

PROJECT MANUAL

Water and Wastewater Improvements

Lake of the Ozarks State Park

Kaiser, Missouri

Designed By: HDR Engineering Inc.
187 David Street
Forsyth, MO 65653

Date Issued: July 30, 2024

Project No.: X2307-02

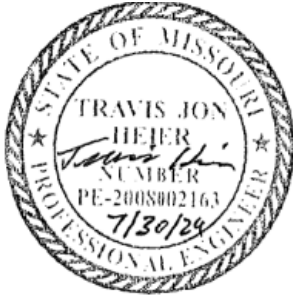
STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

1.1 XSECTION 00 01 07 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: (X2307-02 "Lake of the Ozarks State Park Water and Sewer Improvements")

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:



TRAVIS J. HEIER
MO PE-2008002163
07/30/24

TABLE OF CONTENTS

SECTION	TITLE	NUMBER OF PAGES
DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION		
000000	INTRODUCTORY INFORMATION	
000101	Project Manual Cover	1
000107	Professional Seals and Certifications	1
000110	Table of Contents	2
000115	List of Drawings	1
001116	INVITATION FOR BID (IFB) plus Missouri Buys instructions	2
002113	INSTRUCTIONS TO BIDDERS (Includes MBE/WBE/SDVE Information)	8
003144	MBE/WBE/SDVE Directory	1
The following documents may be found on MissouriBUYS at https://missouribuys.mo.gov/		
004000	PROCUREMENT FORMS & SUPPLEMENTS	
004113	Bid Form	*
004336	Proposed Subcontractors Form	*
004337	MBE/WBE/SDVE Compliance Evaluation Form	*
004338	MBE/WBE/SDVE Eligibility Determination Form for Joint Ventures	*
004339	MBE/WBE/SDVE Good Faith Effort (GFE) Determination Forms	*
004340	SDVE Business Form	*
004541	Affidavit of Work Authorization	*
004545	Anti-Discrimination Against Israel Act Certification Form	*
005000	CONTRACTING FORMS AND SUPPLEMENTS	
005213	Construction Contract	3
005414	Affidavit for Affirmative Action	1
006000	PROJECT FORMS	
006113	Performance and Payment Bond	2
006325	Product Substitution Request	2
006519.16	Final Receipt of Payment and Release Form	1
006519.18	MBE/WBE/SDVE Progress Report	1
006519.21	Affidavit of Compliance with Prevailing Wage Law	1
007000	CONDITIONS OF THE CONTRACT	
007213	General Conditions	20
007300	Supplementary Conditions	1
007333	Supplementary General Conditions for Federally Funded/Assisted Construction Projects	21
007334	Terms and Conditions for Contractor Receipt if Federal ARPA SFRF Funds	9
007346	Wage Rates	8
DIVISION 1 - GENERAL REQUIREMENTS		
011000	Summary of Work	3
012100	Allowances	3
012600	Contract Modification Procedures	2
013100	Coordination	4
013115	Project Management Communications	5
013200	Schedules	4
013300	Submittals	6
013513.31	Site Security and Health Requirements (DNR)	5
015000	Construction Facilities and Temporary Controls	8
016103	Equipment – Basic Requirements	28
017320	Openings and Penetrations in Construction	7
017329	Cutting and Patching	6
017400	Cleaning	3
017500	Checkout and Start-up Procedures	7

017719	Closeout Requirements	4
017823	Operation and Maintenance Data	12
017839	Warranties	3
DIVISION 02 - EXISTING CONDITIONS		
024100	Demolition	11
DIVISION 03 – CONCRETE		
030005	Concrete	15
DIVISION 26 - ELECTRICAL		
260500	Electrical – Basic Requirements	6
260509	Motors	8
260533	Raceways and Boxes	18
260543	Electrical – Exterior Underground	7
260813	Acceptance Testing	8
262419	Motor Control Equipment	9
263600	Transfer Switches	4
DIVISION 31 - EARTHWORK		
311000	Site Clearing	10
312200	Site Grading	6
312219	Finish Grading	5
312300	Earthwork	11
312310	Excavation and Backfill	9
312319	Dewatering	3
312333	Trenching, Backfilling, and Compacting for Utilities	7
DIVISION 32 - EXTERIOR IMPROVEMENTS		
321540	Crushed Stone Surfacing	2
323113	Chain Link Fence and Gates	4
329200	Seeding, Sodding, and Landscaping	6
DIVISION 33 - UTILITIES		
330511	Cementitious Manhole Liner	8
330516	Precast Concrete Manhole Structures	3
330519	Ductile-Iron Utility Pipe	11
330531.11	Polyvinyl Chloride Gravity Sewer Pipe	3
330533.23	Polyethylene Pressure Pipe and Tubing	9
331113	Water Main Construction	4
331623	Ground-Level Steel Water Storage Tanks	8
DIVISION 40 - PROCESS INTERCONNECTIONS		
400500	Pipe and Pipe Fittings - Basic Requirements	16
400519	Ductile Iron Process Pipe	6
400531	Pipe - Plastic	5
400561	Gate Valves	5
400562	Plug Valves	3
400566	Check Valves	6
DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT		
432100	Pumping Equipment - Basic Requirements	5
432513	Pumping Equipment - Submersible End-Suction Sewage Pumps	5
APPENDIX - MDNR OPERATING PERMIT		32

SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

- A. The following list of drawings is a part of the Bid Documents:

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>
1.	Cover Sheet	G-001	7/30/2024
2.	Sheet Index and Overall Site Plan	C-100	7/30/2024
3.	Camp Rising Sun Water Improvements	C-101	7/30/2024
4.	Camp Pin Oak Water Improvements	C-102	7/30/2024
5.	Camp Clover Point Water Improvements	C-103	7/30/2024
6.	Camp Red Bud Water Improvements	C-104	7/30/2024
7.	Outpost Cabins Water Improvements	C-105	7/30/2024
8.	Lagoon Site Plan	C-106	7/30/2024
9.	Pump Station Site Plan	C-107	7/30/2024
10.	Pump Station Process Plan	C-108	7/30/2024
11.	Pump Station Process Section	C-301	7/30/2024
12.	Pump Station Electrical Site Plan	E-101	7/30/2024
13.	Pump Station Electrical Schedules & Schematics	E-601	7/30/2024
14.	Utility Rehabilitation Plan	C-400	7/30/2024
15.	Homestead Campground Site Plan	C-200	7/30/2024
16-23.	Plan & Profile Sheets	C-201-208	7/30/2024
24.	Standard Details	C-501	7/30/2024
25.	Standard Details	C-502	7/30/2024

END OF SECTION 000115

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

- A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

- A. Water and Wastewater Improvements
Lake of the Ozarks State Park
Kaiser, Missouri
Project No.: X2307-02

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, October 17, 2024
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

4.0 DESCRIPTION:

- A. Scope: The project includes water system improvements at Camp Rising Sun, Camp Pin Oak, Camp Clover Point, Camp Red Bud, the Outpost Cabins, and Homestead which include new mains, valves, tanks, and other water related improvements, including a new wastewater lift station and perforated discharge pipe at the McCubbins lagoon site.
- B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, October 2, 2024, at Lake of the Ozarks State Park Office, 403 MO-134, Brumley, MO, 38.12385658294193, -92.56196448976515
- B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

- A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of \$100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, <https://www.adsplanroom.net>. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**
- B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**
- C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

7.0 POINT OF CONTACT:

- A. Designer: HDR Engineering Incorporated, Travis Heier, (417) 546-2131, email: travis.heier@hdrinc.com
- B. Project Manager: Lorena Villalobos, (573) 751-3565, email: Lorena.Villalobos@oa.mo.gov

8.0 GENERAL INFORMATION:

- A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.
- B. Bid results will be available at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> after it is verified that at least one bid is awardable and affordable.
- C. This is a federally funded/assisted construction project that requires compliance by the awarded Bidder with applicable federal laws and regulations. The Bidder should review Section 007333, Supplementary General Conditions for Federally Funded/Assisted Construction Projects and Section 007334, Terms and Conditions for Contractor Receipt of Federal ARPA SFRF Funds, which are made part of this Invitation to Bid and will be made part of the resulting contract by reference.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

- A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to <https://missouribuys.mo.gov> and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.
- B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations."
 2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
 3. Select "Active Solicitations" tab.
 4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.
- C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
 2. Select the three dots under "Actions." Select "Add New Response."
 3. When the Quote box opens, give the response a title and select "OK."
 4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
 5. The Supplier Attachments box will open. Select "Add Attachment" again.
 6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
 7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
 8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
 9. The detailed solicitation will open. At the bottom select "Close."
 10. Ensure receipt of notifications including current e-mail address are enabled within vendor profile.
- D. Any time a bidder wants to modify the bid, he or she will have to retract, make revisions, and then submit again. Please ensure that "draft" status is not shown. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov ; April Howser: 573-751-0053, April.Howser@oa.mo.gov ; or Mandy Roberson: 573-522-0074, Mandy.Roberson@oa.mo.gov.
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Office of Administration Division of Accounting at 573-751-2971 and ask for the MissouriBUYS vendor team.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

- A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.
- B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

- A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

3.0 - BIDDERS' OBLIGATIONS

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.
- B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

- A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.
- B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.
- C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.
- D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

- A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

- B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.
- C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.
- D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

- A. A bid from an individual shall be signed as noted on the Bid Form.
- B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.
- C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

- E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.
- F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.
- B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (<https://www.missouribuys.mo.gov/>) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.
- C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (<https://www.missouribuys.mo.gov/>), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.
- D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.
- E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.
- F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.
- G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.
- B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

- A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.
- B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

- C. The Owner shall award a contract to the lowest, responsive, responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.
- D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the lowest, responsive, responsible bidder.
- E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

- A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

- A. If required by “Section 004113 – Bid Form,” each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in “Section 004336 - Proposed Subcontractors Form.” If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder’s firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

- A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:
 - 1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

- A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.
- B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.
- C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. Pursuant to section 34.600, RSMo, if the Bidder meets the section 34.600, RSMo, definition of a “company” and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel as defined in section 34.600, RSMo, and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

- A. Definitions:
 - 1. “**MBE**” means a Minority Business Enterprise.
 - 2. “**MINORITY**” has the same meaning as set forth in 1 C.S.R. 10-17.010.
 - 3. “**MINORITY BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 4. “**WBE**” means a Women’s Business Enterprise.
 - 5. “**WOMEN’S BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 6. “**SDVE**” means a Service-Disabled Veterans Enterprise.
 - 7. “**SERVICE-DISABLED VETERAN**” has the same meaning as set forth in section 34.074, RSMo.
 - 8. “**SERVICE-DISABLED VETERAN ENTERPRISE**” has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than \$100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.
3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.
4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.
4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (<https://apps1.mo.gov/MWBCertifiedFirms/>). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (<https://oao.mo.gov/sdve-certification-program/>) or the Department of Veterans Affairs' directory (<https://veterans.certify.sba.gov/#search>).
3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
 - a. The amount of actual participation obtained;
 - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
 - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
 - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
 - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
 - f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
 - g. The Bidder's stated reasons for rejecting any bids;
3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
 - a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or
 - b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.
3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

**STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION
*MBE/WBE/SDVE DIRECTORIES***

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO) and is located at the following web address:

<https://apps1.mo.gov/MWBCertifiedFirms/>

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directories may be accessed at the following web addresses:

<https://o eo.mo.gov/sdve-certification-program/>

<https://veterans.certify.sba.gov/#search>



State of Missouri Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the "**Owner**", represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the Department of Natural Resources, Division of State Parks.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name: **Water and Wastewater Improvements
Lake of the Ozarks State Park
Kaiser, Missouri**

Project Number: **X2307-02**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **240 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of \$1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid: \$

TOTAL CONTRACT AMOUNT: (\$CONTRACT AMOUNT)

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

DAVIS-BACON ACT: The requirements of the Davis-Bacon Act are not applicable to this project, which is funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm: Subcontract Amt:\$
MBE/WBE/SDVE Firm: Subcontract Amt:\$
MBE/WBE/SDVE Firm: Subcontract Amt:\$

Total \$

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
 - a. Invitation for Bid (Section 001116)
 - b. Instructions to Bidders (Section 002113)
 - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
 - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
 - i. Bid Form (Section 004113)
 - ii. Unit Prices (Section 004322)
 - iii. Proposed Contractors Form (Section 004336)
 - iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
 - v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
 - vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
 - vii. Missouri Service Disabled Veteran Business Form (Section 004340)

- viii. Affidavit of Work Authorization (Section 004541)
- ix. Affidavit for Affirmative Action (Section 005414)
- e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
- f. General Conditions (Section 007213)
- g. Supplementary Conditions (Section 007300)
- h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
- i. Wage Rate(s) (Section 007346)
- 2. Division 1 – General Requirements
- 3. All Drawings identified in the Project Manual
- 4. All Technical Specifications included in the Project Manual
- 5. Addenda, if applicable

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder’s Certifications of the Bid Form.

