Government reserves the right to require that the Phase I test be totally or partially rerun. Do not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase II assessment must be repeated as if Phase I had just been completed.

#### 3.8.3.3 Exclusions

The Contractor will not be held responsible for failures resulting from the following: Outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the process control system performed as specified. Failure of a Government furnished communications link, provided that the PLC automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to Contractor furnished equipment, installation, or software. Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

### 3.9 FIELD TRAINING

Field training oriented to the specific system must be provided for designated personnel. Furnish a copy of the training manual for each trainee plus two additional copies. Manuals must include an agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Furnish audiovisual equipment and other training supplies and materials. Copies of the audiovisuals must be

delivered with the printed training manuals. The Government reserves the right to videotape training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. Submit the training manual and schedule to receive approval from the Government at least 30 days before the training.

#### 3.9.1 Preliminary Operator Training

Prior to the start of field testing, preliminary operator training must be taught at the project site for 3 consecutive training days. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course must include: general system architecture; functional operation of the system, including workstations; operator commands; application programs, control sequences, and control loops; database entry and modification; reports generation; alarm reporting; diagnostics; and historical files.

#### 3.9.2 Additional Operator Training

Following the field testing, additional classroom training for operators must be taught for 3 consecutive training days; individual instruction sessions of 4 -hour periods in the morning (or afternoon) of the same weekday for 3 consecutive weeks and an additional 2 day classroom session for answering operator questions. Individual instruction must consist of "hands-on" training under the constant monitoring of the instructor. Classroom training must include instruction on the specific hardware configuration of the installed process control system and specific instructions for operating the installed system. Schedule activities during this period so that the specified amount of time on the equipment will be available for each student. The final session will address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed process control system. Each student should be able to start the system, operate the system, recover the system after a failure and describe the specific hardware architecture and operation of the system and be fully proficient in all system operations. Report the skill level of each student at the end of this course.

#### 3.9.3 Maintenance Training

Following the endurance test a minimum period of one training day must be provided by a factory representative or a qualified Contractor trainer for five designated personnel on maintenance of the equipment. The training must include: physical layout of each piece of hardware, calibration procedures, preventive maintenance procedures, schedules, troubleshooting, diagnostic procedures and repair instructions.

#### 3.9.4 Specialized Training

Following the maintenance training, a minimum period of five, total training day(s) must be provided by a factory representative or a qualified Contractor trainer for ten people on the input devices.

3.9.4.1 Flow Meter Training

Each type of flow meter, to include calibration, maintenance and testing of flow elements and transducers.

3.9.4.2 Specialized Sensor Training

Provide training on each type of specialized sensor such as conductivity, ORP, pH and DO to include calibration, maintenance and testing of sensing elements and transducers for five people.

3.10 OPERATION AND MAINTENANCE DATA REQUIREMENTS

Outline the step-by-step procedures required for system startup, operation and shutdown. Include in the instructions layout, wiring and control diagrams of the system as installed, the manufacturer's name, model number, service manual, parts list and a brief description of all equipment and their basic operating features. List routine maintenance procedures, possible breakdowns and repairs and troubleshooting guides.

3.11 ADDITIONAL PROGRAMMING ALLOWANCE

The Control System Integrator (CSI) shall provide an allowance of 40 working hours of programming time for last minute system changes/modifications. This time shall also include evaluating the DO control loop in the BNR system. This allowance is for changes directed at the request of the Government or the engineer.

-- End of Section --



SECTION 40 96 00

APPLICATIONS SOFTWARE

02/20

PART 1 GENERAL

1.1 DEFINITIONS

Definitions, Symbols, and engineering unit abbreviations shall conform to IEEE Stds Dictionary, as applicable.

1.1.1 Abbreviation:

- a. FDT: Factory Demonstration Test.
- b. FSAT: Factory Software Acceptance Test.
- c. FT1: Functional Test 1.
- d. FT2: Functional Test 2.
- e. I&C: Instrumentation and Control.
- f. I/O: Inputs and Outputs.
- g. O&M: Operation and Maintenance.
- h. P&ID: Process and Instrument Diagram.
- i. PC: Personal Computer.
- j. PCS: Plant Control System.
- k. PIC: Process Instrumentation and Control.
- l. PLC: Programmable Logic Controller.
- m. PMCS: Process Monitoring and Control Software.
- n. PT: Performance Testing.
- o. SCS: Supervisory Control System (i.e., Wonderware).
- p. SLC: Single Loop Controller.

1.1.2 Instructor Day

8 hours of actual instruction time.

1.1.3 Detailed Loop Specifications

Detailed lists and descriptions expanding on the process control narratives listed in Article Supplements, giving additional requirements and programming details for individual control loops.

1.1.4 Software

Programming of digital devices using all types of programming language.

Configuring of digital devices using all types of configuring process.

Programs or configuration data stored in read only memory, programmable read only memory, read/write memory, disk, tape, or other storage device.

1.1.5 Types of Software

1.1.5.1 Standard Software

Software packages that are independent of project on which they are used. Standard software includes system software and process monitoring and control software.

a. System Software: Application independent software developed by Microsoft. Includes, but is not limited to, Microsoft's NT operating system; file management utilities; text editors; debugging aids; and diagnostics.

b. Process Monitoring and Control Software (PMCS): Software packages independent of specific process control project on which they are used. Includes, but is not limited to, providing capability for, data acquisition, monitoring, alarming, man-machine interface, data collection, data retrieval, trending, report generation, control, and diagnostics.

#### 1.1.5.2 Application Software

Software to provide functions unique to this Project and that are not provided by standard software alone.

Configuring databases, tables, displays, reports, parameter lists ladder logic, and control strategies required to implement functions unique to this Project.

### 1.2 Division of Work

#### 1.2.1 Software Integrator

Contractor shall provide software integration. When referenced herein, role of Software Integrator shall be filled by qualified members of the Contractor's own forces or by a qualified subcontractor. Software Integrator shall implement noted sections of the applications software specified herein.

#### 1.2.2 Contractor

The Contractor shall have overall system coordination responsibility and shall provide all additional materials and work necessary to supplement the work provided by the Software Integrator and thereby satisfy all requirements of this section.

### 1.3 WORK INCLUDED

#### 1.3.1 General

Work includes coordination, testing, documenting, training and starting up the Process Instrumentation and Control (PIC) Applications Software, complete.

Major applications software work items and responsibilities include:

ITEM	DESCRIPTION	RESPONSIBILITY	
		Contractor	Software Integrator
1	Work sequence and schedule	X	X
2	Software design and		X

	workshops		
3	Package system	X	X
	vendor coordination		
	and testing		
4	Integration of		X
	package system		
	software into PCS		
5	Detailed loop		X
	specifications		
	development and		
	submittals		
6	Applications		X
	software submittals		
7	Applications		X
	software development		
8	Software testing	X	X
9	Software installation		X
10	Software O&M		X
	development		
11	Applications		X
	Software Owner		
	training		
12	Submittals		X

#### 1.4 WORK SEQUENCE AND SCHEDULE

##### 1.4.1 General

All work provided under this section shall be in accordance with a Milestone Breakdown and System Delivery Plan jointly developed by the Contractor and Software Integrator.

##### 1.4.2 Milestone Breakdown (MB)

Summarize the major milestones for work provided by this section along with the major milestones of the overall project. Milestones shall include but not be limited to:

a. System Delivery Plan approved.

b. Software Design Workshops:

1. Software Design Workshop.
2. SCS Standards Workshop.
3. Loop Specifications, P&ID Review Workshop.
4. PLC Software Standards Workshop.
5. SCS Standards Workshop.
6. Plant Process Reporting Workshop.
7. Presoftware Development Workshops.

c. Submittals:

1. Action submittals.
2. Informational submittals.

d. Testing:

1. Factory Software Acceptance Test.
2. Functional Test 1.
3. Functional Test 2.
4. Performance Acceptance Tests.
5. Endurance Test.

e. Owner Training.

f. O&M Manuals.

g. PLC and SCS software licenses.

#### 1.4.3 System Delivery Plan (SDP):

The intent of the SDP is to:

a. Coordinate and communicate applications software design and testing activities.

b. Coordinate interactions with the Owner and Contractor regarding workshops, submittal reviews, contractor(s) progress, test witnessing, training, etc.

c. Communicate and clarify required work sequences and major milestone.  
Minimum Content:

1. Work sequence and schedule.
2. Detailed Loop Specifications submittals.
3. Applications software workshops.
4. Applications software submittals.
5. Applications software development.
6. Software testing.
7. Software installation
8. O&M development.
9. Owner training.

#### 1.5 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

System Delivery Plan

PLC Software Standards

SCS Standards

Applications Software Schedule of Values and Progress Schedule

SD-05 Design Data

Detailed Loop Specifications and P&ID

Presoftware Development

Software Design

Milestone Breakdown

System Delivery Plan

SD-06 Test Reports

Process Reports

Test Procedures and Reports

SD-09 Manufacturer's Field Reports

Owner Training Plan

SD-10 Operation and Maintenance Data

PLC and SCS Software Licenses

Operation and Maintenance Manual

#### 1.5.1 Action Submittals

##### 1.5.1.1 Detailed Loop Specifications and P&ID Submittals

Timing: Following P&ID and Detailed Loop Description Workshop.

Content: Updated version of detailed loop specifications.

##### 1.5.1.2 Process Reports Submittal

Timing: Following Reports Workshop.

Content: Document and submit reporting criteria and functional requirements.

##### 1.5.1.3 PLC Software Standards Submittal

Developed in a Software Workshop, Documented and Submitted as PLC software standards.

##### 1.5.1.4 SCS Standards Submittal

Review and develop SCS standards in a participative workshop with the Owner.

Documented and submitted as SCS software standards.

##### 1.5.1.5 Presoftware Development

Updated version of material presented in Presoftware Development workshop.

##### 1.5.1.6 Software Design Submittal

Detailed description of SCS Configuration and PLC program on a Unit Operation Basis. Submit this during program development stage.

a. An updated version of all information presented in Presoftware Development Submittal.

- b. SCS/PLC I/O database.
- c. Documented PLC Program.
- d. Print out of SCS screens.

#### 1.5.2 Informational Submittals

##### 1.5.2.1 Milestone Breakdown (MB)

Summarize the major milestones for work provided by this section along with the major milestones of the overall project.

##### 1.5.2.2 System Delivery Plan (SDP)

The intent of the SDP is to:

- a. Coordinate and communicate applications software design and testing activities.
- b. Coordinate interactions with the Owner and Contractor regarding workshops, submittal reviews, contractor(s) progress, test witnessing, training, etc.
- c. Communicate and clarify required work sequences and major milestone.

##### 1.5.2.3 Applications Software Schedule of Values and Progress Schedule:

Submit within 30 days after first Preconstruction Conference. Upon acceptance by Engineer, shall form basis and schedule of Submittal reviews, test witnessing, and partial payments. Prior to this acceptance, Engineer will not review Submittals, witness tests, or consider requests for partial payment.

##### 1.5.2.4 Owner Training Plan:

In accordance with Manufacturer's Field Services.

##### 1.5.2.5 Test Procedures and Reports:

Test Forms: Proposed software test procedures, forms, and check lists:

- a. Functional Test Part 2 (FT2).
- b. Performance Test (PT).
- c. Test Procedures: Conduct tests using Engineer accepted test procedures, forms, and checklists.
- d. Test Documentation: Copy of signed of test procedures when tests are completed.

##### 1.5.2.6 Operation and Maintenance Manuals:

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI):

- a. User's manuals for Standard Software packages.
- b. Licensed copies of Standard Software packages.
- c. Updated versions of material provided under Shop Drawing Submittals for Applications Software Design and Development.
- d. SCS/PLC I/O database.
- e. Applications software source files.

## 1.6 SOFTWARE DESIGN WORKSHOPS

### 1.6.1 Location

Owner's facility during the course of the Project.

### 1.6.2 Objective

To provide a vehicle for the Owner to oversee the applications software development.

### 1.6.3 Documentation

Software Integrator summarize resolutions reached in each workshop, including cost and schedule impacts and distribute copies to Owner, Engineer, and Contractor.

### 1.6.4 Software Design Workshop

Order and minimum topics to be covered in each Software Design Workshop. Software Design Workshop (kick off) that establishes project processes, including:

- a. Software Integrator and Contractor organization and reporting procedures.
- b. Workshop objectives.
- c. Submittal process.
- d. Review work sequence and schedule.
- e. Workshop Minimum Duration: 2 hours.

#### 1.6.4.1 Loop Specifications, P&ID Review Workshop

Software Integrator use P&IDs, Loop Specifications and package system vendor provided Package Loop Specifications to present how the proposed control system design and Applications Software will meet the functional requirements specified herein.

At the completion of workshop Applications Software Integrator updates Loop Specifications with changes, additions and clarifications, using revision mode, that document the changes.

Submit finalized Loop Specifications along with an outline of any application software cost and schedule impacts. Include the following:

- a. Preliminary control and alarm setpoint values.
- b. Alarm prioritization list for all alarms.
- c. Dial-out alarm list.

Workshop Minimum Duration: 4 hours.