Further, if the Contractor provides any “personal information” as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

By signature below, the parties hereby execute this contract document.

APPROVED:

 Brian Yansen, Director
 Division of Facilities Management,
 Design and Construction

 Contractor’s Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

Corporate Secretary



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the sole proprietor partner officer or manager or managing member of

NAME

a sole proprietorship partnership
 limited liability company (LLC)

or corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE

DATE

--

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL

STATE OF

COUNTY (OR CITY OF ST. LOUIS)

USE RUBBER STAMP IN CLEAR AREA BELOW

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

NOTARY PUBLIC SIGNATURE

MY COMMISSION EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____ as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars (\$ _____)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of _____, 20_____, enter into a contract with the State of Missouri for

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

- SUBSTITUTION PRIOR TO BID OPENING**
 (Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)
- SUBSTITUTION FOLLOWING AWARD**
 (Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

- Product data for proposed substitution is attached (include description of product, standards, performance, and test data)
- Sample Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	DATE INSTALLED
LOCATION		

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

YES NO

IF YES, EXPLAIN

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

YES NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR

DATE

REVIEW AND ACTION

Resubmit Substitution Request with the following additional information:

Substitution is accepted.

Substitution is accepted with the following comments:

Substitution is not accepted.

ARCHITECT/ENGINEER

DATE



PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT,
 DESIGN AND CONSTRUCTION

MBE/WBE/SDVE PROGRESS REPORT

Remit with ALL Progress and Final Payments

(Please check appropriate box) CONSULTANT CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL <input checked="" type="checkbox"/> FINAL	DATE

PROJECT TITLE			
PROJECT LOCATION			
FIRM			
ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) \$		TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) \$	
THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$			
SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	



STATE OF MISSOURI
 OFFICE OF ADMINISTRATION
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____
 State of _____ personally came and appeared _____
 (NAME)
 _____ of the _____
 (POSITION) (NAME OF THE COMPANY)
 (a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 ____ in carrying out the contract and working in connection with _____
 (NAME OF PROJECT)
 Located at _____ in _____ County
 (NAME OF THE INSTITUTION)
 Missouri, and completed on the _____ day of _____ 20 ____

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSEER OR BLACK INK RUBBER STAMP SEAL	STATE	COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS	
	DAY OF	YEAR
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES
NOTARY PUBLIC NAME (TYPED OR PRINTED)		USE RUBBER STAMP IN CLEAR AREA BELOW

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

- 1.1. Definitions
- 1.2. Drawings and Specifications
- 1.3. Compliance with Laws, Permits, Regulations and Inspections
- 1.4. Nondiscrimination in Employment
- 1.5. Anti-Kickback
- 1.6. Patents and Royalties
- 1.7. Preference for American and Missouri Products and Services
- 1.8. Communications
- 1.9. Separate Contracts and Cooperation
- 1.10. Assignment of Contract
- 1.11. Indemnification
- 1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
- 3.4. Guaranty and Warranties
- 3.5. Operation and Maintenance Manuals
- 3.6. Other Contractor Responsibilities
- 3.7. Subcontracts

4. Changes in the Work

- 4.1. Changes in the Work
- 4.2. Changes in Completion Time

5. Construction and Completion

- 5.1. Construction Commencement
- 5.2. Project Construction
- 5.3. Project Completion
- 5.4. Payments

6. Bond and Insurance

- 6.1. Bond
- 6.2. Insurance

7. Termination or Suspension of Contract

- 7.1. For Site Conditions
- 7.2. For Cause
- 7.3. For Convenience

SECTION 007213 - GENERAL CONDITIONS

- A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.
- B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER"**: The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS"**: The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE"**: Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION"**: Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.

8. **"INCIDENTAL JOB BURDENS"**: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri, acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: All supervision, labor, materials, tool, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.
15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

- A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.
- B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.
- C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.
- D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.
- E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action. If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.
- E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.
- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall

forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action

in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;
2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract,

insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

- A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be

required for a Missouri bidder to successfully bid in the non-domiciliary state.

- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

- A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.
- B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.
- C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any

work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.
- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

- A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

- A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.
- B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

- A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.
- B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.
- C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice.

The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

- D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.
- F. The Owner shall have the right to direct the Contractor to uncover any completed work.
 - 1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.
 - 2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.
- G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.
- H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

- I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

- A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.
- B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.
- C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.
- D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.
- E. When a material has been approved, no change in brand or make will be permitted unless:
 - 1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or
 - 2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

- A. The Contractor’s submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

- B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.
- C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.
- D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:
 - 1. It is in the best interest of the Owner
 - 2. It does not increase the contract sum and/or completion time
 - 3. It does not deviate from the design intent
 - 4. It is without prejudice to any and all rights under the surety bond.
- E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review,

possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

- F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

- A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

- A. General Guaranty
 - 1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
 - 2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
 - 3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the

damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.

4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

- A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.

- a. Recommended spare parts including catalog number and name of local supplier or factory representative.
- b. Belt sizes, types, and lengths.
- c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

- B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.

2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.
- B. Contractor shall, at all times, enforce strict discipline and good order among his employees,

and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

- C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.
- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case,

unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.
- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.
- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

- A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.
- B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.
- C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.
- D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.
- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon

before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor's fee; (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor's mark-up for Work performed by a sub-subcontractor and

passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.
 4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
 5. The percentage(s) for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be the same as those for additive Contract Changes provided above.
- E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.
- F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.
- G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for

compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

- A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:
 - 1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
 - 2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
 - 3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.
- B. Extension of the number of work days stipulated in the Contract for completion of the work without compensation may be made when:
 - 1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
 - 2. Labor strikes or acts of God occur, OR
 - 3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.
- C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.
- D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by

the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

- A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:
 - 1. Contract;
 - 2. Performance/payment bond as described in Article 6.1;
 - 3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
 - 4. Written Affirmative Action Plans as required in Article 1.4.
- Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.
- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.
 - C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

- A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.
- B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
 1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
 2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the

Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the

approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

- D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.
- E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the

"Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
 2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project
- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
 - C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
 - D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
 1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
 2. Delivery is made in accordance with the time frame on the approved schedule.
 3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
 4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
 - E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage,

of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 2. Materials stored in one location off site are valued in excess of \$25,000.
 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
 2. A reasonable doubt that this contract can be completed for the unpaid balance.

3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

- H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.
1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
 2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

- b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
 - c) Certified copies of all payrolls
 - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
 4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
 5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

- A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.
- B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

- A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.
- B. Minimum Scope and Extent of Coverage
 1. General Liability

Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.
 2. Automobile Liability

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".
 3. Workers' Compensation and Employer's Liability

Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.
 4. Builder's Risk or Installation Floater Insurance

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contract price, whichever is greater, with loss payable

to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

1. General Liability

Contractor

\$2,000,000 combined single limit per occurrence for bodily injury, personal injury, and property damage

\$2,000,000 annual aggregate

2. Automobile Liability

\$2,000,000 combined single limit per occurrence for bodily injury and property damage

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of \$1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions,

as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the

performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its

behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.
- B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
- C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
- D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
- E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
- F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date

of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

- A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.
- B. Upon receipt of notification, the Contractor shall:
 1. Cease operations when directed.
 2. Take actions to protect the work and any stored materials.
 3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
 4. Terminate all existing subcontracts, rentals, material, and equipment orders.
 5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.
 6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.
- C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:

Travis Heier
HDR Engineering Inc.
187 David Street
Forsyth, Missouri 65653
Telephone: (417) 546-2131
Email: travis.heier@hdrinc.com

Construction Representative:

Troy Wolken
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, MO 65101
Telephone: (573) 257-0615
Email: Troy.Wolken@oa.mo.gov

Project Manager:

Lorena Villalobos
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 751-3565
Email: Lorena.Villalobos@oa.mo.gov

Contract Specialist:

Paul Girouard
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 751-4797
Email: paul.girouard@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

- A. The Owner will furnish the Contractor with approximately 3 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 3 sets of explanatory or change drawings at no charge.
- C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

SUPPLEMENTARY GENERAL CONDITIONS
FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS

(American Rescue Plan Act (ARPA) Projects)

1.0 Notice of Federal Funding

This project is being performed in whole or in part using federal funds. Therefore, all work or services performed by the Contractor and its subcontractors shall be subject to the terms and conditions set forth below in addition to all terms and conditions in the Construction Contract, General Conditions, and other contract documents. The concepts, rules, and guidelines set forth in 2 C.F.R. 200 describing allowable costs and administrative requirements apply.

2.0 Definitions

As used herein, “Federal Government” means the government of the United States of America. “Federal Agency” means an agency, entity, department or division of the Federal Government that is providing funding for this project. All other terms shall have the meanings established in the Construction Contract, General Conditions, and/or Project Manual, unless such definitions conflict with a definition provided in an applicable statute or regulation.

3.0 Conflicting Terms or Conditions

To the extent that any terms or conditions set forth herein conflict with the Construction Contract or its General Conditions, the more stringent of the two terms and conditions shall govern.

4.0 No Obligation by Federal Government

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, Contractor, or any other party pertaining to any matter resulting from the contract.

5.0 Compliance with Federal Laws, Regulations and Executive Orders

The Contractor and its subcontractors and suppliers are required to comply with all applicable Federal laws, regulations, and executive orders, regardless of whether set forth herein. The Contractor shall assist and enable the State of Missouri in complying with any requirements imposed by the Federal Agency as a condition of funding.

6.0 Compliance with Civil Rights Provisions

The Contractor shall comply with all Federal statutes, executive orders, and regulations relating to nondiscrimination. These include, but are not limited to the following:

Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin;

Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex;

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps;

The Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age;

Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing;

Title VII of the Civil Rights Act of 1964 (42 U.S.C. part 2000(e)), which prohibits discrimination against employees on the basis of religion;

Any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and

The requirements of any other nondiscrimination statute(s) that may apply to the application.

7.0 Equal Employment Opportunity (41 C.F.R. 60-1.4(b)).

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

- (1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

- (2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- (3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicants or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.
- (4) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

- (5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- (7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (8) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: *Provided*, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and sub contractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and sub contractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any

further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

8.0 Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity
(Executive Order 11246, 41 C.F.R. 60-4.2)

(1) The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

(2) The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Time-tables	Goals for minority participation for each trade	Goals for female participation in each trade
106	4.0	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 C.F.R. pt. 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 C.F.R. 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 C.F.R. pt. 60-4. Compliance with the goals will be measured against the total work hours performed.

(3) The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(4) As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

9.0 Standard Federal Equal Employment Opportunity Construction Contract Specifications
(Executive Order 11246 - 41 C.F.R. 60-4.3)

(1) As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

(3) If the Contractor is participating (pursuant to 41 C.F.R. 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

(4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement

contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

(5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

(6) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 C.F.R. pt. 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

(8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

(10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

(11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

(12) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

(13) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 C.F.R. 60-4.8.

(14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily

understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

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

10.0 Prohibition of Segregated Facilities

- (1) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.
- (2) “Segregated facilities,” as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.
- (3) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

11.0 Davis-Bacon Act (40 U.S.C. §§ 3141-3144, and §§ 3146-3148, and 29 C.F.R. pt. 5)

**The requirements of the Davis-Bacon Act and this section are not applicable to this project, which is funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).*

- (1) Minimum wages.
 - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 C.F.R. pt. 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis–Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill,

except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis–Bacon poster (WH–1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- (ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.
- (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- (iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has

found, upon the written request of the Contractor, that the applicable standards of the Davis–Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis–Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis–Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis–Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered

worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime Contractor to require a subcontractor to provide addresses and social security numbers to the prime Contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

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

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

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

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

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

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

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

(4) Apprentices and trainees—

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary

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

- (ii) Trainees. Except as provided in 29 C.F.R. 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 C.F.R. pt. 30.

- (5) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 C.F.R. pt. 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 C.F.R. 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal Agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. 5.5.
- (7) Contract termination: debarment. A breach of the contract clauses in 29 C.F.R. 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. 5.12.
- (8) Compliance with Davis–Bacon and Related Act requirements. All rulings and interpretations of the Davis–Bacon and Related Acts contained in 29 C.F.R. pts. 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. pt.s 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
- (10) Certification of eligibility.
 - (i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

12.0 Copeland “Anti-Kickback” Act

- (1) The Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract. The Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled.
- (2) The Contractor or subcontractor shall insert in any subcontracts the clause above, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 C.F.R. 5.12.

13.0 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 to 3708, 29 C.F.R. 5.5)

- (1) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

14.0 Suspension and Debarment (Executive Orders 12549 and 12689, 2 C.F.R. pt. 180)

- (1) A contract award (see 2 C.F.R. 180.220) must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. pt. 1986 Comp., p. 189) and 12689 (3 C.F.R. pt. 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- (2) The contractor is required to verify that none of the contractor’s principals (defined at 2 C.F.R. 180.995) or its affiliates (defined at 2 C.F.R. 180.905) are excluded (defined at 2 C.F.R. 180.940) or disqualified (defined at 2 C.F.R. 180.935).
- (3) The contractor must comply with 2 C.F.R. pt. 180, subpart C and the regulations of the granting Federal Agency regarding suspension and debarment, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

- (4) This certification is a material representation of fact relied upon by the Owner. If it is later determined that the Contractor did not comply with 2 C.F.R. pt. 180, subpart C in addition to remedies available to the Owner, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (5) By submitting a bid, the bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

15.0 Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352)

- (1) Contractors that apply or bid for an award exceeding \$100,000 agree to file the required certification (set forth below), in compliance with 31 U.S.C. § 1352 (as amended).
- (2) Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352.
- (3) Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form–LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required

certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

16.0 Procurement of Recovered Materials

The Contractor shall comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. § 6962). The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Information about this requirement, along with the list of EPA designated items, is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

17.0 Fair Labor Standards Act

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 C.F.R. pt. 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers. The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

18.0 Access to Records and Reports

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Agency and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

19.0 Occupational Health and Safety Act

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 C.F.R. pt. 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 C.F.R. pt. 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

20.0 Rights to Inventions

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 C.F.R. pt. 401, Rights to Inventions Made by Non-profit Organizations and Small

Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 C.F.R. 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

21.0 Energy Conservation

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201 et seq.).

22.0 Clean Air Act and Federal Water Pollution Control Act

- (1) If the amount of the Contract exceeds \$150,000, the Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq. and the Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq.
- (2) The Contractor agrees to report each violation to the Owner, and understands and agrees that the Owner will, in turn, report each violation as required to assure notification to the Federal Agency and the appropriate Environmental Protection Agency Regional Office.
- (3) The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance.

23.0 Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights

- (1) This contract and employees working on this contract will be subject to the whistleblower rights and remedies in the pilot program on contractor employee whistleblower protections established at 41 U.S.C. § 4712 by section 828 of the National Defense Authorization Act for Fiscal Year 2013 (Pub. L. 112-239) and FAR 3.908.
- (2) The Contractor shall inform its employees in writing, in the predominant language of the workforce, of employee whistleblower rights and protections under 41 U.S.C. § 4712, as described in section 3.908 of the Federal Acquisition Regulation.
- (3) The Contractor shall insert the substance of this clause, including this paragraph (c), in all subcontracts over the simplified acquisition threshold.

24.0 Veteran's Preference

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

25.0 Drug Free Workplace Act

The Contractor shall provide a drug free workplace in accordance with the Drug Free Workplace Act of 1988, 41 U.S.C. Chapter 81, and all applicable regulations. The Contractor shall report any conviction of the Contractor's personnel under a criminal drug statute for violations occurring on the Contractor's premises or off the Contractor's premises while conducting official business. A report of a conviction shall be made to the state agency within five (5) working days after the conviction.

26.0 Access Requirements for Persons with Disabilities

Contractor shall comply with 49 U.S.C. § 5301(d), stating Federal policy that the elderly and persons with disabilities have the same rights as other persons to use mass transportation services and facilities and that special efforts shall be made in planning and designing those services and facilities to implement that policy. Contractor shall also comply with all applicable requirements of Sec. 504 of the Rehabilitation Act (1973), as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, and the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. § 12101 et seq., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments thereto.

27.0 Seismic Safety

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Guidelines for Contract Provisions for Obligated Sponsors and Airport Improvement Program Projects Issued on June 19, 2018 Page 61 Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

28.0 Required Use of American Iron, Steel, Manufactured Products, and Construction Materials – Build America, Buy America (Pub. L. No. 117-58, §§ 70901-52)

**The requirements of the Build America, Buy America Act and this section are not applicable to projects funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA). The Contractor will be subject to the requirements of the Build America, Buy America Act only if SLFRF funds are used in conjunction with funds from another federal program that requires enforcement of the Build America, Buy America Act. Information about federal funding sources is provided in the Invitation for Bid.*

The Owner is the recipient of an award of Federal financial assistance from a program for infrastructure for this project. Pursuant to the Build America, Buy America Act of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58, none of the funds provided under the Federal award may be used unless the requirements of the domestic content procurement preference outlined below are met. Therefore, the Contractor shall ensure the following:

- (1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another

standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

Waivers

When necessary, recipients of Federal financial assistance may apply for, and the awarding agency may grant, a waiver from the domestic content procurement preference.

When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:

(1) applying the domestic content procurement preference would be inconsistent with the public interest;

(2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or

(3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described on the awarding agency web site.

If the Contractor determines that an application for a waiver is necessary or an existing waiver is applicable to this project, the Contractor shall timely notify the Owner. The Owner will make a determination if a waiver is applicable or if a waiver application is necessary. The Contractor shall not submit any waiver application or information directly to the Federal agency without prior approval by the Owner.

Definitions

“Construction materials” includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of: • non-ferrous metals; • plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); • glass (including optic glass); • lumber; or • drywall.

“Domestic content procurement preference” means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

“Infrastructure” includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

“Project” means the construction, alteration, maintenance, or repair of infrastructure in the United States.

29.0 Prohibition on Certain Telecommunication and Video Surveillances Services or Equipment (Pub. L. 115-232, Section 889)

Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of a Federal executive agency and recipients or subrecipients of funds from such agencies from obligating or expending grant, cooperative agreement, loan, or loan guarantee funds on certain telecommunications products or from certain entities for national security reasons. Pursuant to such provisions, the Contractor understands and agrees that the Contractor and its subcontractors shall not obligate or expend loan or grant funds from the Federal Agency under this Contract to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

TERMS AND CONDITIONS FOR CONTRACTOR
RECEIPT OF FEDERAL ARPA SFRF FUNDS

I. Use of Funds: _____ (“Contractor”) understands and agrees that the State of Missouri has received funds for this project under section 602(c) of the Social Security Act (“Act”), as added by Section 9901 of the American Rescue Plan Act (“ARPA”), Pub. L. No. 117-2 (March 11, 2021), 135 Stat. 4, 223–26, and the funds disbursed under such grant may only be used in compliance with the ARPA and the U.S. Department of the Treasury (“Treasury”)’s regulations implementing that section and guidance, and in compliance with all other restrictions and specifications on use set forth in or applicable through this agreement.

Period of Performance: The period of performance for the award begins on the date hereof and ends no later than December 31, 2026. Contractor may use funds granted under this agreement to cover eligible costs incurred during the period of performance, but no later than December 31, 2024.

Reporting: Contractor agrees to comply with any reporting obligations established by Treasury or the State of Missouri (“State”), as it relates to this agreement.

Maintenance of and Access to Records: Contractor shall maintain records and financial documents sufficient to evidence compliance with section 602(c) of the Act and Treasury’s regulations implementing that section and guidance regarding the eligible uses of funds. Contractor shall also maintain records and financial documents: 1. sufficient for the State, with respect to Contractor’s participation in this grant agreement, to evidence compliance with section 602(c) of the Act and Treasury’s regulations implementing that section and guidance regarding the eligible uses of funds; and 2. necessary for the State, with respect to Contractor’s participation in this agreement, to comply with obligations under 2 C.F.R. Part 200 and any other applicable law. The Treasury Office of Inspector General, the Government Accountability Office, their authorized representatives, the State, or its authorized representatives, shall have the right of access to records and documents (electronic and otherwise) of Contractor in order to conduct audits or other investigations or reviews. Records shall be maintained by Contractor for a period of five (5) years after the end of the period of performance. Wherever practicable, records should be collected, transmitted, and stored in open and machine-readable formats. Contractor’s obligations under this section shall include, without limitation, maintenance of the following specified types of records and financial documents: contracts, invoices, receipts, payrolls, and financial statements.

Pre-award Costs: Pre-award costs, as defined at 2 C.F.R. § 200.458, may not be paid with funding from this agreement.

Compliance with Applicable Law and Regulations: Contractor agrees to comply with the requirements of section 602 of the Act, regulations adopted by Treasury pursuant to section 602(f) of the Act, guidance issued by Treasury regarding the foregoing, and all other restrictions and specifications set forth in or applicable through this agreement. Contractor also agrees to comply with all other applicable state and federal statutes, regulations, and executive orders, and

Contractor shall provide for such compliance by other parties in any agreements it enters into with other parties relating to this grant.

Federal regulations applicable to this agreement include, without limitation, the following:

i. If the amount of this agreement is expected to equal or exceed \$25,000, or if this agreement is for federally-required audit services, OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement), 2 C.F.R. Part 180, and Treasury's implementing regulation at 31 C.F.R. Part 19, including both the requirement to comply with that part's Subpart C as a condition of participation in this transaction, and the requirement to pass the requirement to comply with that subpart to each person with whom the participant enters into a covered transaction at the next lower tier;

ii. Recipient Integrity and Performance Matters, pursuant to which the award term set forth at 2 C.F.R. Part 200, Appendix XII, is hereby incorporated by reference;

iii. Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (42 U.S.C. §§ 4601–4655) and implementing regulations; and

iv. Generally applicable federal environmental laws and regulations.