#### 1.6.4.2 PLC Software Standards Workshop

PLC Software Standards shall be developed, then reviewed in a Software Standards Workshop. PLC Software standards shall include the following:

- a. Add on instructions (AOI) and user data types (UDT) for commonly used functions, including but not limited to the following:

1. Process Instrument Scaling:
  - a. Min/max raw value.

- b. Min/max scaled value.
  - c. Signal out of range alarm and alarm disable.
  - d. Out of service.
2. High and Low Process Variable Alarm Checking:
- a. High alarm, setpoint and alarm disable.
  - b. High alarm, setpoint and alarm disable.
  - c. Low alarm, setpoint and alarm disable.
  - d. Low alarm, setpoint and alarm disable.
  - e. Deadband for alarm reset.
3. Constant Speed Motor Control:
- a. Local/Remote status.
  - b. Running status.
  - c. Ready status.
  - d. Fail status.
  - e. Calculated runtime hours and reset.
  - f. Calculated start cycles and reset.
  - g. Remote Auto/Manual select.
  - h. Remote Manual start/stop.
4. Variable Speed Pump Control:
- a. Local/Remote status.
  - b. Runnint status.
  - c. Ready status.
  - d. Fail status.e. Speed status.
  - f. Calculated runtime hours and reset.
  - g. Calculated start cycles and reset.
  - h. Remote Auto/Manual select.
  - i. Remote Manual start/stop.
  - j. Remote Manual speed command.
  - k. Remote Auto speed command.
5. Modulating Valve Control:
- a. Local/Remote status.
  - b. Full open/closed status.
  - c. Ready status.
  - d. Fail status.
  - e. Position status.
  - f. Remote Auto/Manual select.
  - g. Remote Manual position command.
  - h. Remote Auto position command.
6. Open/Stop/Close Valve Control:
- a. Local/Remote status.
  - b. Full open/closed status.
  - c. Ready status.
  - d. Fail status.
  - e. Remote Auto/Manual select.
  - f. Remote Manual open/close commands.
  - g. Remote Auto open/close commands.
7. Solenoid Valve Control:
- a. Remote Auto/Manual select.
  - b. Remote Manual open/close commands.
  - c. Remote Auto open/close commands.
8. Flow Totalization:
- a. Total.



- b. Daily total.
  - c. Reset total command.
  - 9. PID control interface.
  - 10. PLC Status:
    - a. Run mode.
    - b. Clock status.
    - c. Battery status.
    - d. Fault status.
    - e. Module failure status.
    - f. Ethernet communication status.
  - 11. Interface with SCS
    - 1. Tag naming convention.
    - 2. Alarming conventions.
  - 12. Common PLC Functions:
    - 1. PLC to PLC Communications:
      - a. Message read commands.
      - b. Message write commands.
      - c. Produced/Consumed tagging.
      - d. Time synchronization.
    - 2. Program backups.
    - 3. Program Documentation:
      - a. Tag descriptions.
      - b. Rung comments.
      - c. Function Block comments.
    - 4. Program Structure:
      - a. Breakdown of routines and programs by process area and equipment.
      - b. PID control in scheduled routines.
      - c. Flow totalizing in scheduled routines.
      - d. Workshop Minimum Duration:
        - 1. 8 hours
- 1.6.4.3 SCS Standards Workshop
- 1.6.4.3.1 Objective:
- To review and develop SCS standards in a participative workshop with Owner.
- 1.6.4.3.2 Design Products and Topics to be Finalized:
- a. SCS integration.
  - b. Tag Group naming convention.
  - c. SCS Tag naming conventions.
  - d. Overview display design.
  - e. Process graphics.
  - f. Display paging and navigation.
  - g. Dynamic Objects: Pumps, valves, gates, compressors, etc.
  - h. Equipment control through pop-up windows.
  - i. Loop control through pop-up windows.
  - j. Display philosophy, organization and operation.
  - k. General data entry through the SCS.
  - l. Use of tool tips
  - m. Color graphic standards, symbol standards, etc.
  - n. Dynamic Objects: Pumps, compressors, valves, gates, controller

faceplates, process indicators, indicators with alarms, data entry, controller face plate, dampers, aerator, chemical feed pump, mixers.

o. Security.

p. Alarm Management: Operation of the alarms, alarm areas, alarm filtering, alarm prioritization, and alarm dial-out.

q. Trending.

r. Historical data storage and retrieval.

s. Variable naming conventions.

t. Scripting.

u. Tag Group file naming convention.

v. Display file naming convention.

1.6.4.3.3 Workshop Minimum Duration:

8 hours.

1.6.4.4 Plant Process Reporting Workshop:

1.6.4.4.1 Objective

Developed and document number and types of reports.

1.6.4.4.2 Identify and define each type of Process report including:

Daily flow and energy totals.

Weekly flow and energy totals.

Monthly flow and energy totals.

Yearly flow and energy totals.

1.6.4.4.3 Workshop Minimum Duration

2 hours

1.6.4.5 Presoftware Development Workshops:

1.6.4.5.1 Objective:

To present to Engineer and Owner how Applications Software Integrator will implement functional requirements of this section.

1.6.4.5.2 Present information on:

Program Flow Diagram(s) showing all software sections, sub sections, function blocks, subprograms, and their interrelationships.

SCS/PLC I/O Database listing.

SCS Screen sketches that illustrate dynamic objects, how control functions are controlled and monitored, how equipment is controlled and SCS screen navigation.

## PART 2 PRODUCTS

### 2.1 PLC APPLICATION SOFTWARE

#### 2.1.1 PLC Software

The PLC software shall be the latest version of RS LOGIX 5000, or approved equal.

Provide two copies of PLC manufacturer's programming software, toolkit software, applications loader, and similar software designed to facilitate Government's post-startup programming, operations, and maintenance of the PLC system.

#### 2.1.2 PLC Program Design:

The programmable logic controller system (PLC) shall be used to provide facility automatic control, alarm functions, and continuous loop control. Specific PLC functional requirements shall be developed by the Software Integrator based on the process control narratives and as described in the detailed loop specifications.

No control routines, control algorithms, or control logic shall be implemented in the SCS.

##### 2.1.2.1 Break PLC applications software into:

Sections: Contains all logic for a specific unit operation. Each section consists of a general logic subsections and, followed by unit operation subsections.

Subsections: Contains logic for specific equipment such as a pump, valve or loop.

Functional Blocks:

- a. Building block for pumps, valves, loop control, analog processing, alarm switches.
- b. Requirements for standard SCS/PLC function blocks to be provided are specified herein.

##### 2.1.2.2 Program Documentation

Note and describe start of a new program section.

Briefly describe control objectives.

Identifies subsections.

Subsection documentation includes brief description of control objective followed by a description and tag of the equipment being controlled.

2.1.2.3 The PLC applications software shall be configured to allow users to quickly search and locate a specific section. Below is the minimum required.

##### 1. PLC Overhead:

- a. PLC to PLC communications.

b. Time of day.

2. Analog input scaling and alarming.

### 2.1.3 PLC Program Documentation:

#### 2.1.3.1 Function Block Diagram Description:

Written overview description of each function block program.  
Lead user through sections, subsections and function block of programs.  
Generally describe functions being implemented including software block used to implement functional requirements of this Specification.

#### 2.1.3.2 Ladder Diagram Logic Listings:

Include a description for each element (input, output, or special function block).

Comments that describes function of ladder rungs. Average of one 60 character comment line per ladder rung.

Complete ladder diagram logic listings.

Provide following additional information integral to ladder listings to document PLC programs: Note: Documentation will be limited to what PLC documentation system provides:

a. I/O Point Cross Reference List: Provide alias tag for each input and output, alphanumeric functional identification (up to 15 characters). For each I/O point, the cross reference indicates each rung number where the point is used.

b. Internal Coil Cross Reference List: For each coil a 15 character alphanumeric function identification printed above respective coil and all of its contacts in program listing. For each coil, cross reference indicates each rung number where respective coil or contact is used.

c. Data Register Cross Reference List: For each registers locations in program where register is used.

d. A listing of all programmed special functions, including memory locations used and location in program where special functions can be found. Function descriptions also to be shown in special function printout for all pertinent memory locations used in each special function. Programmed values of all memory also shown.

e. Listing of all programmed PID loops by numbers. Function descriptions for all memory locations and status registers used and generated in the loop, as well as loop tuning values, shall also be shown in the PID loop printout. Programmed values of all pertinent memory locations used shall be shown.

f. Timers, counters, integer add and subtract, move, master control relay, programmed values.

## 2.2 SCS APPLICATION SOFTWARE DESIGN REQUIREMENTS

### 2.2.1 SCS Software

a. The current SCS Software for the water system SCADA application is Wonderware 2012, and is migrating to VTSCADA 12.

b. If Contractor provides a product that is not the named manufacturer indicated herein, then, in addition to applicable training requirements indicated elsewhere, Contractor shall also provide offsite advanced factory training to Government personnel for the product provided. Each person shall receive a minimum of ten days of offsite training, for a total of forty days of offsite training provided by the Contractor necessary to satisfy this requirement. Travel costs associated with Government personnel attendance at the training will be provided by the Government. The training shall be conducted at a factory authorized training center and shall cover the following topics at a minimum:

1. Software and Programming
2. Maintenance

Furnish complete training materials to be retained by each trainee. Government personnel may or may not attend training sessions concurrently. Provide sufficient training opportunities within one year from the date that Government assumes beneficial occupancy of the new water treatment plant to allow trainees to attend training at different times.

c. Provide SCS software licenses as follows:

1. One development license to reside on the HMI server.
2. One runtime license for each HMI workstation, HMI field panel, and every other computer or server on which the software is installed.
3. One development license turned over to the Government on portable digital storage media (compact disc) with final, approved O&M Manual submittal.
4. Three runtime licenses turned over to the Government on portable digital storage media (compact disc) with final, approved O&M Manual submittal.

All testing and modifications to applications, firmware, operating systems, will be coordinated with the MCAS Cherry Point Facilities System Support Office (MCAS FSSO).

### 2.2.2 General

Software Integrator shall provide HMI application software specified herein.

The Software Integrator shall develop the SCS design to convey accurate information to the plant operations staff so they can make informed process control decisions and provide the platform to execute the control decisions.

The following outlines key objectives in designing the SCS graphics displays:

- a. Easily navigated menus.
- b. Provide no more than three mouse actions to navigate to any control display.
- c. Maintain consistency in graphic display and controls design.  
(Consistency reduces the chances of misunderstanding, significantly reduces learning time, anxiety and stress.)
- d. Maintain consistent and predictable window operations.
- e. Accurate representation of the plant and its operations, based on the P&IDs
- f. Represent control options in an easily understood fashion.
- g. Develop help screens to provide additional information to help the operations staff understand the control options where complex operations are required.
- h. A pleasant and engaging interface that conforms to the operators "Mental Model."
- i. Where possible, design overview displays similar to the physical layout of the facility. The perspective to the physical layout should be from the local main control room.
- j. Provide operator access to process and alarm setpoints, including the following:
  - 1) Process alarms (High-High, High, Low, and Low-Low).
  - 2) Pump and equipment control setpoints.
  - 3) Process timer setpoints.
  - 4) Sequence setpoints for volume, level, time etc.

### 2.2.3 General Display Organization Philosophy

#### 2.2.3.1 Graphic Display

Graphic displays provide the vehicle for the operations to accomplish supervisory control over the entire treatment process. Organization of these graphics displays into a consistent homogeneous hierarchy that permits fast, easy and intuitive navigation between the displays is essential for plant operations. Figure 1 in Supplement A illustrates an overview of a typical graphic display hierarchy.

#### 2.2.3.2 Process and Control Graphic Display

As shown in Figure 2 in Supplement A, the process and control graphic display hierarchy consists of four levels of displays. The following briefly describes the intent of each of the four levels of displays:

##### 2.2.3.2.1 Level 1-Plant Overview:

The Plant Overview shows the entire plant. The overview displays show the most important (essential) process data and major equipment status on a plant wide basis, but provide no equipment or system control.

The Plant Overview(s) display provide the means to page (i.e., go to) to Process overviews, or directly to Unit Operations.

As a general rule, the Plant overview show the most critical status and system data that give the operations staff a good general feel on how the plant, is currently operating. A Plant Overview is going to be the opening display whenever the SCS is started.

#### 2.2.3.2.2 Level 2-Process Overviews:

Process Overviews are full sized screens.

The Process Overviews show primary process data on unit processes, process, equipment status, or system status, etc. As a general rule no control strategies are implemented through the Process Overviews. The Process Overview provides the means to page to Control Displays.

The general rule is to show enough status and system data information that gives operations staff a good general feel on how the individual processes are currently operating. It also provides a launching pad to access control information associated with the individual processes.

Examples of Process Overviews are Raw Water, Transfer Pump Station, and Membrane System. The Process Overviews generally follow the P&ID drawings. Figures 3, 4, and 5 in Supplement A illustrate the level of detail on a Process Overview display.

#### 2.2.3.2.3 Level 3-Control Displays

Control Displays can be Full screen or popup windows.

Control Displays provide the means to monitor and provide Supervisory Control of specific process operations such as pump stations, specific pumps, heat exchangers, pH control, chemical systems, etc. Depending on the complexity of the specific process there may be several levels of displays. For example, some unit operations will have a special display for each phase of a startup sequence. Control of each piece of equipment on individual unit operation control displays is possible. The following figure illustrates a typical control Display.

a. The Level display provides the capability to control specific equipment, system and to navigate directly to related displays.

Supervisory Control: The objective of the SCS design approach is to implement all Supervisory Control of the plant and its process and control strategies from the control displays. The control strategies include the following functions:

- a. System level control, such as control loops, and sequences, etc.
- b. Equipment level control, such as a pump start/stop control.
- c. Detailed monitoring of sequence steps and general information messages for status
- d. Important alarm messages.
- e. Paging between related displays.
- f. Paging between related processes.

Pop-Up Windows:

- a. Pop-up windows provide the capability to control systems and equipment without cluttering the overview or control display. The Figures 6, 7, 8, and 9, in Supplement A illustrate the configuration of a typical pop-up window.
- b. The typical pop-up window provides the following functions: 1) Status monitoring of equipment being controlled.

- 1) Operating mode.
- 2) Manual mode selection.

- 3) Start/Stop Control in Manual.
- 4) Auto mode selection.
- 5) Failure Reset.
- 6) Equipment description.
- 7) Control for displaying the equipment number.

#### 2.2.3.2.4 Level 4-Trend Displays:

Trend displays are required for operators to have historical data presented in a visual format that depicts what has occurred with various process in the plant over time.

#### 2.2.4 Data Entry Display

The operator clicks on a setpoint pointer then enters the setpoint. The pointer is then scaled the same as the process variable.

#### 2.2.5 Display Navigation:

To provide fast and effective screen navigation shall be provided. The following outlines the type of screen navigation functionality to be provided. The final display navigation process shall be developed in the software workshops.

#### 2.2.6 Main Navigation Menu Bar:

The Main Navigation Menu Bar is series of buttons on the bottom of each display that provides the user with the capability to go to (navigate to) any unit operation.

#### 2.2.7 Previous and Next Display Controls

Previous and Next display configurations shall be provided.

The Next and Previous displays will be configured to operate within the same level. For example, if an operator is on a Level 2 unit process overview, the previous and next displays configuration will be set up to cycle between all the Level 2 unit process overview displays.

If the user was in the Level 3 displays for a specific unit process the next and previous displays will be configured to cycle between all the Level 3 and Level 4 displays associated with the unit process overview.

#### 2.2.8 Alarm Group Display

The alarm group window gives operators a first-level indication of an alarm occurrence by group and allows operators to filter the alarm list. It indicates by solid color that an active (acknowledged) alarm exists in the alarm group and by blinking that an unacknowledged alarm exists in the alarm group. See Figure 10 in Supplement A.

#### 2.2.9 Alarm Summary (Filtered):

The Filtered Alarm summary window is dedicated to the presentation and acknowledgment of alarms. It provides alarm details, such as date and time



of alarm, recurring alarm signal, alarm group, description of the alarm, alarm priority, current value, engineering unit, etc. for all alarms, acknowledged or unacknowledged. Once the alarms occur, they can be taken off the alarm list only if they have been acknowledged and the alarm conditions are no longer true.

#### 2.2.10 Networks and PLC Status:

Status of individual network switches, network segments, and PLCs shall be displayed on a dedicated status display. See Figure 11 in Supplement A.

### 2.3 SCS/PLC I/O DATABASE

#### 2.3.1 SCS/PLC I/O Database:

The Software Integrator shall provide a Database tool that has the following functions:

##### 2.3.1.1 Coordinate

Coordinate, manage and document all points SCS database points including those communicated between the PLCs and SCS.

##### 2.3.1.2 Database

The database shall contain all the field necessary to configure the various points including the following per point type:

Discrete Point Configuration: The Software Integrator shall provide a SCS/PLC Discrete Input/Output (I/O) database of all the analog and discrete points that are communicated to and from the SCS. The list shall be configured on a Microsoft Excel or Access database. The I/O list includes the following fields.

- a. Loop Number.
- b. Tag Number.
- c. HMI object type.
- d. Object Attribute: Further definition of the function of the point contained within the HMI object.
- e. Example:
  - 1) On status.
  - 2) Runtime hours.
  - 3) Auto select.
  - 4) Manual select.
  - 5) Local/Remote status.
  - 6) Etc.
- f. Alarm Description 1.
- g. Alarm Description 2.
- h. Closed Condition (INPUT): Description of the state of the input parameter of device when the field or internal PLC contacts are in the CLOSED position.
- i. Open Condition.
- j. Closed Condition (OUTPUT): Description of the output signal in the energized position.
- k. Alarm area.
- l. PLC NO: PLC number.
- m. PLC tag.

Analog Point Configuration: The Software Integrator shall provide a

SCS/PLC Input/Output (I/O) Database of all analog points that are communicated to and from the SCS. The list shall be configured on a Microsoft Excel or Access database. The Analog I/O database includes the following fields:

- a. Loop Number.
- b. Tag Number.
- c. HMI object type.
- d. Object Attribute: Further definition of the function of the point contained within the HMI object.
- e. Example:
  - 1) Runtime hours.
  - 2) Speed.
  - 3) Speed Command.
  - 4) Level.
  - 5) Etc.
- f. Point description.
- g. Engineering units.
- h. Scale range.
- i. Alarms Functions:
  - 1) High-High.
  - 2) High.
  - 3) Low.
  - 4) Low-Low.
  - 5) Signal fail.
  - 6) Other.
- j. PLC NO: PLC number.
- k. PLC tag.

## 2.4 STANDARD PLC/SCS FUNCTIONS BLOCKS

### 2.4.1 General

The follow Standard functions blocks specify the standard PLC/SCS functions block to be developed and used to implement the PLC/SCS requirements described in the Loop Specifications submittal.

### 2.4.2 Discrete SCS/PLC Mode Command and Feed Back Status:

When the SCS commands the PLC to specific mode such as Auto or Manual, the SCS shall be configured with an Auto write command database point and a in Auto mode database status.

### 2.4.3 Discrete Equipment Control

Controlled equipment to have ON-OFF-REMOTE (OOR) switch input to the PLC. The Controlled equipment shall include ON running status. PLC outputs include a RUN signal (or separate START and STOP signals) to start the equipment. The Applications Software shall prevent Start/Stop control of equipment by the PLC unless the OOR switch is in the REMOTE position.

When the controlled Equipment is in REMOTE, the SCS and PLC shall be enabled to set the Equipment mode to SCS AUTO or SCS MANUAL. When the controlled Equipment is in SCS Manual the SCS and PLC shall be configured to Start and Stop the Equipment from the SCS. When the Controlled Equipment is in SCS Auto the automatic PLC routine shall control the

ON/OFF status of the Equipment.

Monitor the ON status of equipment in the REMOTE mode. If the PLC calls for the equipment to RUN and does not receive an ON signal after a suitable time delay, lock out the equipment in the PLC and generate an alarm to the SCS.

Equipment Ready Status: Provide equipment Ready status that is logically true when equipment is in REMOTE, SCS AUTO and not FAILED. If the PLC calls for the equipment not to RUN (STOP) and the ON signal is true after a suitable time delay, lock out the equipment in the PLC and generate equipment failure alarm to the SCS. The equipment failure alarm condition and the equipment lock out shall be cleared by an SCS initiated Reset.

Provide a test input that is to be used for system testing. When the TEST input is true the RUN (or START/STOP) output shall be prohibited from energizing. When in this mode, the ON status points read by the SCS and used by the PLC logic will follow the command to run, instead of the field ON inputs.

Provide a bumpless transfer from LOCAL to REMOTE mode. If the Pump is running in the LOCAL mode it shall continue running when transferred to REMOTE.

#### 2.4.4 Discrete Valve (or Gate) Control

Controlled valves have OPEN-CLOSED-REMOTE (OCR) switches with OPEN, CLOSED and REMOTE inputs to the PLC. PLC outputs include an OPEN signal (or separate OPEN and CLOSE signals) to open the valve. The applications software shall prevent control of valve by the PLC unless the OCR switch is in the REMOTE position.

Equipment Available Status: Provide equipment available status that is logically true when equipment is in REMOTE, SCS AUTO and not FAILED. When the controlled valve is in REMOTE the SCS and PLC shall be configured to set the valve mode to SCS AUTO or SCS MANUAL. When the controlled valve is in SCS Manual the SCS and PLC shall be configured to Open and Close the valve from the SCS. When the Controlled valve is in SCS Auto the automatic PLC routine shall control the Open/Close position of the valve.

Monitor the OPEN/CLOSED status of valve in the REMOTE position. If the SCS/PLC calls for the valve to OPEN and does not receive an OPEN signal after a suitable time delay, lock out the valve in the PLC and generate an alarm to the SCS.

If the PLC calls for the valve to CLOSE and continues to receive an OPEN signal or does not receive a CLOSED signal after a suitable time delay. Generate a valve failed alarm to the SCS. The alarm condition and the valve shall be cleared when the valve is noted to be in the correct position.

Provide a test input that to be used for System Testing. When the TEST input is true the OPEN (or OPEN/CLOSE) output shall be prohibited from energizing. When in this mode, the OPEN/CLOSE status points read by the SCS and used by the PLC logic will follow the command to OPEN/CLOSE, instead of the field OPEN/CLOSE inputs.

#### 2.4.5 Analog Inputs

Provide sample times for analog inputs of no slower than one sample every 2 seconds. For inputs that are used for control purposes, use sample times no slower than once every 1 second.

Use the PLCs built-in lag filter and set the time constants to no greater than four times the input sample time.

All analog inputs shall be configured into a floating point variable and scaled in engineering units.

Provide analog switches on each analog input. Analog switches to provide High and Low alarms, or as shown or as described in the loop specifications. The setpoints for the analog switches shall be accessible and changeable through the SCS.

Monitor signal failure (out of normal range) on all analog inputs and alarm on the SCS.

#### 2.4.6 Analog Control

Unless otherwise noted, controllers shall be configured as Proportional-Integral (PI) type. Unless specifically noted do not use derivative mode.

Provide access through the SCS for discrete mode changes, Setpoint and controller output when the controller is in manual.

Controller gain and integral time constant shall be adjusted to provide stable operation normal operating conditions.

Use the position from of the PI equation unless otherwise noted.

Freeze the controller bias to prevent reset wind up, if the output is out of range.

Controller sample times shall be no slower than once every 2 seconds. Provide bumpless transfer between operating modes, auto to manual, and manual to auto.

Provide a SCS Controller tuning display for each loop. The tuning display shall have a trend that trends the Process Variable, Setpoint and Output.

Provide a setpoint initialization routine that initializes the setpoint to the value of process variable when the loop is set to Automatic.

Unless otherwise noted, the Analog control shall be one shot into Manual when signal failure is detected on the Process variable. Provide a SCS alarm that indicates that the loop was set to MANUAL.

Controller shall have CASCADE mode functionality as noted.

#### 2.4.7 Alarm Processing

Provide alarms as noted or shown.

All alarms shall be configured into Alarm Areas as specified by the Owner in the Workshops.

Discrete type alarms shall be provided with an adjustable delay timer so that they do not become nuisance alarms.

Analog alarms shall be programmed in the PLC, setting discrete tags monitored by the SCS. No analog alarm functions at the SCS are allowed.

All alarms shall have individual disable function programmed at the PLC and toggled from the SCS.

#### 2.4.8 Manual Equipment Control from the PLC

Provide a SCS AUTO/MANUAL mode for PLC-controlled devices. In the SCS AUTO mode, the device shall operate as described in the Loop Specifications. In the SCS MANUAL mode, the operator shall control the device through Start/Stop or Open/Close commands from the SCS.

The software AUTO/MANUAL selection shall be allowed only when the device's panel switch is in the REMOTE or COMPUTER position.

Provide MANUAL mode start and stop capability on all equipment, valves, and packaged systems (devices) that are controlled from the PLC, unless otherwise noted.

Receive a discrete variable from the SCS in the MANUAL mode, indicating that the device should start or stop (open or close).

When the device is in MANUAL, disable normal sequence of operations from controlling the device. Do not override shut-down interlocks.

#### 2.4.9 Run-Time Counters

Provide a run-time counter for all motorized equipment that has an ON signal to the PLC.

Accumulate run times in hours with a minimum resolution of 0.1 hour. Counters shall roll over automatically when the accumulator is full.

Provide for a contact from the SCS to reset all run-time counters, on demand or by reaching a preset of 30,000 hours.

Store all run-time counters in a linear block of PLC memory for transmission to the SCS.

#### 2.4.10 Sequences

Sequences specified in the loop descriptions shall have the following general requirements:

All sequences shall be divided into individual steps and be a command report-back type sequence. For example, the PLC shall issue a command for a valve to open (or pump to start) and then it will monitor the valve limit switches (or motor starter auxiliary contact or flow switch) to verify that it did open (or pump start). If the correct feedback status is not received within a preset time limit an individual failed alarm shall be initiated.

Once a sequence has been started, it shall advance from one step to the next when all of the previous steps commanded by the PLC have been verified by the "report-back" portion of the program.

Each sequence shall have a systems level MANUAL/OFF/AUTOMATIC control from the SCS. In the OFF mode the sequence shall be reset to the home, step 0. In the manual mode the sequence shall be started by a SCS START/STOP control. In the AUTOMATIC mode the sequence shall be started by the specified automatic control functions.

If in any sequence step, a device fails to respond to the control of the PLC the sequence shall stop and remain in the current step. The sequence shall remain in the failed step until the SCS start function is initiated. The sequence will then retest the current step and advance to the next step if the device has responded to the control action.

Each sequence shall have a SCS JOG function. The JOG function shall advance the step by one, independent of the normal step advance conditionals and timers.

Each sequence shall transmit bit variable indicating the active step to the SCS.

#### 2.4.11 Totalization

All Flow, weight, and power signals shall be totalized in the PLC and the flow totals communicated to the SCS. All totalizers shall be calculated at least every 3 seconds. PLC special function programs shall be configured to scale the process variable to be totalized into gallons, pounds, or KWH in three seconds. These scaled variables shall be accumulated every 3 seconds until an accumulated value is greater than the unit digit value. When the accumulated value is greater than the unit digit value, a totalizing counter shall incremented by one and the accumulated value subtracted from the unit digit value, and the accumulated value set equal to the result. A threshold detector shall be developed to inhibit the totalizer from totalizing until the process value is greater than a preset percentage of the scale range. Each totalizer shall reset to 0 at 30,000 counts or from a single reset coil shall reset all PLC totalizer counters. The reset coil shall be controlled by the SCS.

#### 2.4.12 Process Control Functions Timing

The objective of the process control function timing function is to reduce processor loading on any one scan by distributing over four time slots.

Provide a timing sequence that is designed to distribute processing of functions in one of four time slots. The duration of each time slot shall be controlled to one scan, approximately 0.25 second.

### PART 3 EXECUTION

#### 3.1 TESTING

##### 3.1.1 General

Test software to demonstrate that the applications software satisfies requirements outlined in the Loop specifications, and described in submittals, and workshops.

3.1.1.1 Test Format: Cause and Effect:

Person conducting test initiates input (cause). Specific test requirement is satisfied if correct result (effect), occurs.

3.1.1.2 Procedures, Forms, and Checklists

The Test will be completed on a unit operation and loop basis that is design to coordinate with the PIC testing and startup.

The Software Integrator shall generate testing forms, and checklists from the SCS/PLC database.

Have space after each test item description for sign off by appropriate party after satisfactory completion.

3.1.2 PIC Integrator and Vendor Factory Demonstration Testing

Software Integrator shall travel to each PIC Integrator and vendor factory and attend the vendor FDT for a minimum of 2 days per vendor test.