Federal statutes and regulations prohibiting discrimination applicable to this agreement include, without limitation, the following:

i. Title VI of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d *et seq.*) and Treasury's implementing regulations at 31 C.F.R. Part 22, which prohibit discrimination on the basis of race, color, or national origin under programs or activities receiving federal financial assistance;

ii. the Fair Housing Act, Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§ 3601 *et seq.*) which prohibits discrimination in housing on the basis of race, color, religion, national origin, sex, familial status, or disability;

iii. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), which prohibits discrimination on the basis of disability under any program or activity receiving federal financial assistance;

iv. the Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq.*) and Treasury's implementing regulations at 31 C.F.R. Part 23, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance; and

v. For local governments only, Title II of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. §§ 12101 *et seq.*), which prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto.

Remedial Actions: The State reserves the right to impose additional conditions or requirements on Contractor's receipt of this funds under this agreement, as the State deems necessary or advisable, in order to facilitate compliance with any existing or additional conditions or requirements imposed upon the State by Treasury for the State's receipt of ARPA funds. The State also reserves the right to seek recoupment or repayment of funds under this agreement in whole or in part, in the event that Treasury seeks recoupment or repayment of payments made to the State, for reasons relating to Contractor's acts or omissions respecting this agreement. These reservations are expressed without limitation to any other rights the State may hold, either to impose additional conditions or requirements on Contractor's receipt of funds under this agreement or to recoup such funds in whole or in part, under this agreement or other applicable law.

Hatch Act: Contractor agrees to comply, as applicable, with requirements of the Hatch Act (5 U.S.C. §§ 1501–1508 and 7324–7328), which limit certain political activities of State or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.

False Statements: Contractor understands that making false statements or claims in connection with this award is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.

Publications: Any publications produced with funds from this agreement must display the following language: "This product [is being] [was] supported, in whole or in part, by federal award number [enter project FAIN] awarded to State of Missouri by the U.S. Department of the Treasury."

Debts Owed State and Federal Government: Any funds paid to Contractor (1) in excess of the amount to which Contractor is finally determined to be authorized to retain under the terms of this agreement; (2) that are determined by the Treasury Office of Inspector General to have been misused; or (3) that are determined by Treasury to be subject to a repayment obligation pursuant to sections 602(e) and 603(b)(2)(D) of the Act and have not been repaid by Contractor shall constitute a debt owed by the State to the federal government. In such instance, the funds constituting the State's debt to the federal government shall also constitute Contractor's debt to the State. Debts owed by Contractor to the State must be paid promptly by Contractor. A debt owed the State by Contractor under this agreement is delinquent if it has not been paid by the date specified in the State's initial demand for payment, unless other satisfactory arrangements have been made or if Contractor knowingly or improperly retains funds that are a debt as defined in this paragraph. The State will take any actions available to it to collect such a debt, including but not limited to actions available to it under the "Remedial Actions" paragraph found in this same section (I) above. The rights of the State as expressed in this paragraph are in addition to, and do not imply the exclusion of, any other rights the State may have under applicable law to collect a debt or seek damages from Contractor.

Disclaimer: In its award of federal financial assistance to the State, Treasury provides that the United States expressly disclaims any and all responsibility or liability to the State or third

persons for the actions of the State or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any other losses resulting in any way from the performance of this award or any contract or subcontract under this award. Furthermore, in its award of federal financial assistance to the State, Treasury also states that the acceptance of this award by the State does not in any way establish an agency relationship between the United States and the State. This disclaimer applies with equal force to this agreement.

Increasing Seat Belt Use in the United States: Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), Contractor is hereby encouraged to adopt and enforce on-the-job seat belt policies and programs for its employees when operating company-owned, rented or personally owned vehicles, and to encourage any subcontractors to do the same.

Reducing Text Messaging While Driving: Pursuant to federal Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), the State hereby encourages Contractor to adopt and enforce policies that ban text messaging while driving, and to encourage any subcontractors to do the same.¹

II. By entering into this agreement, Contractor ensures its current and future compliance with Title VI of the Civil Rights Act of 1964, as amended, which prohibits exclusion from participation, denial of the benefits of, or subjection to discrimination under programs and activities receiving federal funds, of any person in the United States on the ground of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by Treasury Title VI regulations at 31 C.F.R. Part 22 and other pertinent executive orders such as federal Executive Order 13166; directives; circulars; policies; memoranda and/or guidance documents.

Contractor acknowledges that federal Executive Order 13166, “Improving Access to Services for Persons with Limited English Proficiency,” seeks to improve access to federally assisted programs and activities for individuals who, because of national origin, have Limited English Proficiency (“LEP”). Contractor understands that denying a person access to its programs, services, and activities because of LEP is a form of national origin discrimination prohibited under Title VI of the Civil Rights Act of 1964 and Treasury’s implementing regulations. Accordingly, Contractor shall initiate reasonable steps, or comply with Treasury’s directives, to ensure that LEP persons have meaningful access to its programs, services, and activities. Contractor understands and agrees that meaningful access may entail providing language assistance services, including oral interpretation and written translation where necessary, to ensure effective communication in Contractor’s programs, services, and activities.

Contractor agrees to consider the need for language services for LEP persons during development of applicable budgets and when conducting programs, services, and activities. As a resource, Treasury has published its LEP guidance at 70 FR 6067. For more information on LEP, please visit <http://www.lep.gov>.

¹ Section I is based on requirements set forth in Treasury’s Coronavirus State Fiscal Recovery Fund Award Terms and Conditions document, executed by the State on July 26, 2021.

Contractor acknowledges and agrees that compliance with this assurance constitutes a condition of continued receipt of federal financial assistance and is binding upon Contractor and Contractor's successors, transferees, and assignees for the period in which such assistance is provided.

Contractor shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise discriminating against a person on the basis of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by the Department of the Treasury's Title VI regulations, 31 C.F.R. Part 22, which are herein incorporated by reference and made a part of this agreement. Title VI also includes protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. § 2000d et seq., as implemented by the Department of the Treasury's Title VI regulations 31 C.F.R. Part 22, and herein incorporated by reference and made a part of this agreement.

Contractor shall cooperate in any enforcement or compliance review activities by Treasury or the State of the aforementioned obligations. Enforcement may include investigation, arbitration, mediation, litigation, and monitoring of any settlement agreements that may result from these actions. That is, Contractor shall comply with information requests, on-site compliance review, and reporting requirements.

Contractor shall maintain and provide to applicants, beneficiaries, their representatives, or any other party requesting the same, information on how to file a Title VI complaint of discrimination with the State of Missouri.

Contractor shall provide to the State documentation of an administrative agency's or court's findings of non-compliance of Title VI and efforts to address the non-compliance, including any voluntary compliance or other agreements between Contractor and the administrative agency that makes any such finding. If Contractor settles a case or matter alleging such discrimination, Contractor must provide to the State documentation of the settlement. If Contractor has not been the subject of any court or administrative agency finding of discrimination, Contractor shall so state.

The United States of America has the right to seek judicial enforcement of the terms of this assurance section and nothing in this section alters or limits the federal enforcement measures that the United States may take in order to address violations of this section or applicable federal law.

Under penalty of perjury, the undersigned certifies that he/she has read and understood this section's obligations as herein described, that any information submitted in conjunction with this assurance document is accurate and complete, and that Contractor is in compliance with the aforementioned nondiscrimination requirements.

By signing this certification, the undersigned represents his or her intention, and legal authorization, to do so on behalf of Contractor.²

Signature of Contractor's Authorized Representative

Date: _____

Printed Name of Contractor's Authorized Representative

Contractor's Unique Entity Identifier: _____
(*Name associated with the Unique Entity Identifier must match the Contractor's name on contract documents)

III. This agreement shall be conducted in accordance with the standards set forth at 2 C.F.R. §§ 200.317 through 200.327, as applicable. Pursuant to 2 C.F.R. § 200.327 and Appendix II to Part 200 of Title 2 of the C.F.R.:

i. Contracts for more than \$250,000 must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

ii. All contracts in excess of \$10,000 must address termination for cause and for convenience by the State, including the manner by which it will be effected and the basis for settlement.

iii. Except as otherwise provided under 41 C.F.R. Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 C.F.R. Part 60-1.3 must include the equal opportunity clause provided under 41 C.F.R. 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p.339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 C.F.R. Part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

iv. When required by federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 C.F.R. Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute,

² Section II is based on requirements set forth in Treasury's Assurance of Compliance with Civil Rights Requirements document, executed by the State on July 26, 2021.

contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract must be conditioned upon the acceptance of the wage determination. The non-federal entity must report all suspected or reported violations to the federal awarding agency. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 C.F.R. Part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-federal entity must report all suspected or reported violations to the federal awarding agency.

v. Where applicable, all contracts awarded by the non-federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Contract Work Hours and Safety Standards Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.³

vi. If the State or Contractor wishes to enter into a contract or subcontract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under the State’s award of ARPA funds or this agreement, the State and/or Contractor must comply with the requirements of 37 C.F.R. Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

vii. Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the

³ Additionally, “in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in [29 C.F.R.] § 5.1,” 29 C.F.R. § 5.5(c) requires that another clause be included “in any such contract,” *id.* For language appropriate to construction of this additional clause, see 29 C.F.R. § 5.5(c).

Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA). [

viii. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. Part 1986 Comp., p. 189) and 12689 (3 C.F.R. Part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. This requirement applies when the amount of the agreement is expected to equal or exceed \$25,000, or if the agreement is for federally-required audit services. 2 C.F.R. § 180.220.]

ix. Contractors that apply or bid for an award exceeding \$100,000 must file the certification required by 31 U.S.C. § 1352, the Byrd Anti-Lobbying Amendment. Under that law, each tier certifies to the tier above that it will not and has not used federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the non-federal award.

x. A non-federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines. In the performance of this agreement, Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired: 1. competitively within a timeframe providing for compliance with this agreement’s performance schedule; 2. meeting this agreement’s performance requirements; or 3. at a reasonable price. Information about this requirement, along with the list of EPA-designated items, is available at EPA’s Comprehensive Procurement Guidelines webpage: <http://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>. Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

xi. Pursuant to Pub. L. No. 115-232, H.R. 5515 (115th Congress, 2018), and 2 C.F.R. § 200.216, funds provided by this agreement shall not be obligated or expended to: 1. Procure or obtain; 2. Extend or renew a contract to procure or obtain; or 3. Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered

telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. For purposes of this prohibition, “covered telecommunications equipment or services” has the meaning as set forth at Sec. 889(f)(3) of Pub. L. No. 115-232. *See also* 2 C.F.R. § 200.216.

xii. Pursuant to 2 C.F.R. § 200.322, as appropriate and to the extent consistent with law, Contractor should, to the greatest extent practicable under this agreement, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). For purposes of this provision: 1. “produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States. 2. “manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 015
CAMDEN COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

Building Construction Rates for
CAMDEN County

Section 015

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$25.63*
Boilermaker	\$25.63*
Bricklayer-Stone Mason	\$25.63*
Carpenter	\$52.74
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$25.63*
Plasterer	
Communication Technician	\$25.63*
Electrician (Inside Wireman)	\$58.50
Electrician Outside Lineman	\$25.63*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$25.63*
Glazier	\$25.63*
Ironworker	\$71.02
Laborer	\$52.04
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$25.63*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$60.68
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$25.63*
Plumber	\$67.99
Pipe Fitter	
Roofer	\$25.63*
Sheet Metal Worker	\$56.62
Sprinkler Fitter	\$66.90
Truck Driver	\$25.63*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
CAMDEN County

Section 015

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$25.63*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$25.63*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$49.46
General Laborer	
Skilled Laborer	
Operating Engineer	\$57.94
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$25.63*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 066
MILLER COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

Building Construction Rates for
MILLER County

Section 066

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$24.34*
Boilermaker	\$24.34*
Bricklayer-Stone Mason	\$24.34*
Carpenter	\$49.65
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$45.44
Plasterer	
Communication Technician	\$24.34*
Electrician (Inside Wireman)	\$58.34
Electrician Outside Lineman	\$24.34*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$24.34*
Glazier	\$24.34*
Ironworker	\$24.34*
Laborer	\$42.59
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$24.34*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$64.49
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$24.34*
Plumber	\$69.19
Pipe Fitter	
Rofer	\$24.34*
Sheet Metal Worker	\$56.86
Sprinkler Fitter	\$24.34*
Truck Driver	\$24.34*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
MILLER County

Section 066

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$24.34*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$24.34*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$49.02
General Laborer	
Skilled Laborer	
Operating Engineer	\$24.34*
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$24.34*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of Water and Wastewater Improvements at Lake of the Ozarks State Park.
 - 1. Project Location: **Lake of the Ozarks State Park.**
 - 2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.
- B. Contract Documents, dated **July 30, 2024** were prepared for the Project by **HDR Engineering, Inc., PO Box 969, 187 E. David St., Forsyth, MO 65653.**
- C. The Work consists of **improvements to the water systems at several camps and the addition of a new lift station.**
 - 1. The Work includes:
 - a. Water System Improvements at Camp Rising Sun, Camp Pin Oak, Camp Clover Point, Camp Red Bud, the Outpost Cabins, and the Homestead which include new mains, valves, tanks, and other water related improvements.
 - b. A new wastewater lift station.
 - c. A perforated discharge pipe at the McCubbins lagoon site.
 - d. Homestead Campground waterline improvements to be completed first due to coordination required with campground expansion to be completed by others.
 - e. The work will be constructed under a single prime contract.

1.3 WORK UNDER OTHER CONTRACTS

- A. None.

1.4 FUTURE WORK

- A. None.

1.5 WORK SEQUENCE

- A. The Work will be conducted in one phase. Certain aspects of the work may be required to be completed during the off camping season.

1.6 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period..

1.7 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.
- B. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. The Designer will prepare a Certificate of Partial Occupancy for each specific portion of the Work to be occupied prior to substantial completion.
 - 2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions for the building.
 - 3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions for the building.

1.8 OWNER-FURNISHED PRODUCTS

- 1. None.

1.9 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE

END OF SECTION 01 10 00

SECTION 01 21 00 ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Weather allowances.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
 - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

- A. Included within the completion period for this project are a specified number of "bad weather" days (see Schedule of Allowances).
- B. The Contractor's progress schedule shall clearly indicate the bad weather day allowance as an "activity" or "activities". In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor's scheduled workday, that day shall be declared unavailable for work due to weather (a "bad weather" day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor's current progress schedule.
- C. The Contractor's Representative and the Construction Representative shall agree monthly on the number of "bad weather" days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the "bad weather" days for a particular month, that disagreement shall be noted on this written document and signed by each party's representative. Failure of the Contractor's representative to sign the "bad weather" day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the "bad weather" day determination contained in that document.
- D. There will be no modification to the time of contract performance due solely to the failure to deplete the "bad weather" day allowance.

- E. Once this allowance is depleted, a no cost Change Order time extension will be executed for "bad weather" days, as defined above, encountered during the remainder of the Project.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

- A. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Designer under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Weather Allowance: Included within the completion period for this Project ten (10) “bad weather” days.

END OF SECTION 01 21 00

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
 - 1. Division 1, Section 01 21 00 "Allowances" for procedural requirements for handling and processing Allowances.
 - 2. Division 1, Section 01 22 00 "Unit Prices" for administrative requirements for using Unit Prices.
 - 3. Division 1, Section 01 31 15 "Project Management Communications" for administrative requirements for communications.
 - 4. Division 0, Section 00 72 13, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 5. Division 0, Section 00 72 13, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

- A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a "Request for Information" (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.
- C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written

notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

- A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

1.5 PROPOSAL REQUESTS

- A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
 - a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
 - b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 31 00

COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.
- C. Related Sections include the following:
 - 1. Division 1, Section 01 32 00 "Schedules" for preparing and submitting Contractor's Construction Schedule.
 - 2. Articles 1.8.B and 1.8.C of Section 00 72 13 "General Conditions" for coordinating meetings onsite.
 - 3. Article 5.4.H of Section 00 72 13 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which depend on each other for proper installation, connection, and operation.
- B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required

maintenance, service, and repair of all components including mechanical and electrical.

- C. Prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate Contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Startup and adjustment of systems.
 - 8. Project Closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

- A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the

meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.
- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 00 72 13 "General Conditions".
1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Review of mockups
 - i. Possible conflicts
 - j. Compatibility problems
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written recommendations
 - n. Warranty requirements
 - o. Compatibility of materials
 - p. Acceptability of substrates
 - q. Temporary facilities and controls
 - r. Space and access limitations
 - s. Regulations of authorities having jurisdiction
 - t. Testing and inspecting requirements
 - u. Installation procedures
 - v. Coordination with other Work

- w. Required performance results
 - x. Protection of adjacent Work
 - y. Protection of construction and personnel
3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
 6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
 7. Project name
 8. Name and address of Contractor
 9. Name and address of Designer
 10. RFI number including RFIs that were dropped and not submitted
 11. RFI description
 12. Date the RFI was submitted
 13. Date Designer's response was received
 14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 31 15
PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 01 33 00 - Submittals
- C. Division 1, Section 01 26 00 – Contract Modification Procedures

1.2 SUMMARY

- A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
 - 1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
 - 2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited
- B. Support: E-Builder® will provide on-going support through on-line help files.
- C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses.

Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files

- E. Authorized Users: Access to the web site will be by individuals who are authorized users.
1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: <https://oa.mo.gov/facilities/vendor-links/contractor-forms>. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
 2. Authorized users will be contacted directly and assigned a temporary user password.
 3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
- F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).
- G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
1. Document Integrity and Revisions:
 - a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
 - b. The system shall make it easy to identify revised or superseded documents and their predecessors.
 - c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
 2. Document Security:
 - a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!

3. Document Integration:
 - a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
4. Reporting:
 - a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
5. Notifications and Distribution:
 - a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
6. Required Document Types:
 - a. RFI, Request for Information.
 - b. Submittals, including record numbering by drawing and specification section.
 - c. Transmittals, including record of documents and materials delivered in hard copy.
 - d. Meeting Minutes.
 - e. Application for Payments (Draft or Pencil).
 - f. Review Comments.
 - g. Field Reports.
 - h. Construction Photographs.
 - i. Drawings.
 - j. Supplemental Sketches.
 - k. Schedules.
 - l. Specifications.
 - m. Request for Proposals
 - n. Designer's Supplemental Instructions
 - o. Punch Lists
- H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
 - a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
 - b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and

suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.

- c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

- I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
 1. Providing suitable computer systems for each licensed user at the users normal work location¹ with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 2. Each of the above referenced computer systems shall have the following minimum system² and software requirements:
 - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
 - 1) Operating System: Windows XP or newer
 - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
 - 3) Minimum Recommend Connection Speed: 256K or above
 - 4) Processor Speed: 1 Gigahertz and above
 - 5) RAM: 512 mb
 - 6) Operating system and software shall be properly licensed.
 - 7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - 8) Adobe Acrobat Reader (current version is a free distribution for download).
 - 9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

¹ The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

² The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 01 31 15

SECTION 01 32 00
SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

- A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.
 - 1. The Schedule of Values must have the following line items included with the value of the item as indicated below:
 - a. O&M's (Owner's Manual)
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - b. Close Out Documents
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - c. General Conditions
 - 1) No more than 10%
- B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.
- C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall

coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 01 21 00 – Allowances.
1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
 - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
 3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
 6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
1. Requirement for Phased completion
 2. Work by separate Contractors
 3. Work by the Owner
 4. Pre-purchased materials
 5. Coordination with existing construction
 6. Limitations of continued occupancies
 7. Un-interruptible services
 8. Partial Occupancy prior to Substantial Completion
 9. Site restrictions

10. Provisions for future construction
 11. Seasonal variations
 12. Environmental control
- C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:
1. Subcontract awards
 2. Submittals
 3. Purchases
 4. Mockups
 5. Fabrication
 6. Sample testing
 7. Deliveries
 8. Installation
 9. Testing
 10. Adjusting
 11. Curing
 12. Startup and placement into final use and operation
- D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a “major area” is a story of construction, a separate building, or a similar significant construction element.
1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure
 - c. Completion of mechanical installation
 - d. Completion of the electrical portion of the Work
 - e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

- A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 01 33 00 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.
- B. Prepare the schedule in chronological order. Provide the following information
1. Scheduled date for the first submittal
 2. Related Section number
 3. Submittal category
 4. Name of the Subcontractor

5. Description of the part of the Work covered
 6. Scheduled date for resubmittal
 7. Scheduled date for the Designer's final release or approval
- C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.
1. Post copies in the Project meeting room and temporary field office.
 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.
- D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

- A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.
- B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:
1. Specification Section number
 2. Description of the test
 3. Identification of applicable standards
 4. Identification of test methods
 5. Number of tests required
 6. Time schedule or time span for tests
 7. Entity responsible for performing tests
 8. Requirements for taking samples
 9. Unique characteristics of each service
- C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 01 32 00

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Samples
 - 4. Quality Assurance Submittals
 - 5. Construction Photographs
 - 6. Operating and Maintenance Manuals
 - 7. Warranties
- B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Construction Progress Schedule including Schedule of Values
 - 2. Performance and Payment Bonds
 - 3. Insurance Certificates
 - 4. Applications for Payment
 - 5. Certified Payroll Reports
 - 6. Partial and Final Receipt of Payment and Release Forms
 - 7. Affidavit – Compliance with Prevailing Wage Law
 - 8. Record Drawings
 - 9. Notifications, Permits, etc.
- C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.
- D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

- A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

- B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:
 - 1. Date of Submission
 - 2. Name of Project
 - 3. Location
 - 4. Section Number of Specification
 - 5. State Project Number
 - 6. Name of Submitting Contractor
 - 7. Name of Subcontractor
 - 8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

- A. Comply with the General Conditions, Article 3.2.