- a. PIC Integrator Plant PLCs and panels.
- b. Membrane Bypass Filter System.
- c. Strainer System

Software Integrator and vendor shall demonstrate functions agreed upon during the Application Software Development workshops.

Software Integrator shall provide temporary portable computer and 8 port network switch at FDT to demonstrate PCS HMI application.

Software Integrator shall coordinate with Contractor for early delivery of programming equipment PLCs to demonstrate PCS PLC application interface with vendor control system.

3.1.3 Factory Software Acceptance Test (FSAT)

Scope: Test entire PLC and SCS including network communications, vendor package control systems with exception of primary elements, final control elements, and certain smaller panels, to demonstrate that it is operational and meets the specified requirements. The FSAT shall be successfully completed to the satisfaction of the Engineer before beginning FT1.

Location: Software Integrator facility.

Prerequisite: Completion of PIC FDT and all package vendor FDTs.

Test shall be done using the following equipment:

- a. Computers provided by Section 40 95 50 INSTRUMENTATION AND CONTROL COMPONENTS.
- b. Programming equipment provided by Section 40 95 50 INSTRUMENTATION AND CONTROL COMPONENTS, Supplement PLC Equipment List.
- c. System Integrator shall provide all necessary temporary equipment such as network switches, cables, and power strips as required to complete the test.

Vendor Package Control System: Software Integrator shall use copies of vendor PLC programs from the vendor FDTs to demonstrate interfaces between SCS and vendor PLC.

SCS Display Tests: The Object of the test is to verify all SCS database points and points communicated between the SCS and PLCs and not the operation of the PLC software. Each SCS display and dynamic object on that display and control will be tested and verified. The Applications Software Integrator shall provide a test form for each display that lists all of dynamic objects, controls, pop-up windows and their associated database tags and corresponding PLC address. The test form shall provide a place for a sign off for the Software Integrator and Engineer. SCS Display Navigation Test: The Objective of the test is to verify all the display navigation controls.

Loop-Specific Functions: Demonstrate functions shown on P&IDs, specified in the Loop Specifications, described in submittals, and workshops. This test shall not be started until the Display and Display navigation tests have been successfully completed. This test shall verify all SCS and PLC functions through indications on the SCS and the PLC programming software. The Applications Software Integrator shall develop a test form on a unit operation and loop basis. The form shall list all controlled equipment, control routines, alarm points, status points, setpoints, controllers, sequences that are specified in the Loop Specifications. The test shall demonstrate all manual and automatic functions are operating as specified and verify that the outputs and inputs are configured to the correct PLC I/O point.

Make following documentation available to Owner at Test Site both before and during FSAT:

- a. Loop specifications.
- b. Pre-software design submittal.
- c. Software design submittal.
- d. O&M material.
- e. Master copy of FSAT sign off sheets.

#### 3.1.4 FT1

Performed by PIC System Integrator, Contractor, and package system vendors to test and document PIC, excluding Software Integrator provided applications software, is ready for operation. Prior to FT2, startup test period and PT, inspect, test, and document that entire PIC is ready for operation. Performed by PIC Contractor to test and document that PIC, excluding Software Integrator provided PLC and SCS applications software.

#### 3.1.5 FT2

Combined effort between Contractor and Software Integrator to confirm that PIC, including applications software, is ready for operation.

Prerequisite:

- a. Completion of FT1.

Joint test with Software Integrator, PIC System Integrator, and package control system vendors. Repeat of FT1, except including Software Integrator provided PLC and SCS applications software. Plant interlocking and communications with PLCs and SCS shall be tested on loop-by-loop basis.



Test procedures provided by Software Integrator based on Loop specifications.

3.1.6 PT

These are the activities that refer to as performance testing.

a. Once FT1 and FT2 have been completed and facility has been started up, perform a witnessed PT on complete PIC and software to demonstrate that it is operating as required by the Contract Documents and software loop descriptions. Demonstrate each required function on a paragraph-by-paragraph, loop-by-loop basis.

b. Loop-specific and non-loop-specific tests same as required for FSAT except that entire installed PIC tested using actual process variables and all functions demonstrated.

c. Perform local and manual tests for each loop before proceeding to remote and automatic modes.

d. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.

e. Make updated versions of documentation required for PT available to Owner at Site, both before and during tests.

f. Make one copy of all software O&M manuals available to the Owner at the Site both before and during testing.

3.1.7 ET

These are the activities that refer to as endurance testing.

Once PT has been completed and facility has been started up, perform the ET Phase I on the complete treatment plant PIC system and software to demonstrate that it is operating as required by the Contract Documents and software loop descriptions.

After the completion of ET Phase I identify failures, determine causes of failures, repair failures, and deliver a written report to the Engineer and Owner. After delivering the written report, convene a test review meeting at the job site to present the results and recommendations to the Engineer and Owner. As a part of this test review meeting, demonstrate that failures have been corrected by performing appropriate portions of the performance test.

Based on the Contractor's report and the test review meeting, the Government will determine if retesting is necessary and the restart point. The Government reserves the right to require that the Phase I test be totally or partially rerun. Do not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed. Make updated versions of documentation required for ET available to Owner at Site, both before and during tests.

### 3.2 OWNER TRAINING

#### 3.2.1 General

Software Integrator shall provide an integrated training program for Owner's personnel.

Perform training to meet specific needs of Owner's personnel.

Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.

Provide instruction on all working shift(s) as needed to accommodate the Owner's personnel schedule.

Owner reserves the right to make and reuse videotapes of all training sessions.

#### 3.2.2 Operations

##### 3.2.2.1 Training

Software Integrator shall provide a minimum of 10 days of training at the Site indicated by the Owner for Owner's personnel in the operation of the PLC. Training shall include:

a. Standard operational features of PLC equipment provided.

b. Specific features provided for this project including:

1) General Loop functions.

2) Operation of Each Loop: For example, AUTO/MANUAL control, control setpoint settings, control mode selection, alarm acknowledgment.

3) Operation of Each SCS display, dynamic objects, and controls on that display.

4) The information shall be presented in an electronic format similar to the following Microsoft Power Point slide that illustrates the function of a compound mode in a chlorination control routine.  
(See Figure 12 in Supplement A.1)

##### 3.2.2.2 Operations Startup Suggestions

Suggested unit operations startup suggestions shall be developed and presented to the operations staff. The suggested unit operation shall consist of two sections, field setup and Startup through the SCS.

a. The Field Set up shall list the field devices such as pumps, valves, chemical feeders, etc., and the position of their local control switches to transfer control to the SCS.

b. The Startup Sequence through the SCS shall list each equipment

control, its display where located and the control action to be taken and the expected response to be seen on the SCS.

1. Well Pumps - 34, 35, and 42:

- a. Pumps.
- b. Valves.
- c. Flow Control.
- d. Misc. I/O Well House.

#### 3.2.2.3 Alarm Summary

Describe each SCS alarm, including SCS tag name, detailed description of the alarm, probable cause, suggested operator action(s), and if the alarm is a dial-out alarm.

The Alarm summary shall be configured in Microsoft Excel.

#### 3.2.3 Software Maintenance

Provide a minimum of 5 days of training at the Site for Owner personnel in the maintenance of the PLC and SCS software.

Software functional Block diagrams.

Documented ladder diagrams.

SCS/PLC I/O Database.

#### 3.3 O&M Manuals

##### 3.3.1 General: Provide the following:

- a. Suggested startup procedures.
- b. raining material.
- c. Alarm summaries.

##### 3.3.2 Software: Provide the following:

- a. Finalized loop specifications.
- b. Documented ladder programs.
- c. PLC/SCS I/O database, forms, queries, and reports.

#### 3.4 SUPPLEMENTS

- a. Example Screens.
- b. Loop Descriptions Examples.
- c. Process Control Narratives.

SECTION 46 30 00

CHEMICAL FEED SYSTEMS

08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z400.1/Z129.1 (2010) Hazardous Workplace Chemicals - Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation

ASTM INTERNATIONAL (ASTM)

ASTM D1785 (2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM E1067/E1067M (2018) Standard Practice for Acoustic Emission Examination of Fiberglass Reinforced Plastic Resin (FRP) Tanks/Vessels

ASTM F441/F441M (2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

HYDRAULIC INSTITUTE (HI)

HI 9.1-9.5 (2000) Pumps - General Guidelines for Types, Applications, Definitions, Sound Measurements and Documentation

HI ANSI/HI 7.1-7.5 (2017) Controlled-Volume Metering Pumps American National Standard for Nomenclature, Definitions, Application, and Operation - B115

PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION (PHCC)

NAPHCC NSPC (2015) National Standard Plumbing Code Illustrated

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Chemical Feed System

Auxiliary Equipment and Spare Parts

SD-06 Test Reports

Factory Test Report

Operating Tests

Controlled Volume Pumps - Operational Tests

Controlled Volume Pumps - Time, Volume And Pumping Pressure Tests

Flow Tests

SD-07 Certificates

Safety Data Sheet

Supplied Chemical

Service Organization

Certificates

SD-10 Operation and Maintenance Data

Operating Instructions

Maintenance Instructions

SD-11 Closeout Submittals

Extended Warranty

1.3 MAINTENANCE MATERIAL SUBMITTALS

Concurrent with delivery and installation of the specified equipment, furnish auxiliary equipment and spare parts as follows:

- a. Spare parts for each different item of material and equipment specified including all of the parts recommended by the manufacturer to be replaced after 3 years service.

- b. For each machine: one extra of each part used that is made from glass, hard rubber, or clear plastic; one extra set of solution-hose connections; one extra set of diaphragms, two filler plug seal washers; two ball checks; two seats; two complete sets of all gaskets; one spare diaphragm for each back pressure regulator; one hydraulic plunger assembly for each different size metering pump; one of each type of material back pressure regulator, with three spare springs and fluorocarbon resin diaphragms for each; one spare diaphragm and air valve for pulsation dampener.
  - c. For each different size of direct current motor one SCR circuit board with 12 drive motor fuses and 12 SCR controller fuses; overload replacement elements for each size and type of motor.
  - d. One set of special tools for each type of equipment including calibration devices, and instruments required for adjustment, calibration, disassembly, operation, and maintenance of the equipment.
  - e. Two pairs of safety goggles and/or face shields, two chemical resistant aprons, and two pairs of chemical resistant gloves in one or more wall mounted steel cases.
  - f. One assembly tool for tubular diaphragm.
  - g. One lever type grease gun or other lubricating device for each type of grease required.
  - h. One or more steel tool cases mounted on the wall in a convenient location complete with flat key locks, two keys, and clips or hooks to hold each special tool.
- 1.4 DELIVERY, STORAGE, AND HANDLING

Protect material and equipment delivered and placed in storage from the weather, excessive humidity and excessive temperature variation, dirt, dust, or other contaminants.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide a chemical feed system consisting of a polyblend polymer feed system. This is a skid system swap of the current polymer feed system. The polymer system will reuse existing inlet and outlet piping, but all components of the two (2) existing skids shall be replaced.

#### 2.1.1 System Requirements

Select and fabricate the pumps in accordance with HI ANSI/HI 7.1-7.5 and HI 9.1-9.5 except as modified herein. Provide pump stands and platforms adequate to support the pumping system.

#### 2.1.2 Performance Requirements

Capacity and features of the chemical feed systems and accessories must be suitable for 24-hour full load service in ambient, non-freezing conditions.

### 2.1.3 Submittal Data for Chemical Feed System

Submit manufacturer's performance charts, and pump curves. List of materials, list of equipment, including a complete list of parts and supplies with current unit prices and source of supply. List of special tools for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly.

### 2.1.4 Extended Warranty

provide Manufacturer's Extended Warranty to cover system components for 3 years.

## 2.2 EQUIPMENT

### 2.2.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Equipment must be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Submit Service Organization Certificates outlining their location and qualifications to the Contracting Office.

### 2.2.2 Nameplates

Secure a plate to each major item of equipment containing the manufacturer's name, address, type or style, model or serial number, and catalog number.

### 2.2.3 Polymer Feed System

#### 2.2.3.1 Multi-Zone Mixing Chamber and Post-Dilution

##### A. Multi-Zone Mixing Chamber and Post-Dilution

1. Polymer and water shall be mixed in a chamber designed to create sufficient mixing energy.

a. High shear zone of the mixing chamber shall have a mechanical mixing impeller for successful initial activation and the low shear zone shall not have a mixing impeller to avoid damaging polymer molecules.

b. Solution shall undergo a tapered mixing intensity slope as it exits the initial high shear zone and passes through a second low shear zone, isolated by a baffle.

c. The design shall have primary mixing and post-dilution to maximize the value of breaker surfactant present in emulsion polymer, as per the AWWA Standard for Polyacrylamide (ANSI/AWWA B453-06).

d. Polymer activation efficiency shall be consistent over the dilution water range.

e. The volume of the mixing chamber shall be a minimum of 1.0 gallon to provide sufficient residence time for activating and disentangling polymer molecules.

2. Mixing chamber shall be transparent with acrylic barrel to allow viewing of mixing intensity. Opaque mixing chambers shall be unacceptable.

3. Impeller shall be driven by a 1 HP maximum washdown duty motor.

a. Motor shall be TEFC.

b. Impeller speed shall be 3450 rpm, minimum.

c. Motor shall be direct-coupled to impeller shaft.

4. Mixing chamber shall include a stainless steel injection check valve.
5. Mixing impeller shall be cast brass construction with holes drilled on the backside of the impeller. The impeller, when rotating, shall pull fluid from around the mechanical seal pocket to eliminate the need for a separate mechanical seal flushing system.
6. In order to quantify the mixing intensity in the mix chamber, the applied horsepower shall be defined by measuring the difference in torque when the mix chamber is empty versus being full of water. This value shall be the basis of determining the mixing intensity defined as "G" value.
7. The G-value in the high shear mixing zone shall exceed 14,000 sec<sup>-1</sup> to effectively disperse polymer gels to prevent fisheye formation.
8. The G-value in the low shear mixing zone shall be lowered to 3,500 sec<sup>-1</sup> to avoid damaging polymer chains.

B. Dilution Water Control

1. Dilution water shall be split into two streams.
  - a. Primary water flow shall supply the mixing chamber.
  - b. Secondary water flow shall be used to post dilute the activated polymer stream.
  - c. These two streams shall be completely blended by a static mixer prior to exiting the unit.
  - d. Each stream shall have a rotameter for display of flow rate.
  - e. Each stream shall have a rate control valve for isolation of or throttling of water flow.
2. Unit shall have an electric solenoid valve for on/off control of total dilution water flow. Valve shall have brass body with NBR seals and NEMA 4X rated coil enclosure.

3. Dilution water and solution output connections shall include 304 stainless steel unions connected to the chassis.

C. Pump

1. Unit shall have a neat polymer metering pump.
  - a. Pump shall be positive displacement, progressing cavity type.
  - b. Rotor shall be 316 stainless steel.
  - c. Stator shall be Viton.
  - d. Pump shall have mechanical seal. Pumps supplied with packing seals shall not be considered equal.
  - e. Rotor speed shall not exceed 500 rpm.
2. Pump shall be driven by a ½ HP, TEFC, AC motor.
  - a. Variable speed shall be provided by a VFD controller.
  - b. Pump shall be direct-coupled to gear motor.
3. Pump shall include a pressure relief valve and pressure gauge located on the discharge side of the pump and piped to the pump suction. Pressure relief valve shall be PVC construction with Viton seals. Systems utilizing pressure relief on the mix chamber discharge and requiring a connection to drain shall not be considered equal.
4. A suitably-sized calibration cylinder shall be mounted to the frame with PVC isolation ball valves. Cylinder shall be calibrated in mL, and be constructed of clear PVC with slip on cap and ½ inch NPT vent connection.

D. Controls

1. System shall be supplied with waterproof control enclosure. Unit shall be powered through an on-off-remote circuit controlled by a three position switch.
  - a. In the remote switch position, the unit shall accept a run signal.
  - b. Unit is manually powered in the on position.
1. A VFD shall be supplied to vary pump speed. A keypad shall be mounted on the motor control enclosure for VFD control and display.
  - a. VFD shall accept single phase power and convert it to three phase output.



- b. Up/Down arrows shall control motor speed in manual mode.
- c. VFD shall accept 4-20 mA input signal to vary pump speed in automatic mode.
- 2. Unit shall accept a 4-20 mA analog signal to pace the polymer metering pump.
  - a. The controller shall also have manual motor speed control via a potentiometer on touchpad for VFD.
- 3. Unit shall detect loss of water flow, sensing that water flow has been interrupted for any reason, will place the polymer pump and mix chamber on standby and will restart it automatically when flow is restored.
- 4. An integral timer shall monitor loss of flow and energize contacts indicating alarm after 15 seconds of continuous loss.

#### 2.2.3.2 Technical Data

- A. Connections - Plumbing
  - 1. Dilution water inlet, 1-1/2" FNPT
  - 2. Neat polymer inlet, 1/2" FNPT
  - 3. Solution discharge, 1-1/2" FNPT
- B. Connections - Electrical
  - 1. Voltage - 120 VAC / 1 Phase/ 60 Hz - 21 amps
  - 2. Terminal blocks - 4-20 mA signal input
  - 3. Terminal blocks - dry contact input for remote start
  - 4. Terminal blocks - dry contact alarm output
  - 5. Terminal blocks - dry contact run output
- C. Dimensions
  - 1. Frame - 37" wide x 28" deep x 47" high (94x71x120 cm)
- D. Materials of Construction
  - 1. Structural frame - 304 stainless steel
  - 2. Plumbing - PVC, nylon, stainless steel
  - 3. Mixing chamber - PVC, acrylic
- E. Performance
  - 1. Dilution water - 120-1200 GPH primary mixing  
120-1200 GPH post dilution
  - 2. Metering pump - 0.5-10 GPH neat polymer

#### 2.2.3.3 Spare Parts

Spare parts kit shall include mechanical seal, mixing chamber o-rings, injection check valve, and pump stator.

#### 2.2.4 Controls

Provide the chemical metering equipment with the appurtenances and accessories, as required, for flow capacity adjustment. Provide manual range adjustment on all systems.

##### 2.2.4.1 Automatic Control

Provide automatic control with the capability to vary feed rate based on signals from a flowmeter or PLC.

##### 2.2.4.2 Manual Control

Provide nonautomatic control with the capability for starting or stopping the chemical metering equipment and adjustment of the solution feed rate by

the operator.

#### 2.2.5 Calibration Standpipes

Provide chemical metering equipment with a calibration standpipe for measuring pump output. The standpipe must allow convenient observation of the change of fluid level for at least 1/2 minute at full stroke and maximum speed settings, and of Schedule 80, clear PVC pipe conforming to ASTM D1785 with Schedule 80 fittings equipped with a flanged connection to the pump manifold and an end cap fitted with a PVC vacuum breaker and ball valve for air venting. The standpipe must have a clear, observable length of at least 12 inches and be permanently calibrated in gallons and fractions thereof, to allow reading of the fluid contents with an accuracy of 1 percent.

#### 2.2.6 Pressure Gauges

Provide diaphragm type gauges with Bourdon tube and diaphragm compartments filled completely with oil, and made of materials suitable for the application. Install diaphragm seals at each gauge connection to isolate gauges from corrosion, sludge or other hazards of the process fluid. Provide seal material that is compatible with the oil in the gauge and the process fluid.

#### 2.2.7 Piping

##### 2.2.7.1 Backflow Preventor

Provide backflow prevention devices or air gaps on tank fill lines in accordance with NAPHCC NSPC.

##### 2.2.7.2 Chemical Solution Piping

###### 2.2.7.2.1 Smaller than 1-1/2 inch Diameter

Chemical solution piping smaller than 1-1/2 inch diameter must be PVC pipe conforming to ASTM D1785 or CPVC pipe conforming to ASTM F441/F441M or rubber tubing. Provide plastic fittings for plastic pipe with solvent welded joints. Make joints for rubber hose using a clamp-type mechanical coupling.

#### 2.2.8 Equipment Appurtenances

Provide galvanized steel, cadmium plated or Type 316 stainless steel bolts, nuts, anchors, washers and all other types of supports necessary for the installation of the equipment.

#### 2.2.9 Factory Painting

Factory painting must conform to manufacturer's standard factory finish, provided it does not discolor in the presence of hydrogen sulfide fumes, high water vapor atmosphere, alkaline water vapor, and concentrated chlorine (oxidizing) conditions. Coating must be at least 1.75 mils thick.

#### 2.2.10 Factory Test Report

Factory examine fiberglass tanks in accordance with ASTM E1067/E1067M prior to shipping. Furnish a copy of the corresponding test report with each

tank.

## 2.3 MATERIALS

Submit Safety Data Sheets in conformance with ANSI Z400.1/Z129.1 for each chemical. Provide a 90 day supply at the maximum pumping rate for each feeder or pair of duplexed feeders. Submit two copies of certification stating that each supplied chemical meets the following requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

After becoming familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

### 3.2 INSTALLATION

Submit detail drawings containing complete piping, wiring, schematic, flow diagrams, and any other details required to demonstrate that the system has been coordinated and properly functions as a unit. On the drawings show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation.

#### 3.2.1 Chemical Feeding Equipment

Install controlled volume pumps, equipment, and appurtenances to provide a complete and integrated system in accordance with the instruction of the manufacturer and under the direct supervision of the manufacturer's representative.

#### 3.2.2 Field Painting

Thoroughly clean, prime and top-coat factory painted items requiring touching up in the field with the manufacturer's standard factory finish provided it does not discolor in the presence of hydrogen sulfide fumes, high water vapor atmosphere, alkaline water vapor, and concentrated chlorine (oxidizing) conditions. Paint the equipment which did not receive a factory finish as specified in Section 09 96 00 HIGH PERFORMANCE COATINGS. Coating must be at least 1.75 mils thick. Provide piping identification as specified in 09 96 00

#### 3.2.3 Framed Instructions

Submit framed instructions for approval prior to postings. Final size must be easy to read by operators 5 feet from instructions. Limit frame size to 11" x 17" size provide multiple frames if needed. Post framed instructions, containing wiring and control diagrams, where directed. Post condensed operating instructions as outlined in paragraph 3.4.2 Operating Instructions. Post the framed instructions before acceptance testing of the systems.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Testing

After installation of each controlled volume pump, carry out operating tests

as specified below to assure that the chemical metering installation operates properly. If any deficiencies are revealed during any tests, correct such deficiencies and reconduct the tests. Submit reports of all tests in booklet form prior to final acceptance of the installation. Show all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Indicate in each test report the final position of controls.

#### 3.3.1.1 Controlled Volume Pumps - Operational Tests

Test pumps to demonstrate that the pumps are capable of operating without vibration or leakage. Perform testing at the pump's maximum flow rate and at half the flow rate. Demonstrate testing while controlled and operated in all feasible modes with the pumps operated singly and in unison. Plot the response of each pump on curves for the various operating pressures encountered and the results compare to the curves shown on the manufacturer's published pump data. If control characteristic curves are not available at the time of testing, the pump manufacturer's service engineer must generate such curves for each pump; graphically depicting the pump displacement at 25, 50, 75, and 100 percent of motor speed for SCR equipped pumps, and at 25, 50, 75, and 100 percent of maximum stroke position for all pumps. Generate curves only for the specified back pressure.

#### 3.3.1.2 Controlled Volume Pumps - Time, Volume and Pumping Pressure Tests

Test pumps by filling the standpipe with chemical and measuring the outage, with all other equipment valved off. Record the time, volume and pumping pressures.

#### 3.3.1.3 Flow Tests

Test pumps to demonstrate zero gpm flow at a zero stroke or speed setting. Failure to meet this test is cause for rejection. Test pumps through full range of performance: min. flow 2 gph. Submit test results to prove pump functions within specified system parameters.

#### 3.3.2 Manufacturer Field Service

Provide the services of a manufacturer's representative who is certified by manufacturer in the installation, adjustment, and operation of the equipment specified. The representative must supervise the installation, adjustment, and testing of the equipment. Submit certificates to Contracting Officer for approval.

#### 3.4 CLOSEOUT ACTIVITIES

##### 3.4.1 FIELD TRAINING

Conduct a field training course for designated operating, maintenance and supervisory staff members. Provide training for a total period of 8 hours of normal working time and start after the system is functionally complete but prior to final acceptance tests. Cover all of the items contained in the Operating and Maintenance Instructions during field training.

##### 3.4.2 Operating Instructions

Submit complete copies of operating instructions outlining the step-by-step

procedures required for system startup, operation and shutdown. Include in the instructions the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Also include in the instructions as-built drawings of the piping layout, equipment layout, simplified wiring and control diagrams of the system as installed, and flow diagrams.

#### 3.4.3 Maintenance Instructions

Submit complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble-shooting guides.

-- End of Section --

SECTION 46 43 21

SECONDARY CLARIFIER RECONDITIONING

03/19

PART 1 GENERAL

This section includes replacement of the secondary clarifier internal equipment on Clarifiers No. 1 and 2. All clarifier internal equipment is to be replaced except the fiberglass weirs. Brush-type circular clarifier launder cleaners are to be added to Clarifiers No. 1, 2 and 4.1.1

SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Circular Clarifier System

Show the complete assembly of the equipment with all components, mechanisms, and parts; each with an assigned number corresponding to the equipment manufacturer's parts list. Show details for each component of the clarifier mechanism including installation of piping, anchorage, wiring, and tank floor surfacing. Also submit drawings for the brush launder cleaning system

Provide detailed connection and related notes to clarify special fabrication and installation that will insure the clarifier sludge suction header and squeegee remains flush with the negatively sloped floors that exist in the clarifier structures receiving new equipment.

SD-10 Operation and Maintenance Data

Circular Clarifier System1.2 QUALITY CONTROL1.2.1

Qualifications1. It is the intention of this specification to cover minimum acceptable quality for a complete installation with the exception of the motor controls, electrical work and piping requirements.

2. Basis of Design for the material and equipment specified is the Tow-Bro® clarifier design and FEDWA inlet designed by Envirex® Products of Evoqua Water Technologies in Waukesha, WI. Other clarifier systems may be submitted, but any changes to the clarifier design will be at the expense of the Contractor.

3. The equipment Manufacturer shall have not less than fifteen (15) successful years of experience in the design, construction and operation of the type specified at ten (10) different plants.

4. The Engineer may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

1.2.2 Warranty

Seller shall furnish its standard warranty against defects in material and

workmanship for all Equipment provided by Seller under this Section. The Seller shall warrant the Equipment, or any components thereof, through the earlier of:

1. Eighteen (18) months from delivery of the Equipment or
2. Twelve (12) months from initial operation of the Equipment.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Equipment and parts shall be packaged for shipment to prevent breakage and damage to components. Deliver materials for the site, inspect for damage, unload and store with a minimum of handling. Store materials off the ground and under a weathertight covering.

### 1.4 MANUFACTURER'S REPRESENTATIVE

Furnish the service of the clarifier equipment manufacturer's representative or technician, experienced in installation and operation of the type of systems being provided, to supervise the erection, start up, acceptance tests, and final inspection.

### 1.5 WARRANTY

The system shall be warranted for 1 year from substantial completion.

## PART 2 PRODUCTS

Provide two (2) circular clarifier systems in accordance with the contract specifications herein and the contract drawings.

### 2.1 EQUIPMENT

1. Furnish and install suction type sludge collector for installation in one (1) concrete settling tank.

- a. Tank diameter to be 75 feet with inboard effluent launder.
- b. Tank side water depth to be 14 feet.
- c. Tank freeboard to be 2 feet.
- d. Floor slope is negative. Equipment shall function properly on floor slope conditions as reflected on drawings which include spot elevations at the center and peripheral of the structure.