- B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

- C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:
 - 1. Dimensions
 - 2. Identification of products and materials included by sheet and detail number
 - 3. Compliance with specified standards
 - 4. Notation of coordination requirements

5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

1.5 PRODUCT DATA

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with Trade Association standards
 - c. Compliance with recognized Testing Agency standards
 - d. Application of Testing Agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:
 - a. Specification Section number and reference
 - b. Generic description of the Sample
 - c. Sample source
 - d. Product name or name of the Manufacturer
 - e. Compliance with recognized standards
 - f. Availability and delivery time
 2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

- a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
3. Field samples are full-size examples erected onsite to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.7 QUALITY ASSURANCE DOCUMENTS

- A. The Contractor shall comply with the General Conditions, Article 3.2
- B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.
 1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.
- D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.
- E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.
 1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
 2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.
 3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.
 4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

- A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

- A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

SPEC SECTION	TITLE	CATEGORY
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
030005	Concrete	Product Data Test Report
260500	Electrical	Product Data
263600	Transfer Switches	Product Data Operation / Maintenance Manual
312333	Trenching, Backfilling, and Compacting for Utilities	Product Data
321540	Crushed Stone Surfacing	Product Data
323113	Chain Link Fence and Gates	Product Data Shop Drawings
329200	Seeding, Sodding, and Landscaping	Product Data Sample
330511	Cementitious Manhole Liner	Product Data
330516	Precast Concrete Manhole Structures	Product Data Shop Drawings
330519	Ductile Iron Utility Pipe	Product Data
330531.11	PVC Gravity Sewer Pipe	Product Data
330533.23	Polyethylene Pressure Pipe and Tubing	Product Data
331113	Water Main Construction	Product Data
400519	Ductile Iron Process Pipe	Product Data
400531	Pipe-Plastic	Product Data
400561	Gate Valves	Product Data
400562	Plug Valves	Product Data
400566	Check Valves	Product Data

432513

Pumping Equipment - Submersible End-
Suction Sewage Pumps

Product Data

Shop Drawings

Operation / Maintenance
Manual

END OF SECTION 013300

SECTION 01 35 13.31
SITE SECURITY AND HEALTH REQUIREMENTS (DNR)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUBMITTALS

- A. List of required submittals:
 - 1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
 - 2. Schedule of proposed shutdowns, if applicable.
 - 3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

- A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.
- B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.
- C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.
- D. All construction personnel shall visibly display issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

- A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.
 2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
 3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.
- B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.
- C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.
- D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.
- E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.
- F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.
- G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.
- H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 DISRUPTION OF UTILITIES

- A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.
- B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

3.4 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.
2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:
 - a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
 - b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
 - c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating

- safety regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
 5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.
 6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
 7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
 8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
 9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
 10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
 11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
 12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 01 35 13.31

SECTION 01 50 00
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities may include, but are not limited to, the following:
1. Water service and distribution
 2. Temporary electric power and light
 3. Temporary heat
 4. Ventilation
 5. Sanitary facilities, including drinking water
 6. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
1. Field offices and storage sheds
 2. Temporary roads and paving
 3. Dewatering facilities and drains
 4. Temporary enclosures
 5. Hoists and temporary elevator use
 6. Temporary project identification signs and bulletin boards
 7. Waste disposal services
 8. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, to following:
1. Temporary fire protection
 2. Barricades, warning signs, and lights
 3. Sidewalk bridge or enclosure fence for the site
 4. Environmental protection

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

- B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department, and rescue squad rules
 - 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations". ANSI A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities".
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood:
 - 1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 - 2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.

3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.
- C. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
 - D. Water: Provide potable water approved by local health authorities.
 - E. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.
- C. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.

- F. Temporary Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned and maintained in a condition acceptable to the Owner. All construction personnel will be allowed access only to those specific facilities designed by the Construction Representative. At substantial completion, restore these facilities to the condition prevalent at the time of initial use.
- G. Wash Facilities: The Owner will provide wash facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.
- H. Drinking-Water Facilities: The Owner will provide drinking water facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.
- I. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
 - 1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
 - 1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
 - 2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.
- D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
 - 1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.
 - 2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 - 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.

4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.
- H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- J. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- K. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- D. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
 - 2. Provide plywood fence, 8' (2.5m) high, framed with (4) 2"x4" (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8' (2.5m) apart.
- 3. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- E. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01 50 00

SECTION 01 61 03
EQUIPMENT - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

B. Related Sections include but are not necessarily limited to:

1. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. American Gear Manufacturers Association (AGMA).
3. American Petroleum Institute
 - a. API 686 - Recommended Practice for Machinery Installation and Installation Design
4. ASTM International (ASTM):
 - a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.
 - b. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
5. Hydraulic Institute (HI):
 - a. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
6. International Electrotechnical Commission (IEC).
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
8. International Organization for Standardization (ISO):
 - a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.
 - b. 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and Tolerances for Rotors with Rigid Behavior.
9. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 6, Enclosures for Industrial Control and System.
 - c. MG 1, Motors and Generators.
10. InterNational Electrical Testing Association (NETA):
 - a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
11. National Fire Protection Association (NFPA):

- a. 70, National Electrical Code (NEC):
 - 12. National Institute for Certification in Engineering Technologies (NICET).
 - 13. National Institute of Standards and Technology (NIST).
 - 14. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
 - 15. Underwriters Laboratories, Inc. (UL).
 - a. 508, Standard for Safety Industrial Control Equipment.
 - b. 508A, Standard for Safety Industrial Control Panels.
 - c. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
 - 16. Vibration Institute.
- B. Supplier's Vibration Analyst:
- 1. Supplier's vibration analyst shall prepare pre-Shop Drawing vibration analysis of equipment.
 - 2. Where required, Supplier's vibration analyst shall be either equipment manufacturer's qualified employee or independent business entity whose sole business, or principal part of its business, is evaluating and determining natural frequencies of rotating equipment.
 - 3. Shall possess not less than 10 years' relevant experience.
 - 4. Supplier's Vibration Analyst's Professional Engineer:
 - a. Vibration analysis shall be performed by, or under the direct, personal supervision of, professional engineer licensed and registered in the same jurisdiction as the Site experienced in preparing finite element analyses, rotordynamic analyses, and experimental modal analysis similar to that required for the Work.
 - b. Professional engineer shall possess not less than five years' combined experience in field testing and data analysis for vibration analysis.
 - c. Vibration analysis professional engineer's seal and signature, with indication of date seal and signature were applied to the subject document, shall clearly appear on all results and reports furnished as Submittals.
- C. Field Vibration Testing Subcontractor:
- 1. Field vibration testing Subcontractor shall, where required by the Contract Documents, perform vibration testing of equipment installed at the Site and perform associated vibration analyses.
 - 2. Vibration testing Subcontractor shall be an independent entity that has performed as its sole business, or principal part of its business, for not less than 10 years, inspection, testing, calibrating, adjusting equipment and systems, and performing vibration testing of equipment.
 - 3. Entities whose principal business is one or more of the following are not considered independent vibration testing entities and, therefore, shall not be field vibration testing Subcontractor:
 - a. Motor sales, service, or repairs.
 - b. Process equipment sales, service, or repairs.
 - 4. Acceptable entities include, but are not necessarily limited to::

- a. AVS Engineering: <https://www.avseengineering.net/>
 - b. Engineering Testing Services: <https://etestinc.com/>
 - c. Maritech, LLC: <http://www.maritech-llc.com/contact.html>
 - d. Or equal.
5. Field vibration testing Subcontractor must have an established program for monitoring and testing equipment calibration, with accuracy traceable in an unbroken chain, in accordance with NIST requirements.
 6. Field Personnel: Each person employed for field vibration testing on the Work shall possess not less than the following qualifications:
 - a. Three years' field experience covering all phases of field vibration testing and data gathering.
 - b. Current, valid Vibration Category II certification from Vibration Institute or a licensed, registered professional engineer who need not be licensed and registered in the same jurisdiction as the Site.
 7. Analysis Personnel: Personnel performing analysis for field vibration testing Subcontractor shall possess not less than the following qualifications:
 - a. Five years' combined field testing and data analysis experience.
 - b. Current, valid Vibration Category III certification from the Vibration Institute or a professional engineer licensed and registered in in the same jurisdiction as the Site. Where required by Laws and Regulations, field vibration analysis report shall be sealed, signed, and dated by professional engineer who personally prepared, or exercised personal, supervisory control over subordinates in preparing, the field vibration analysis report.
 8. Analysis Equipment: Field vibration testing Subcontractor shall have access to and use, where appropriate, the following testing equipment, properly maintained and calibrated:
 - a. Impact Hammer:
 - 1) Frequency Range: 1 kHz.
 - 2) Range (5v output) 5,000 pounds-force (22,200 newtons).
 - 3) Hammer sensitivity (approx.) 1mV/lbf (0.23 mV/N)
 - b. Analyzer:
 - 1) Frequency Range: 1 Hz to 10,000Hz.
 - 2) Frequency Accuracy: 0.02 percent.
 - 3) Non-Integrated Spectral Amplitude Accuracy: 5 percent, 3 Hz to 65 Hz.
 - 4) Single Integrated Spectral Amplitude Accuracy: 5 percent, 10 Hz to 20 Hz.
 - 5) Supports measurements of acceleration, velocity, and displacement.
 - c. Vibration Sensor:
 - 1) Sensitivity: ± 5 percent = 100 mV/g
 - 2) Acceleration Range: ± 5 g.
 - 3) Amplitude Nonlinearity: ± 1 percent
 - 4) Frequency Response: ± 10 Hz to 7kHz (± 3 dB)
 - d. Data logging equipment for simultaneous recording of the following data points:
 - 1) Vibration in the X, Y, and axial planes (for all pumps pursuant to ANSI/HI Standard).
 - 2) Digital tachometer recording RPM.

- 3) Discharge Pressure Transmitter
 - a) Accuracy: 0.3 percent of range
 - b) Fluid Temperature Range: 32 to 100 DegF
- 4) Suction Pressure Transmitter (when other than submersible pump or vertical turbine (suspended) pump).
 - a) Accuracy 0.35 percent of range.
 - b) Fluid Temperature Range: 32 to 100 DegF.
 - c) For submersible pumps and vertical turbine (suspended) type pumps, suction liquid surface level signal from Site's monitoring and control system (e.g., plant PLC/SCADA system).
- 5) For pumps, pumping rate (flow) signal from Site's monitoring and control system (e.g., plant PLC/SCADA system)
- 6) Equipment/motor bearing temperature signal from Site's monitoring and control system (e.g., plant PLC/SCADA system)).
- 7) Pump/motor vibration signal from Site's monitoring and control system (e.g., plant PLC/SCADA system).

D. Infrared Thermography Testing Program:

1. Testing firm:
 - a. An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration, and adjusting of systems.
 - b. Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain, according to NIST.
2. Field personnel:
 - a. Minimum of one year field experience covering all phases of field thermography testing and data gathering.
 - b. Supervisor certified by NETA or NICET.
3. Analysis personnel:
 - a. Minimum three years combined field testing and data analysis experience.
 - b. Supervisor certified by NETA or NICET.

E. Electrical Equipment and Connections Testing Program:

1. Qualification requirements as specified in section 26 08 13 - Acceptance Testing.

F. Miscellaneous:

1. A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:
 - a. More than one manufacturer is listed for a given "product" in Specifications.
 - b. No manufacturer is listed.
2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings and defined in the Electrical specifications.
3. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and verify their compatibility.

1.3 DEFINITIONS

- A. Product: Manufactured materials and equipment.
- B. Major Equipment Supports - Supports for Equipment:
 - 1. Located on or suspended from elevated slabs with supported equipment weighing 2000 pounds or greater, or;
 - 2. Located on or suspended from roofs with supported equipment weighing 500 pounds or greater, or;
 - 3. Located on slab-on-grade or earth with supported equipment weighing 5000 pounds or more.
- C. Equipment:
 - 1. One or more assemblies capable of performing a complete function.
 - 2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
 - 3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.
- D. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.
- E. Baseplate or equipment base plate or machine base
 - 1. Are fabricated frames of structural shapes and plates with enough strength and sturdiness to serve as the surface to which other equipment is attached to and supported by. Baseplates can be directly mounted and grouted to concrete equipment support bases or machined and bolted to a sole plate.
- F. Sole plate
 - 1. A thick steel machined plate that is attached to and grouted to a concrete equipment support base.
 - 2. Base plates are bolted to a sole plate when a sole plate is specified and/or provide.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. General for all equipment:
 - a. Data sheets that include manufacturer's name and complete product model number.
 - 1) Clearly identify all optional accessories that are included.
 - b. Acknowledgement that products submitted comply with the requirements of the standards referenced.
 - c. Manufacturer's delivery, storage, handling, and installation instructions.
 - d. Equipment identification utilizing numbering system and name utilized in Drawings.
 - e. Equipment installation details:
 - 1) Location of anchorage.
 - 2) Anchorage setting templates.