2. Clarifier Mechanism

- a. Provide a center pier supported, center feed design with peripheral overflow.
- b. Provide a center drive mechanism that supports a walkway, maintenance platform and rotating structural steel cage.
- c. The cage shall support Tow-Bro® Unitube header, manifold and truss arm.
- d. One (1) surface skimmer which includes scum blade and hinged skimmer assembly.
- e. Fabricated steel structures shall be shipped in the largest sub-assemblies permitted by carrier regulations, properly match-marked and identified for ease of field erection.

#### 2.1.1 Design

Internal Diameter, feet 75

Side-water Depth, feet	14
Minimum Freeboard, feet	2
Floor Slope	Negative slope - reference drawings
<u>Center Pier</u>	
Minimum inside diameter, inches	24
<u>Flocculation Well</u>	
Diameter	14' 9"
Depth below water surface	5' 0"
Number of Scum Ports	6
Well Thickness	3/16"
Configuration	Circle
<u>FEDWA - EDI</u>	
Plate thickness	3/16"
Impingement Zones	4
<u>Skimmer</u>	
Number of Skimmer Arms	1
<u>Scum Trough</u>	
Trough Width, feet	6
Maximum Headloss for Header, feet	1.0
Minimum Flow Velocity in Header, ft/s	0.50
Minimum Header Orifice Diameter, in	1.5
Header Thickness, inches	1/4
Header Support Type	Tie bar
Ball Race Diameter, inches	42
<u>Torque Requirements</u>	
AGMA Rated Torque, ft-lbs.	21,900
Motor Shut-Off Torque, ft-lbs.	26,280
Momentary Peak Torque, ft-lbs.	43,800
Service Factor	1.25
Drive Output Speed, RPM	0.04

#### 2.1.2 Materials

1. Drive housing shall be cast iron
2. Submerged Steel in contact with process water: A36 Carbon Steel
  - a. Alternatives: Galvanized, 304 Stainless Steel or 316 Stainless Steel
3. Non-Submerged Steel: A36 Carbon Steel
  - a. Alternatives: Galvanized, 304 Stainless Steel or 316 Stainless Steel
4. Grating: Aluminum
  - a. Alternatives: Galvanized, FRP, etc.
5. Handrails: Aluminum
  - a. Alternatives: Galvanized, etc.
6. Anchor bolts and hardware: Type 316 stainless steel.

#### 2.1.3 Structural Members

1. Structural steel shall conform to Part 1.01-D.
2. Structural steel components shall have minimum thickness of 1/4" unless otherwise specified.
3. Sharp corners of cut or sheared edges will be dulled with one pass of a power grinder to create a smooth edge.
4. All welding shall conform to American Welding Society Standard AWS D1.1. Structural support members shall be shop welded for bolted field



assembly. Field welding shall be minimal.

5. Design components so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.

6. Panel lengths and member sizes shall be selected such that slenderness ratios do not exceed 200 for compression and 240 for tension. For strength, the controlling member force shall be used to determine member size.

7. Maximum deflection in a span under combined live and dead loads shall not exceed  $L/360$ .

#### 2.1.4 Drive Mechanism

##### 1. General

a. Drive mechanism consisting of primary helical gear reduction, intermediate worm gear reduction unit and enclosed final reduction unit consisting of internal spur gear and pinion in a turntable base is to be completely assembled and finish painted in the Manufacturer's shop.

b. All gearing shall be enclosed in gray cast iron ASTM A-48 Class 40B housings. Fabricated steel housings, exposed gearing and submerged bearings will not be acceptable.

c. The drive shall be designed to allow removal and replacement of internal gear, balls and strip liners without raising the walkway.

d. All components of the drive mechanism shall be designed in accordance with AGMA Standard 6034-B92 "Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors", and Standard 2001-D04 "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth"; for 24-hour continuous, uniform load duty and 20-year design gear life at the specified output speed. The AGMA rated torque of the drive shall be the lowest value computed for worm gear set, spur gear and pinion for strength and durability.

e. Select conservative values for bending strength and pitting resistance life factors  $K_1$  and  $C_1$  based on a minimum of 420,000 cycles of the main gear. The drive AGMA torque rating shall be as specified above with a minimum 1.25 service factor.

f. All bearings shall be designed for a minimum B-10 life of 200,000 hours.

##### 2. Primary Reduction Unit

a. Provide commercially available helical gear reducer or gearmotor in a cast housing.

b. All bearings shall be anti-friction type running in oil.

c. Motor shall be totally enclosed, ball bearing type, of ample power for starting and continuously operating the drive mechanism without overloading.

d. Motor to conform to NEMA standards and be suitable for operation on 230/460 volt, 3 phase, 60 Hertz current.

e. Primary reduction unit shall drive the intermediate reduction through a chain and sprocket arrangement with #80L self-lubricating chain and non-corrosive OSHA approved removable chain guard.

f. Provide proper chain tension by an adjustable steel base mounted on the intermediate reduction unit.

##### 3. Intermediate Reduction Unit

a. Provide worm gear speed reduction with grease and oil lubricated anti-friction type bearings in cast iron housing securely bolted on the

machined top face of the final reduction unit. Worm and shaft shall be a two-piece assembly for ease of maintenance. Cycloidal and planetary gearing will not be acceptable.

- b. Align and maintain accurate centers with the final reduction gearing. Swivel base mounting of the intermediate unit will not be acceptable.
- c. Mount an electro-mechanical overload device on the thrust end of the worm shaft consisting of plate spring assembly, plunger, indicator dial two (2) micro-switches (one N.O. and one N.C.) and a terminal block, all enclosed in a weather tight, gray cast iron housing. Amperage metering devices will not be considered equal to the overload device specified.
- d. Micro-switches shall be factory set to: (1) sound an alarm when the load on the mechanism reaches 100% of the AGMA torque; and (2) stop the motor when the load reaches 120% of the AGMA torque.
- e. Provide a shear pin device mounted on the drive end of the worm shaft.

#### 4. Final Reduction

- a. Provide internal, full depth involute tooth design, ductile iron spur gear driven by a heat treated steel pinion from the slow speed shaft of the intermediate reduction unit. Stub tooth design will not be acceptable.
- b. Provide bearings at top and bottom of pinion to ensure complete tooth contact between mating surfaces. Pinion and pinion shaft shall be furnished as a two-piece assembly for ease of maintenance.
- c. Provide cast iron turntable base with annular raceway to contain balls upon which the internal gear rotates. The ball race shall ensure low unit ball load, long life and stability without the use of submerged guide shoes, bumpers or steady bearings.
- d. Provide four (4) 3/8" thick x 3/4" wide renewable special hardened (38-42 Rockwell C) steel liner strips force fitted (pins and cap screws not permitted) into the turntable base and internal gear for balls to bear on vertically and horizontally.
- e. Provide an internal gear of split design with precision mating surfaces for ease of removal of gear, balls and liner strips without raising bridge. Drives without this feature are not acceptable.
- f. Internal gear, pinion and balls to run in an oil bath and be protected by a felt seal and vertical neoprene dust shield.
- g. Provide oil filling and level pipe along with a drain plug and sight gauge.
- h. Turntable base shall be bolted to the center column and be designed to support the bridge, internal gear and rotating mechanism.

#### 2.1.5 FEDWA Flocculation Baffles

- 1. Provide inlet baffles to promote effective mixing and tapered flocculation.
- 2. Flow shall impinge three (3) overlapping vertical target baffles in secession with a series of four (4) impingement zones.
- 3. Design to provide a "Gt" (t in seconds) value in the well not exceeding 6,000 with a velocity gradient "G" within the well of at least 35 fps/ft and not exceeding 60 fps/ft at a minimum water temperature of 10 degrees-C at peak influent flow.
- 4. Provide horizontal shelf baffles to prevent downward movement in flocculation zone.
- 5. Baffles shall bolt to center cage and well support beams.
- 6. The baffles to be fabricated from minimum 3/16" thick A36 carbon steel plate.
- 7. Hydraulic calculations shall be provided showing dimensional characteristics, port area, velocity, headloss, and mixing intensity.

8. LA EDI system shall be the only acceptable alternative to the FEDWA design

#### 2.1.6 Flocculation Feedwell

1. The flocculation feedwell fabricated from 3/16" steel plate sections supported from the drive cage or bridge extensions.
2. Incorporate steel stiffeners at the top and bottom to maintain shape and rigidity.
3. Feedwell shall be of adequate size to diffuse the flow into the tank at a uniform flow through velocity.
4. Ports shall be cut into the flocculation feedwell to permit entrapped scum to escape.
5. Ports shall be baffled to prevent short circuiting to the weirs.

#### 2.1.7 Center Pier

1. A cylindrical 1/4" thick steel plate center pier shall support the drive, collector mechanism and access bridge.
2. Top of pier to have a drive mounting plate set plumb with the centerline.
3. Drive to be positioned, leveled and grouted in place on top of pier with a non shrink grout.
4. Manufacturer to provide minimum eight (8) 1" diameter anchor bolts and steel template/grout shield to accurately locate anchors.
5. Center pier shall serve as the influent pipe.
6. Center pier shall have a minimum of four (4) overflow areas at its upper end to diffuse flow into the flocculation feedwell at a velocity not to exceed 1.75 fps at maximum design mixed liquor flow.

#### 2.1.8 Sludge Collection Header

1. The header shall be parallel to the tank floor and have a series of inlet orifices such that the entire tank bottom is swept clean in a single revolution.
2. The header shall be designed to uniformly remove sludge in proportion to the area swept with the removal of a larger volume of sludge at greater distances from the tank center.
3. Sludge shall be transported through the header to the center manifold, with removal being accomplished by hydrostatic pressure.
4. Provide a fully tapered, rectangular-shaped Unitube header varying in cross section from a maximum near the tank center to a minimum at the outer wall.
5. Fabricate header from 1/4" thick steel plate and hot-dip galvanized after fabrication. Provide steel plate counterweights not exceeding 50# each as necessary for proper equipment balance. Field welding of galvanized header or supports will not be allowed.
6. Longitudinal cross sectional axis to be mounted at an angle of 45 degrees to tank bottom to trap sludge.
7. Provide a 2" fluidizing vane as an integral part of header. Attach neoprene squeegee to fluidizing vane provided with 1" vertical adjustment.
8. Manufacturer to size and space header inlet orifices at regular intervals not exceeding 30".
9. Orifice design to be proportionate to the volume of sludge withdrawn from the entire tank floor at all flows.
10. Provide header flange with silicone seal for bolted connection to

center manifold. Header shall be tie bar supported.

11. Alternate Manufacturers shall submit header verification field data in accordance with the Substitute Equipment Section of this specification.

12. Sludge withdrawal by means of individual riser pipes or stepped header construction will not be acceptable.

#### 2.1.9 Center Cage, Truss Arm and Manifold

1. Center cage to be of an all-welded box truss construction made up of structural steel members having a minimum thickness of 1/4"

2. Provide one (1) truss arm per skimmer assembly.

3. Truss arm shall be furnished with a triangular three-point contact design for ease of installation and alignment. Truss shall be constructed with 1/4" minimum thick members. Truss shall be pinned at the base for vertical adjustment and connected to the center cage through strut and adjustable clevis assembly. Tie-rod and turnbuckle designs that do not provide lateral support will not be acceptable.

4. Provide a cylindrical manifold with two (2) seals for bolted connection to the sludge collection header and bottom of cage. A bottom seal plate shall be furnished by the equipment Manufacturer securely anchored to the floor and grouted in place after final adjustment.

#### 2.1.10 Surface Skimmer

1. Provide skimmer arm consisting of scum blade and hinged wiper assembly.

a. The scum blade shall span the full length between the flocculation feedwell and scum trough. Scum blade shall have a height of 5-in rigidly attached to vertical pipe supports and structural A-frame.

b. Mount a hinged wiper assembly on the end of the scum blade to form a pocket for trapping scum. The wiper assembly shall maintain continual contact and proper alignment between scum blade, outer scum baffle and scum trough. The wiper blade shall have a wearing strip on its outer end which contacts the scum baffle and neoprene strip on its inner and lower edges which contact the scum trough.

c. All springs, pivot points and threaded fasteners shall be constructed of 302 stainless steel. The hinged wiper assembly shall be hot dipped galvanized. The wiper blade shall be neoprene with Durometer range 50-60. The wiper assembly shall be the same dimension of the scum trough.

d. Provide a manual lockout mechanism on hinged skimmer assembly to allow for flexible independent operation for surface ice. Lockout mechanism shall raise hinged skimmer assembly above water surface without removal.

2. Provide one (1) scum trough 6-ft wide with inclined beach of 1/4" thick plate, supported from the tank wall.

a. Scum trough shall have an overall length of 4'-9" along the scum baffle consisting of beach plate, inner radius baffle, hopper and 6" discharge pipe. Manufacturer shall provide a loose plate flange for contractor to field weld and connect to scum drain piping.

b. Beach plate to slope at a nominal incline of 1-3/4" per foot to a point 5" below the maximum water elevation. The trough shall be provided with a submerged shelf extension spanning an additional 4'-0" along the scum baffle. An inner radius baffle extending 9" below and 3" above maximum water level shall run from the trough to the end of the submerged shelf.

3. Provide a mechanical flushing device made from 304 stainless steel and activated by the main tank skimmer arm. The flushing device shall pivot on a fabricated hinge that uses a 3/4" diameter minimum stainless steel

pin/bolt. The flushing device will provide a counter weight action which in conjunction with a neoprene seal will assure a positive closure. The flushing device shall be held open to allow 15 to 25 gallons of flushing water per trip.

#### 2.1.11 Access Bridge

1. Provide a bridge of pony truss construction extending from the tank wall to the stationary drive base.
2. Provide a bridge extension to provide access to the far-side of the drive mechanism.
3. Bridge to be designed for the dead load and a live load of 50#/sq. ft., with a deflection not exceeding L/360 of the span.
4. Provide a 3' wide walkway of 1-1/4" x 3/16" aluminum grating extending over the entire bridge length.
5. Provide a 2-rail handrail consisting of 1-1/2" diameter, Sch. 40 mechanically fastened aluminum pipe for rails and Sch. 80 posts. Post spacing not to exceed 5'. Omit handrail only where truss bridge members at 21" and 42" above the walkway provide the same function.
6. Provide a 4" high aluminum toe plate along both sides of bridge and bridge extension.
7. Provide a minimum 8' x 10' rectangular platform to provide a 2' working clearance around the drive.