- 3) Manufacturer's installation instructions.
 - f. Equipment area classification rating.
 - g. Shipping and operating weight.
 - h. Equipment physical characteristics:
 - 1) Dimensions (both horizontal and vertical).
 - 2) Materials of construction and construction details.
 - i. Equipment factory primer and paint data.
 - j. Manufacturer's recommended spare parts list.
 - k. Equipment lining and coatings.
 - l. Equipment utility requirements include air, natural gas, electricity, and water.
 - m. Ladders and platforms provided with equipment:
 - 1) Certification that all components comply fully with OSHA requirements.
 - 2) Full details of construction/fabrication.
 - 3) Scaled plan and sections showing relationship to equipment.
2. Mechanical and process equipment:
- a. Operating characteristics:
 - 1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
 - 2) Brake horsepower requirements.
 - 3) Copies of equipment data plates.
 - b. Piping and duct connection size, type and location.
 - c. Equipment bearing life certification.
 - d. Equipment foundation data:
 - 1) Equipment center of gravity.
 - 2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
 - 3) Type, size, and materials of construction of anchorage.
3. Electric motor:
- a. Motor manufacturer and model number.
 - b. Complete motor nameplate data.
 - c. Weight.
 - d. NEMA design type.
 - e. Enclosure type.
 - f. Frame size.
 - g. Winding insulation class and temperature rise.
 - h. Starts per hour.
 - i. Performance data:
 - 1) Motor speed-torque curve superimposed over driven machine speed-torque curve during start-up acceleration and at rated terminal voltage a minimum permissible or specified terminal voltage for all motors over 50 HP.
 - 2) Time-current plots with acceleration versus current and thermal damage curves at the operating and ambient temperatures and at rated terminal

- voltage and minimum permissible or specified terminal voltage for all motors over 50 HP.
- 3) Guaranteed minimum efficiencies at 100 percent, 75 percent, and 50 percent of full load.
 - 4) Guaranteed minimum power factor at 100 percent, 75 percent, and 50 percent of full load.
 - 5) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
 - 6) Starting, full load, and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
- j. Bearing data and lubrication system.
- k. Natural frequency calculations for:
- 1) Completed assembly including but not limited to the equipment base, rotating piece of equipment, and the rotating piece of equipment driver.
 - 2) Individual piece of rotating equipment.
 - 3) Equipment driver and connected gear reducer, if applicable.
- l. Thermal protection system including recommended alarm and trip settings for winding and bearing RTD's.
- m. [Maximum permissible capacitor (kVAC) that can be connected to the motor.]
- n. [Recommended size of power factor correction capacitors to improve power factor to 0.95 lagging when operated at full load.]
- o. Fabrication and/or layout drawings:
- 1) Dimensioned outlined drawing.
 - 2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
- p. Certifications:
- 1) When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
 - 2) When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.
 - a) Include minimum speed at which the motor may be operated for the driven machinery.
- q. Electrical gear:
- 1) Unless specified in a narrow-scope Specification Section, provide the following:
 - a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
 - 2) Control panels:
 - a) Panel construction.
 - b) Point-to-point ladder diagrams.
 - c) Scaled panel face and subpanel layout.
 - d) Technical product data on panel components.
 - e) Panel and subpanel dimensions and weights.
 - f) Panel access openings.
 - g) Nameplate schedule.

- h) Panel anchorage.
 - i) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70. Include any required calculations.
 - 4. Systems schematics and data:
 - a. Provide system schematics where required in system specifications.
 - 1) Acknowledge all system components being supplied as part of the system.
 - 2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
 - 3) Provide technical data for each system component showing compliance with the Contract Document requirements.
 - 4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
 - 5. For factory painted equipment, provide paint submittals in accordance with Section 09 96 00.
 - 6. Qualifications for:
 - a. Natural frequency analysis firm and personnel.
 - b. Vibration testing firm and personnel.
 - c. Infrared thermography testing firm and personnel.
 - d. Electrical equipment and connections testing firm and personnel.
 - 7. Equipment Monitoring and Testing plans, in accordance with PART 3 of this Specification Section:
 - a. Natural frequency analysis and calculations.
 - b. Vibration testing.
 - c. Thermography testing.
 - d. Electrical equipment and connection testing.
- B. Factory Test Reports:
- 1. Natural frequency bump test reports where required for rotating equipment.
 - a. Minimum characteristics of impact hammer.
 - 1) Frequency Range 1 kHz.
 - 2) Range (5v output) 5,000 pounds-force (22,200 N).
 - 3) Hammer Sensitivity (7pprox.) 1 mV/lbf (0.23 mV/N).
 - 4) Resonant Frequency 12 kHz
 - 2. Motor, equipment and final assembled equipment including motor.
 - a. Determine natural frequency of assembled motor prior to shipping to equipment manufacturer or job site.
 - 1) Individual motor fastened to an "infinitely rigid" mass at the same bolt circle as the final assembled equipment.
 - b. Determine natural frequency of the pump.
 - 1) Pump fastened to an "infinitely rigid" mass at the same bolt circle as the final assembled equipment.
 - c. Determine natural frequency of the pump/motor assembly.
 - 1) Pump/motor assembly fastened to an "infinitely rigid" mass at the same bolt circle as the final field assembled equipment.

- d. For this use, the "infinitely rigid" mass shall be at least 10 times the weight of the equipment being tested.
 - 3. Submit natural frequency report(s) for approval prior to shipment.
 - 4. Equipment performance tests.
 - a. As listed in individual equipment specifications.
- C. Contract Closeout Information:
- 1. Operation and Maintenance Data:
 - a. See Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- D. Informational Submittals:
- 1. Notification, at least one week in advance, that testing will be conducted at factory.
 - 2. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
 - 3. Submit sample Manufacturer's Field Service Report (MFSR). Report shall use manufacturer's standard report or use the form in the Exhibits and have at least the following information:
 - a. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
 - b. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
 - c. Motor test reports.
 - d. Field noise testing reports if such testing is specified.
 - e. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
 - f. Provide three bound final written reports documenting natural frequency testing, vibration monitoring and testing for specified equipment.
 - 1) Include the acceptance criteria of all equipment tested.
 - 2) Provide individual tabbed sections for information associated with each piece of tested equipment.
 - g. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
 - h. Testing and monitoring reports in accordance with PART 3 of this Specification Section.
 - i. Certification that driven equipment and VFD are compatible.
 - 4. Submit completed Manufacturer's Field Service Report (MFSR) for each piece of equipment supplied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Motors:
 - a. ABB Baldor-Reliance.
 - b. General Electric.
 - c. Hyundai Heavy Industries.
 - d. Marathon Electric.
 - e. Siemens.
 - f. TECO-Westinghouse.
 - g. Toshiba U.S.
 - h. U.S. Motors, Nidec Motor Corporation.
 - i. WEG.
 2. Mechanical variable speed drives:
 - a. Reeves.
 - b. U.S. Motors (VariDrive).

2.2 MANUFACTURED UNITS

- A. Electric Motors:
1. Where used in conjunction with adjustable speed AC or DC drives, provide motors that are fully compatible with the speed controllers.
 2. Design for frequent starting duty equivalent to duty service required by driven equipment.
 3. Design for full voltage starting.
 4. Design bearing life based upon actual operating load conditions imposed by driven equipment.
 5. Size for altitude of Project.
 6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
 7. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
 8. AC electric motors less than 1/3 hp:
 - a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Permanently lubricated sealed bearings conforming to ABMA standards.
 - c. Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.
 9. AC electric motors 1/3 to 1 hp:
 - a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Permanently lubricated sealed bearings conforming to ABMA standards.
 - 1) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.

10. AC electric motors 1-1/2 to 10 hp:
 - a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Permanently lubricated sealed bearings conforming to ABMA standards.
 - c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
11. AC electric motors greater than 10 hp:
 - a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
 - 1) Design bearing life for 90 percent survival rating at 50,000 hours of operation for motors up to and including 100 hp.
 - 2) For motors greater than 100 hp, design bearing life for 90 percent survival rating at 100,000 HRS of operation.
 - c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
 - d. Thermal protection:
 - 1) For motors 50 hp and above controlled from a variable frequency drive and for all other motors 100 hp and above, provide one of the following:
 - a) Integral thermal detectors (thermostat) per phase with normally closed contacts wired in series that will open on overtemperature
 - b) Resistance type temperature detector (RTD) complete with monitor and alarm panel having a normally closed contact that will open on overtemperature.
 - (1) Two thermal sensing devices per phase in each phase hot-spot location.
 - (2) Monitor and alarm panel:
 - (a) For constant speed motors, install panel in and energize from the motor starter equipment.
 - (b) For variable speed motors, install panel in and energize from the variable speed drive equipment.
12. Severe duty motor to have the following minimum features:
 - a. All cast iron construction.
 - b. Gasketed conduit box.
 - c. Epoxy finish for corrosion protection.
 - d. Hydroscopic varnish on windings for corrosion protection.
 - e. Drain plug and breather.

B. NEMA Design Squirrel Cage Induction Motors:

1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
2. Motors to meet NEMA MG 1 (NEMA Premium) [local jurisdiction] efficiencies.
3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
4. For use on variable frequency type adjustable speed drives, provide:
 - a. Induction motors that are in compliance with NEMA MG 1, Part 31.
 - b. Nameplate identification meeting NEMA MG 1 Part 31 requirements.

- c. Insulated drive end bearing on all motors.
- d. Insulated non-drive end bearings, at a minimum, on all motors with horizontal shaft 100 hp and larger.
- e. An insulated bearing carrier on the non-drive end for vertical shaft motors 100 hp and larger.
- f. Shaft grounding ring on all motors:
 - 1) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
 - 2) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
- g. Have the following minimum turndown ratio without the use of additional cooling, such as a blower, to provide continuous supply of cooling air over the motor.
 - 1) Variable torque: 10:1.
 - 2) Constant torque: 6:1.
- 5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 degrees C ambient.
- 6. Design motors for continuous duty.
- 7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
 - a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
- 8. Motor enclosure and winding insulation application:
 - a. The following shall apply unless modified by specific Specification Sections:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	DPFG (for horizontal motors), WP-I (for vertical motors)
Wet indoor Areas	TEFC, Standard Insulation
Wet outdoor Areas	TEFC, Extra Dip and Bake for Moisture
Corrosive Areas	TEFC, Severe/ Chemical Duty
Class I, Division 1 Areas	Explosion Proof, Approved for Class I Division 1 Locations
Class II, Division 1 Areas	Explosion Proof, Approved for Class II Division 1 Locations
Class I or Class II, Division 2 Areas	Explosion Proof, Approved for Division 1 Locations or TEFC with maximum external frame temperature compatible with the gas or dust in the area

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

- 9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.
- 10. Balance motors to ISO G2.5 level.
 - a. Submit prior to shipping to equipment manufacturer or job site.

- C. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.
- D. V-Belt Drive:
 - 1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
 - 2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
 - 3. Provide staticproof belts.
- E. Mechanical Variable Speed Drives:
 - 1. Oil-lubricated shaft-mounted reduction gear drive capable of 300 percent shock load and providing a 1.5 service factor in accordance with AGMA.
 - 2. Secure drive to equipment base.
 - 3. Flexible coupling between drive shaft and equipment shaft.
- F. Vibration Isolators:
 - 1. Provide all equipment subject to vibration with restrained spring type vibration isolators or pads according to the manufacturer's written recommendation.
- G. Space Heaters:
 - 1. Silicone rubber strip type, 120 V rated.
 - 2. Provided on:
 - a. All motors 10 hp and larger mounted outdoors.
 - b. Indoor motors in humid environments as indicated.