#### 2.1.12 Anchor Bolts

1. All equipment anchor bolts shall be Type 316 stainless steel.
2. Equipment Manufacturer shall furnish steel template and grout shield to accurately locate center pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

#### 2.1.13 Brush Type Circular Clarifier Launder Cleaners

Provide and install a brush type launder cleaning system by the clarifier manufacturer compatible with the clarifier scum assembly.

##### 2.1.13.1 Materials

Attachment Assembly	Stainless Steel, ASTM A240, Type 304
Primary Frame	Stainless Steel, ASTM A240, Type 304
Brush Arms	Stainless Steel, ASTM A240, Type 304
Brush Bridge	Stainless Steel, ASTM A554, Type 304
Brush Backing	Structural foam polypropylene
Brush Bristles	Polypropylene
Springs	Stainless Steel, ASTM A313, Type 304
Nuts and Bolts	Stainless Steel, ASTM A593 and ASTM F594, Type 304

Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

#### 2.1.13.2 General

The launder cleaner shall be affixed to the scum skimming arm of the clarifier equipment. The cleaner shall be fully compatible with the clarifier equipment and shall not interfere with any aspect of the clarifier equipment operation. The brush arms and brushes shall have two positions, engaged and disengaged. Engaging and disengaging of brushes shall be accomplished readily by operators positioned on the clarifier bridge or on the surface adjacent to the clarified using poles and/or other tools provided for this purpose. When cleaning is not desired the brushes shall be capable of being disengaged and scum skimming shall continue under normal operation. Both positions shall have locking mechanisms to prevent accidental position changes.

#### 2.1.13.3 Attachment Assembly and Primary Frame

The attachment assembly design shall be coordinated with the design of the clarifier equipment and the launders. The assembly shall attach directly to the clarified equipment skimming arm and shall be coated with the same coating as the clarifier mechanism.

The primary frame shall be designed for easy insertion into the attachment assembly. The frame shall be tightened into position through the use of set screws. The primary frame design shall allow the brushes to be positioned at any point along the frame.

#### 2.1.13.4 Brushes

Each brush arm shall consist of a telescoping arm which allows for position adjustment of each arm, a brush holder, and a means of engaging the brush with sufficient force to remove algae and debris. Each arm shall be designed with flexibility to clean surfaces within a plus or minus 4 inch radial variance.

#### 2.1.13.5 Brush Bridge

Brush bridges twat allow the launder cleaner to travel over effluent launders oriented perpendicular to the launder cleaner's direction of travel shall be provided.

#### 2.1.13.6 Brushes

Brushes shall be provided which slip easily into place in the brush holders. Brush backing shall be able to withstand continuous exposure to sunlight, project environmental conditions, and elements found in secondary effluent. Brush bristles shall have adequate trim, length, density and stiffness to last for a year at the cleaning duration and frequency. Brushes shall be appropriately cut and shaped to clean without binding.

#### 2.1.13.7 Spare Parts

A spare set of brushes shall be supplied for each clarifier.

## 2.2 SURFACE PREPARATION

- A. The center drive mechanism shall be shipped, assembled and finish painted in accordance with 09 96 00.
- B. The unitube sludge collection header shall be hot-dip galvanized after fabrication.
- C. Submerged and/or non-submerged components shall be prepared by in accordance to 09 96 00.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. The Contractor shall install the clarifier as shown on the drawings.
- B. Equipment shall be installed in accordance with GENERAL MECHANICAL REQUIREMENTS and in accordance with the Manufacturer's recommendations to provide a complete installation.
- C. The Contractor shall complete the following:
  - 1. Plumb and grout the center pier
  - 2. Add grout beneath the manifold seal ring and adjust for horizontal plane
  - 3. Grout the floor in accordance with the Manufacturer's recommendations
  - 4. Add grout between the center pier and drive unit
- D. Operating Instructions and/or Operator Training
  - 1. Manufacturer to provide two (2) trips and two (2) days of field service. One day shall be dedicated to a pre-grout inspection. After installation, a post-grout inspection shall be conducted followed by a general training seminar.

The clarifier brush system shall be installed and tested under the direction

### 3.2 START UP

- A. A start-up inspection and test shall be performed on each clarifier to verify proper installation, alignment and operation.
- B. Testing shall include the following:
  - 1. Drive
    - a. Alignment and Installation
      - 1. Check alignment of the drive and driven sprockets
      - 2. Check chain for proper tension
      - 3. Ensure proper fit of chain guard
      - 4. Measure the stop block clearance and lower drive housing
      - 5. Review and confirm the correct motor, gear reducer, and drive chain have been installed on the clarifier drive per the defined mechanism design
      - 6. Confirm installation of the proper shear pin
      - 7. Bump motor to confirm correct rotation
    - b. Lubrication
      - 1. Check the drive mechanism for the correct lubrication levels
      - 2. Service all lubrication points and grease fittings
      - 3. Check the air vents in the gear reducers
    - c. Micro-switches
      - 1. The torque protection micro-switches must be connected per the diagram on the drive drawing.
      - 2. The shut-down switch must be connected: a manual reset must be wired in the circuit when the motor shut-off switch is activated.
      - 3. Set alarm and motor shut-off torque overload gap per the

drive drawing

2. Clarifier Mechanism

a. Installation

1. Confirm proper installation of all field bolt material
2. Check the bridge and platform for proper level installation
3. Ensure proper spacing has been installed on the bridge expansion end to allow for sufficient room to expand and contract
4. Run the mechanism and check the horizontal plane at four points on the wall (90 deg. apart) for tanks up to 80' in diameter, eight points (45 deg. Apart) for large tanks. Always recheck starting point.
5. Check manifold runs concentric to center pier
6. Check the slope of the header at fluidizing blade
7. Confirm that the upper and lower manifold seals are installed properly
8. Check the elevation and scum beach level relative to the max water surface
9. Preform alignment check of the header and truss arms
10. Proper tracking and alignment of skimmer assembly with water elevation and scum trough

-- End of Section --



SECTION 46 44 20

MECHANICAL BAR SCREEN RECONDITIONING

05/22

PART 1 GENERAL

1.1 DESCRIPTION

Recondition the existing Aqua Guard Mechanical Screen Model AG-MN-A with the following new parts described in Part 2.

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Screen Assembly

Rotating Brush Assembly

1.3 QUALITY CONTROL

1.3.1 Qualifications

A. The Aqua Guard Mechanical Screen and Rotopress unit equipment replacement parts shall be supplied by the original manufacturer who is fully experienced, reputable and qualified in the supply of the equipment parts specified when possible.

B. The original equipment manufacturer or Contractor shall provide a qualified technician(s) to perform the reconditioning of the Aqua Guard Mechanical Screen and place back into operation.

1.4 WARRANTY

A. The original equipment manufacturer shall warrant the new parts installation for the equipment and its controls for one (1) year from the completion of the rebuilt unit.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The Cherry Point WWTP currently has a Parkson Aqua Guard Mechanical Screen AG-MN-A. Serial number is 20127902. Project number is 201279. The contractor to verify the specific model information. This contract serves to replace internal components of the system.

2.1.1 Design Requirements

A. Description

1. Screen Width - 2 feet 10.5 inches

2. Solids Discharge Height - 32 feet
3. Screen Angle - 85
4. Screen Opening - 6 mm

B. Material of Construction

1. Elements high impact polycarbonate alloy
2. Frame 304 SS
3. Convey or Chain 304/410
4. Filter Element Shafts 304 SS
5. Side Plate high impact phenol

2.2 SCREEN RECONDITIONING

A. Listed below are the required items to be reconditioned on the screen equipment:

Item Description

Complete Screen Assembly

Rotating Brush Assembly

Brush Bearing

Rotating Front Guide Rail Bearing,  
Pillowblock

Drive Shaft Flange Bearing

Bushing Q1

Bushing, G

Sprocket, Brush

Sprocket, Drive Shaft

Brush Chain

Chain Tightener

Upper Guide Rail AS & OH

Lower Guide Rail

Guide Rail

Side Seal

Discharge Pan Seal

Front Seal Brush Set w/Clips

Nameplates/Labels

Filler Plate

PART 3 EXECUTION

3.1 SCREEN RECONDITIONING

The contractor must provide a Parkson certified rebuild on site with OEM parts and technicians.

A. Contractor will be required to perform the following as a minimum.

1. Disconnect power to mechanical screen

2. Remove Aqua screen from channel
3. Set equipment on level surface for reconditioning and follow the manufacturers recommendations
4. Thoroughly clean the units by the means of high pressure wash to removal all solids
5. Disposal of solid waste and old equipment parts removed
6. Reinstall units in channel
7. Reconnect all piping and electrical

### 3.2 FIELD REPRESENTATIVE SERVICES

A. Prior to mobilizing on site, a qualified Parkson representative will review shop drawings for the unit being reconditioned and verify all part numbers and items needed. Representative shall also make a site visit to obtain information and/or verify any other site conditions as necessary to satisfactorily perform all work.

B. Parkson will furnish one (1) factory representative for approximately 5 days (including travel) during one (1) trip to provide rebuilding supervision, and operator training.

C. Parkson's representative shall inspect the installation and provide a written certification that the mechanical screen recondition units have been performed in accordance with the manufacturer's requirements.

-- End of Section --

SECTION 46 51 00.00

AIR DIFFUSION SYSTEM

05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3 (2016) Malleable Iron Threaded Fittings, Classes 150 and 300

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C200 (2012) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C207 (2018) Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 in. through 144 in. (100 mm through 3600 mm)

AWWA C208 (2017) Dimensions for Fabricated Steel Water Pipe Fittings

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A240/A240M (2020a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A530/A530M (2012) Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe

ASTM A554 (2021) Standard Specification for Welded Stainless Steel Mechanical Tubing

ASTM A774/A774M (2014; R 2019) Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

ASTM A778/A778M (2016; R 2021) Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

ASTM B98/B98M	(2013) Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2564	(2020) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

## 1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation

SD-03 Product Data

Materials and Equipment

SD-06 Test Reports

Field Testing

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals

## 1.3 QUALITY CONTROL

### 1.3.1 Qualifications

Welding procedures and welders are required to be qualified in accordance with the code under which the welding is specified to be accomplished.

## 1.4 MATERIALS SUBMITTALS

Submit a complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, proposed diagrams, installation instructions and other sheets. Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 3 months prior to the date of beneficial occupancy. Include a complete list of parts and supplies, with current unit prices and source of supply.

#### 1.4.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and which essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment is required to be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 1.4.2 Nameplates

Include on each major item of equipment the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 1.4.3 Special Tools

Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment.

#### 1.4.4 Factory Painting

Unless otherwise specified, clean, prime, and give two coats of machinery enamel to all equipment at the factory. Fiberglass, stainless steel, and galvanized components need not be painted.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Ensure all equipment delivered and placed in storage is stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide a diffused aeration manifold, piping, and diffuser system using fine bubble membrane disc diffusers for BNR Train 1. Provide a total of 1,610 (plus spares) - 9 inch membrane disc diffuser assemblies manufactured by Xylem - Sanitaire Products of 9333 N. 49th Street, Brown Deer, Wisconsin, 53223. No alternate membrane disc diffuser will be considered in order to remain consistent with the current brand of diffusers that were recently replaced in BNR Train 2.

The quantity of diffusers in each zone should match the schedule below:

Primary Swing Zone 1 = 76 diffusers

Oxic Zone 1A = 224 diffusers

Oxic Zone 1B = 114 diffusers, 128 diffusers, and 82 diffusers respectively

Oxic Zone 1C = 80 diffusers

Secondary Swing Zone 1 = 76 diffusers

Reaeration Zone = 24 diffusers

## 2.2 EQUIPMENT

### 2.2.1 Air Distribution System

Provide a system, including piping, valves, and supports to distribute air from the blowers to the air diffusers. Ensure the system is of adequate capacity for the intended purpose and is adjustable for balancing of air distribution.

#### 2.2.1.1 Fixed Header Air Distribution System

Provide a fixed header air distribution as indicated consisting of a drop leg assembly, fixed headers, and supports. Ensure the system is compatible with the air main and the specified diffusers.

##### 2.2.1.1.1 Fixed Headers

Provide fixed headers of the dimensions and configuration indicated. Provide header connections of a type allowing rotational adjustment of individual header sections of sufficient strength to transmit the longitudinal forces caused by expansion and contraction of the header. Design the headers to allow expansion and contraction up to a maximum temperature of 125 degrees F without damage to the system. Prevent rotation of the header due to thermal expansion and contraction. Provide fixed headers of stainless steel systems or fiberglass systems as follows:

- a. Stainless Steel Systems: Fabricate all welded parts of the system from 304L stainless steel in accordance with ASTM A240/A240M. Provide pipe wall thickness as follows: for 10 inch diameter and less, supply 0.0625 inch (16 gauge) thick pipe; for 12 inch diameter, supply 0.0781 inch (14 gauge) thick pipe; for 14 inch through 18 inch diameter, supply 0.1094 inch (12 gauge) thick pipe; for 20 inch diameter, supply 0.1250 inch (11 gauge) thick pipe; for 24 inch diameter, supply 0.1406 inch (10 gauge) thick pipe. Provide header dimensions as indicated with dimensional tolerances in accordance with ASTM A530/A530M and ASTM A554. Fabricate welded stainless steel fittings and welded stainless steel tubular products in accordance with ASTM A774/A774M and ASTM A778/A778M. Perform all welding in the shop. Add filler wire to all welds to provide a cross section equal to the parent material. Ensure butt welds have full penetration to the interior surface. Ensure interior weld beads are smooth, evenly distributed, and with an interior projection not exceeding 1/16 inch. Wire brush outside weld area with stainless steel brushes. Prior to fabrication, passivate each part of the assembly by pickling and ensure it is completely neutralized. Provide bolts, washers, follower flanges, and other non-welded parts made of 304 stainless steel. Provide low silicon bronze nuts in accordance with ASTM B98/B98M.

##### 2.2.1.1.2 Support System

Provide a system for support and anchoring of the header. Ensure the system is compatible with the expansion and contraction control design. Ensure the support system provides for a minimum of 4 inch vertical adjustment and 1 inch lateral adjustment of the header. Contour the system to fit the bottom 90 degrees of the pipe while maintaining a bearing surface at least 2 inch wide.

## 2.2.2 Diffusers

### 2.2.2.1 Diffuser Performance

- a. Provide the quantity of diffusers, manifolds, and piping as shown on the contract drawings.
- b. Set maximum allowable headloss in the system to 16 inches of water, excluding submergence.

### 2.2.2.2 Membrane Diffuser

- a. Incorporate an integral check valve into the membrane diffuser.
- b. Design and test diffusers at point of manufacture for a dynamic wet pressure (DWP) of 12 inches +/- 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.
- c. Visual Uniformity - Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.
- d. Quality Control - Test diffuser using primary sampling criteria outlined in Military Standard 105E.
- e. Manufacture the circular membrane diffuser with an integral O-ring of EPDM synthetic rubber compound with precision die formed slits.
- f. Add carbon black to the material for resistance to ultraviolet light.
- g. Design diffuser as one piece injection molded part with a minimum thickness of 0.080 inches for 9 inch diameter unit.
- h. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/sq. ft. of material.
- i. EPDM membranes shall conform to the following physical properties:
  - 1) Membrane Material: EPDM
  - 2) Tensile Stress: 1200 PSI Minimum per ASTM D412
  - 3) Durometer: 58 +/- 5 Shore A
  - 4) Elong - % Ret 70 Hrs: 75% Max
  - 5) Elong - % Min At Break: 350% Min
2. Diffuser Holders
  - a. Design holder with air flow control orifice, integral diffuser support plate and removable retainer ring. Holder to provide support for the diffuser and seal the diffuser in the holder to prevent air leakage around the O-ring.
  - b. Design retainer ring threads with minimum cross section of 1/8 inch to allow for one complete turn to engage threads.

### 2.2.2.3 Spare Diffusers

Furnish not less than 20% percent of the installed quantity of diffusers as replacements. Furnish diffusers complete with all parts required for installation.

## 2.2.3 Materials and Equipment

Ensure materials and equipment conform to the following respective publications and other specified requirements.



#### 2.2.3.1 Steel Pipe and Fittings

Provide steel pipe 6 inch in diameter and larger in accordance with AWWA C200. Provide steel pipe less than 6 inch in diameter with threaded end, galvanized, in accordance with ASTM A53/A53M, standard weight. Ensure mechanical joints conform to AWWA C200. Ensure flanged joints conform to AWWA C207. Provide fittings for steel pipe 6 inch in diameter and larger in accordance with AWWA C200 and fabricated in accordance with AWWA C208. For steel pipe less than 6 inch in diameter, provide galvanized fittings in accordance with ASME B16.3.

#### 2.2.3.2 Polyvinyl Chloride (PVC) Pipe and Fittings

Ensure PVC pipe and fittings conforming to ASTM D1785 Schedule 40 or 80. Use solvent weld joints conforming to ASTM D2564.

#### 2.2.3.3 Stainless Steel Tubing and Fittings

Unless shown or specified otherwise, provide stainless steel tubing in accordance with the following.

#### 2.2.3.4 Pipe Hangers and Supports

Provide pipe hangers and supports conforming to MSS SP-58.

#### 2.2.4 Metering and Instrumentation

Metering and instrumentation is specified in Section 40 60 00.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

#### 3.2 EQUIPMENT INSTALLATION

Submit drawings containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show in the drawings proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

##### 3.2.1 Air Distribution System Installation

Install the air distribution system as indicated and in accordance with the manufacturer's written instructions. Maintain the crown of the air main at the same elevation. Adjust the system such that all diffusers on a header are within 4 inch of a common horizontal plane.

##### 3.2.2 Diffuser Installation

Install diffusers as indicated and in accordance with the manufacturer's written recommendations.

### 3.2.3 Framed Instructions

Post framed instructions containing wiring and control diagrams under glass or in laminated plastic where directed. Show wiring and control diagrams and complete layout of the entire system in the instructions. Also include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system. Post the framed instructions acceptance testing of the system.

## 3.3 FIELD QUALITY CONTROL

### 3.3.1 Field Testing

Submit performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Indicate the final position of controls in each test report.

#### 3.3.1.1 Blower Test

After the air distribution and diffusion systems have been installed, test each blower at the specified operating conditions to determine compliance with the specifications and proper operation.

#### 3.3.1.2 Piping System Test

Test all piping with air at a minimum of two times the normal design pressure for at least 60 minutes and such additional time as is required for the Contracting Officer to inspect the piping for leaks. Repair all leaks and retest the system until no leakage is discovered.

#### 3.3.1.3 Diffuser Test

After diffuser installation, cover the diffusers with clear water to a depth of approximately 2 feet. Release air through the diffusers and inspect the system for uniform air distribution. Replace diffusers as required to obtain uniformity.

### 3.3.2 Manufacturer's Services

Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. Ensure that the representative supervises the installation, adjustment, and testing of the equipment.

## 3.4 CLOSEOUT ACTIVITIES

### 3.4.1 Field Training

Provide a field training course for designated operating and maintenance staff members. Provide training for a total period of 8 hours of normal working time and start training after the system is functionally complete but prior to final acceptance tests. Cover all of the items contained in the operating and maintenance manuals in the field training.

#### 3.4.2 Operating and Maintenance Manuals

Provide three copies of operation and three copies of maintenance manuals for the equipment furnished. Provide a pdf copy of all operation and maintenance manuals to the Contracting Officer. Submit one complete set prior to performance testing and the remainder upon acceptance. Ensure the operating manuals detail the step-by-step procedures required for system startup, operation, and shutdown. Ensure operating manuals include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Ensure the maintenance manuals list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Have all manuals approved prior to the field training course.

#### 3.5 PAINTING

Conduct all field painting as specified in Section 09 96 00 HIGH PERFORMANCE COATINGS.

-- End of Section --

SECTION 46 61 00

FILTRATION EQUIPMENT

02/11

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include complete wiring and schematic diagrams; equipment layout and anchorage; and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

SD-03 Product Data Qualifications Media Spare Parts Factory Tests

1.2 QUALIFICATIONS

The cloth media filters are a proprietary product of Aqua Aerobic Systems, Inc. No alternate replacement media will be accepted..

1.2.1 Installer

The installer shall have a minimum of (5) years experience in the installation of a minimum of (5) similar filtration systems processing municipal wastewater. The installer shall show evidence of satisfactory operation for at least (3) installations processing flows greater than (5) MGD.

1.2.2 Manufacturer

The filter manufacturer shall have experience in the design and manufacture of cloth media filters for a minimum of ten (10) years and shall be able to demonstrate a minimum of twenty (20) installations within the United States in municipal wastewater applications with cloth media. Of these twenty installations five (5) are required to have a maximum rated capacity equaling or exceeding five (5) MGD. The manufacturer shall also have experience using cloth media filters to treat wastewater for reuse applications for a minimum of five (5) years and shall be able to demonstrate a minimum of ten (10) installations within the United States in municipal wastewater applications with cloth media producing reclaimed quality effluent.

A representative of the filtration system manufacturer, who is familiar with the design and experienced in the installation, adjustment, and operation of the equipment specified shall be present at the jobsite during installation of the filtration system as detailed in paragraph 3.8 below.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Protect all equipment and associated appurtenances from the weather, excessive humidity, excessive temperature variation, and dirt, dust, or other contaminants. Equipment shall be delivered and placed in proper storage until installation.

## 1.4 EXTRA MATERIALS

Standard spare parts shall be provided as recommended in the manufacturer's instruction manuals for each component of the equipment. Submit spare parts data for each different item of material and equipment specified. Include in the data a complete list of parts and supplies, with current unit prices and source of supply.

## PART 2 PRODUCTS

## 2.1 SYSTEM DESCRIPTION

The WWTP currently has 3 cloth media filters manufactured by Aqua Aerobic Systems, Inc. This project will replace the cloth media in each of the filters. The structural disk assembly shall be reused, but they should be removed from each tank and the media removed and replaced. Once the replacement media is installed, the Contractor should reinstall the disks in the filter basin.

## 2.1.1 Influent Flow Characteristics

Design Flow	3.5 MGD
Maximum Flow Rate	10.5 MGD
Design Influent Temperature	20 degrees C
Maximum Influent Temperature	31 degrees C
Minimum Influent Temperature	5 degrees C
Flow Conditions	continuous, diurnal distribution
Design Influent, Suspended Solids	25 mg/L daily average 30 mg/L maximum at average daily flow
Maximum pH	9.0
Minimum pH	6.0
Source of Process Water	biological treatment
Chemical Pretreatment	alum, polymer, and NaOCl as needed

## 2.1.2 Design Criteria

Number of Filters	3
Maximum Effluent, Suspended Solids	<5 mg/L monthly average <10 mg/L daily maximum

Maximum Effluent, Turbidity	<5 NTU
Maximum Effluent, Particle Size	10 micron
Backwash Type	Liquid suction back through filter cloth
Maximum Filtration Rate	6.5 gal/second/square foot
Maximum Influent, Pipe Velocity	5.0 ft/s
Maximum Effluent, Pipe Velocity	5.0 ft/s

## 2.2 CLOTH MEDIA FILTERS

### 2.2.1 Design Requirements

The Filter System consists of (3) identical disk filter units. Each unit can operate fully independently of the other units. The Filter Media shall be designed to meet the following flow requirements:

Maximum Filter Area Loading	6.5 gal/min/ft squared
Maximum Average Daily Flow	8.0 MGD, System shall meet Maximum Average Daily Flow with (1) unit offline

### 2.2.2 Cloth Filter Assemblies

Cloth/frame assemblies shall be constructed such that each segment is easily removable from the centertube, without special tools, to allow for removal and replacement of the cloth at the point of installation. Systems requiring special tools and/or the return of media segments to the factory for replacement shall not be considered.

Filter cloths shall be of fiber pile construction having a nominal filtration rating of less than or equal to 10 microns. Cloths shall be chlorine resistant. Granular media and screens having structured identical openings shall not be allowed. Pile cloth media with nylon material of construction is not free chlorine resistant and shall not be acceptable. The cloth depth shall allow for storage of captured solids within the depth of the media and removal of a wider particle size range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss. Woven mesh or microstrainer

type disk with no filtration depth are not a technological equal and will not be acceptable.

Effective submerged filtration area is defined as only the portion of the disk that is submerged during filtration. Any disk area that is not submerged shall not be considered as effective area. Only cloth area submerged under operational conditions will be considered when determining effective filter area.

Each filter unit shall have the same effective surface area. Surface loading shall meet design requirements of paragraph 2.1.2 and the Contract Documents.

Disks shall be easily removed from the filter tank for regular maintenance. Filter disk assemblies weighing more than 30 pounds will require the addition of a monorail with electric hoist to assist in replacement of filter disk assemblies. Canopy ceiling height shall be increased as necessary to accommodate the use of this hoist. All materials and Engineering design changes to accommodate assemblies weighing more than 30 pounds shall be included at the expense of the Contractor and should be included in the Contractor's Bid amount at the time of award. Cost may include but are not limited to, changes in structural components including canopy and structural steel and the concrete slab.

During Filtration, the filter unit shall operate in a static condition with no moving parts. The filter system shall provide for the collection of filtered solids on the outside of the cloth media surface utilizing vacuum type manifolding. Filtered effluent shall be used for backwashing. The filter flow path shall be from the outside of the disk to the inside. Systems with flow paths from the inside to the outside of the disk that collect filtered solids and debris on the interior surfaces of the disk shall not be accepted.

Submittal information shall include calculations that verify the effective filtration surface area. Media surface fused directly to support structure such that water cannot pass through the media shall not be included in these calculations.

The Operator shall be able to bring a drained filter on line by simply opening the influent isolation device. If the filter design is such that it must be filled with water before the influent isolation device is opened to prevent damage to the filter media, an automated process that sequentially brings the filter back online with a single switch shall be provided to prevent accidental media damage. The automated process shall activate a minimum 6" diameter motorized valve to fill the filter with effluent or other clean water source in not more than five minutes, verify that the filter is full, and open the motorized influent isolation device.

Because of the frequency of backwash and misting associated with spray systems, designs that utilize high pressure spray as the sole means of solids removal will not be acceptable.

Submittals shall include a hydraulic profile through the filter showing the following:

- a. Influent weir length
- b. Influent weir elevation

- c. Influent weir nappe at design and peak flows
- d. Effluent weir length
- e. Effluent weir elevation
- f. Effluent weir nappe at design and peak flows

#### 2.2.3 Factory Tests

Test reports of all factory tests specified in the above paragraphs and throughout this specification shall be submitted for review prior to installation. Equipment not tested per the specification requirements shall be required to be tested to meet the satisfaction of the Contracting Officer at the expense of the Contractor prior to acceptance for installation.

#### 2.3 MATERIALS PROTECTION

The interior and exterior of fabricated ferrous metal components shall be treated after fabrication to prevent corrosion. The surfaces of the filter tanks shall be sandblasted and completely factory finish painted prior to shipment. Insulating components such as gaskets, couplings, or bushing or dielectric-type which will prevent corrosion of bimetallic-type contacts, shall be used at connections between dissimilar metals.

#### PART 3 EXECUTION

##### 3.1 EXAMINATION

Verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

##### 3.2 PREPARATION

###### 3.2.1 Fabrication

Work not required to be performed in the field shall be performed in a factory under controlled conditions.

###### 3.2.2 System Installation

The system shall be installed such that proper wastewater flow through the unit and required effluent conditions as specified in Paragraphs Design Criteria will be achieved and maintained.

##### 3.3 WARRANTY

The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or parts which have been altered, applied, operated or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

-- End of Section --