2.3 COMPONENTS

- A. Gear Drives and Drive Components:
 - 1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
 - 2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to nameplate horsepower of drive motor.
 - 3. Design drive units for 24 hour continuous service, constructed so oil leakage around shafts is precluded.
 - 4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of AGMA.
 - 5. Gear reducers:
 - a. Provide gear reducer totally enclosed and oil lubricated.
 - b. Utilize antifriction bearings throughout.
 - c. Provide worm gear reducers having a service factor of at least 1.20.
 - d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

2.4 ACCESSORIES

- A. Guards:
 - 1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
 - 2. Interior applications:

- a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
 - b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 inches spacing.
 - c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
3. Exterior applications:
- a. Construct from 16 GA stainless steel or aluminum.
 - b. Construct to preclude entrance of rain, snow, or moisture.
 - c. Roll to conform to shaft or coupling surface.
 - d. Connect to equipment frame with stainless steel bolts and wing nuts.
- B. Anchorage:
- 1. Cast-in-place anchorage:
 - a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
 - b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
 - c. Provide two nuts for each bolt.
 - 2. Drilled anchorage:
 - a. Adhesive anchors.
 - b. Epoxy grout.
 - c. Threaded rods same as cast-in-place.
- C. Data Plate:
- 1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
 - 2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.
- D. Gages:
- 1. Provide at the following locations:
 - a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.
 - b. At locations identified on Drawings.
 - 2. Utilize tapping sleeves for mounting per Section 40 05 00.
- E. Lifting Eye Bolts or Lugs:
- 1. Provide on all equipment 50 pounds or greater.
 - 2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.
- F. Platforms and Ladders:
- 1. Design and fabricate in accordance with OSHA Standards.
 - 2. Fabricate components from aluminum.
 - 3. Provide platform surface: Non-skid grating, unless specified in narrow-scope Specification Sections.

2.5 FABRICATION

- A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.
- B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- C. Furnish like parts of duplicate units to be interchangeable.
- D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
- E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
 - 1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
 - 1. Provide drain connection for 3/4 inches PVC tubing.
- G. Machine the mounting feet of rotating equipment.
- H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that cannot be properly prepared and painted.
 - 1. When such back to back fabrication cannot be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
 - 2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment.
- I. Natural frequency/critical Speed:
 - 1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
 - 2. Excessive vibration is sufficient cause for equipment rejection.
 - 3. Ratio of all rotative speeds to natural frequency/critical speed of a unit or components: Greater than 1.2.
- J. Equipment Base
 - 1. Adequate grout and vent openings to allow grout to flow under entire base.
- K. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
 - 1. Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
 - 2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
 - 3. Affix entire assembly with a UL 508A or UL 698A label "Listed Enclosed Industrial Control Panel" prior to delivery.
 - a. Control panels without an affixed UL 508A or UL 698A label shall be rejected.

4. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - a. Determine the SCCR rating by one of the following methods:
 - 1) Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
 - 2) Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - 3) Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
 - b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.
 - c. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

2.6 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:

1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified to receive field painting.

B. Field paint other equipment.

2.7 SOURCE QUALITY CONTROL

A. Motor Tests:

1. Test motors in accordance with NEMA and IEEE standards.
2. Provide routine test for all motors.
3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
 - a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
 - b. Pay all costs, including shipping and handling, for all motors failing the tests.
 - c. If two successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

B. Balance:

1. Unless specified otherwise, for all equipment 10 hp or greater, all rotating elements in motors, pumps, blowers, and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. Balance all rotating elements to the following criteria, per ISO 21940-11:

$$U_{per} = \frac{G \times 6.015 \times W / 2}{N}$$

Where:

U_{per} = Permissible residual unbalance for each correction plane in ounce-inches (OZ-IN). See ISO 21940-11 for acceptable values.

G = ISO Balance Quality Grade Number, per ISO 21940-11

W = Rotor weight in pounds

N = Maximum continuous operating RPM

- a. Where specified, balancing reports, demonstrating compliance with this requirement, shall be submitted as product data.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment as shown on the Drawings and other Contract Documents, in accordance with manufacturer's written instructions, and in accordance with Laws and Regulations. Where the Contract Documents, manufacturer's written instructions, or Laws and Regulations conflict, obtain interpretation or clarification from Engineer before proceeding.
- B. Utilize appropriate templates for anchorage placement for equipment installed on concrete.
- C. Equipment Drainage Discharges:
 1. For equipment having drainage requirements, such as seal water, provide 3/4-inch copper, PVC, or clear plastic tubing from drainage discharge at equipment base to nearest floor drain or equipment drain. Do not discharge liquid across floors.
 2. Furnish and install bell up at each equipment base.
 3. Route equipment drainage piping clear of major traffic areas, to discharge to locations approved by Engineer. To extent practical, avoid creating tripping hazards.
- D. Coordination of Equipment Supports and Bases with Structures:
 1. Do not construct foundations until major equipment supports are approved by Engineer.
- E. Equipment Lubrication Points:
 1. Extend all non-accessible or difficult-to-access lubrication fittings to reasonably accessible locations to facility operation and maintenance personnel without use of ladders or elevating devices, by providing stainless steel tubing (of appropriate wall thickness for the service and application) to a location which allows easy access of fittings from closest operating floor level.
- F. Concrete Equipment Support Bases:
 1. Install level in both directions, with acceptable vertical tolerance of 1/4-inch±.
 2. At anchorage locations, install bases flat and level.
- G. Machine Bases / Sole Plates:
 1. Grease or tape anchorages and jack screws to inhibit grout from adhering to bolts and other anchors.
 - a. Jack screws number and size by equipment manufacturer.
 - 1) Jack screw
 - a) 304 Stainless Steel minimum
 - b) 0.5 inches diameter minimum
 - 2) Jack Screw Pad
 - a) 2 inch diameter minimum

- b) Anchored in place with a structural epoxy adhesive.
 - 2. Install machine base of rotating equipment on equipment base.
 - 3. Level in both directions using jack screws, with a machinist level, according to machined surfaces on base. Base shall be level within vertical tolerance of the lesser of (a) 0.005 inch per foot with no more than 0.0005 inches difference between any two points, or (b) equipment manufacturer's written instructions.
 - 4. Level machine base on equipment base and align couplings between driver and driven equipment.
- H. Couplings for Rotating Equipment:
- 1. Align in annular and parallel positions.
 - a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 inch tolerance for couplings four-inch size and smaller.
 - b. Couplings larger than four-inch size: Increase tolerance 0.0005 inch per inch of coupling diameter above four-inch; for example: for six-inch coupling, tolerance is 0.002 inch. For 10 inch coupling, required tolerance is 0.004 inch.
 - c. For equipment rotating at speeds greater than 1200 rpm, tolerance for both annular and parallel positions shall be rate of 0.00025 inch (or less) per inch of coupling diameter.
 - 2. If equipment is furnished by manufacturer as mounted unit, verify factory alignment after installation at the Site. Realign if as necessary, in accordance with equipment manufacturers' written instructions, to provide required factory tolerance..
 - 3. Inspect surfaces for runout before attempting to trim or align units.
- I. Grouting:
- 1. Level onto equipment base with jack screws in accordance with the Contract Documents, provide a dam or formwork around base to contain grout between equipment base and equipment support pad.
 - 2. Preparation:
 - a. Extend dam or formwork to cover leveling shims and blocks.
 - b. Anchor sleeves:
 - 1) Required for equipment (Pumps, Mixers, Blowers) greater than 50 hp
 - 2) If anchor sleeves were used, fill voids in anchor sleeves with foam or room temperature vulcanizing (RTV) silicone to keep grout from filling sleeves.
 - c. Do not use nuts below the machine base to level the unit.
 - d. Saturate top of roughened concrete surface with water before grouting.
 - 3. Grout Installation:
 - a. Install grout until entire space under machine base is completely filled to underside of base. Voids are unacceptable.
 - b. Puddle grout by working a stiff wire through the grout and vent holes, to ensure grout is installed properly and to release air entrained in grout or base cavity.
 - 4. After Grout Installation:
 - a. When grout is sufficiently hardened, remove dam or formwork and finish exposed grout surface to fine, smooth surface.
 - b. Completely cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too-rapid evaporation of water from grout.

- c. Check for voids by tapping along the top deck of the mounting plate. A solid thud indicates grout-filled areas while a drum-like hollow sound indicates a void requiring filling.
 - 1) Void areas are to be filled by drilling 1/8 inches NPT holes in opposite corners of each void area. Grout to be pumped into one void with a grout gun until grout emerges from the other vent hole.
- d. When grout is fully hardened (after not less than seven days), remove jack screws, and tighten nuts on anchor bolts and similar anchors to required torque.
- e. Inspect and verify levelness of machine base and, if not in accordance with requirements, remedy by removing base and reinstalling in accordance with the Contract Documents.
- f. Inspect driver-driven equipment for proper alignment. When not in accordance with requirements, remedy so that the Work is not defective.

3.2 INSTALLATION CHECKS

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
 - 1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
- B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
 - 1. Has been properly installed and lubricated.
 - 2. Is in accurate alignment.
 - 3. Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4. Has been operated under full load conditions and that it operated satisfactorily.
 - a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
- C. No separate payment shall be made for installation checks.
 - 1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

- A. Identify equipment and install hazard warning signs.

3.4 WIRING CONNECTIONS AND TERMINATION

- A. Clean wires before installing lugs and connectors.
- B. Coat connection with oxidation eliminating compound for aluminum wire.
- C. Terminate motor circuit conductors with copper lugs bolted to motor leads.
- D. Tape stripped ends of conductors and associated connectors with electrical tape.
 - 1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.
- E. Connections to carry full ampacity of conductors without temperature rise.
- F. Terminate spare conductors with electrical tape.

3.5 FIELD QUALITY CONTROL

A. General:

1. Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
2. Execute pre-demonstration requirements in accordance with Section 01 75 00.
3. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
4. Provide testing for all equipment furnished or installed as part of the Work.
5. Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptable standards.
6. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
 - a. Contract Drawings and Specifications.
 - b. Related construction change documentation.
 - c. Approved Shop Drawings.
 - d. Approved Operation and Maintenance Manuals.
 - e. Other pertinent information as required.

B. Equipment Monitoring and Testing Plans:

1. Approved in accordance with Shop Drawing submittal schedule.
2. Included as a minimum:
 - a. Qualifications of firm, field personnel, and analysis personnel doing the Work.
 - b. List and description of testing and analysis equipment to be utilized.
 - c. List of all equipment to be testing, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,

C. Instruments Used in Equipment and Connections Quality Control Testing:

1. Minimum calibration frequency:
 - a. Field analog instruments: Not more than 6 months.
 - b. Field digital instruments: Not more than 12 months.
 - c. Laboratory instruments: Not more than 12 months.
 - d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
2. Carry current calibration status and labels on all testing instruments.
3. See individual testing programs for additional instrumentation compliance requirements.

D. Testing and Monitoring Program Documentation:

1. Provide reports with tabbed sections for each piece of equipment tested.
2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
 - a. Include legible copies of all forms used to record field test information.

3. Prior to start of testing, submit one copy of preliminary report format for Engineer review and comment
 - a. Include data gathering and sample test report forms that will be utilized.
 4. In the final report, include as a minimum, the following information for all equipment tested:
 - a. Equipment identification, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,
 - b. Date and time of each test.
 - c. Ambient conditions including temperature, humidity, and precipitation.
 - d. Visual inspection report.
 - e. Description of test and referenced standards, if any, followed while conducting tests.
 - f. Results of initial and all retesting.
 - g. Acceptance criteria.
 - h. "As found" and "as left" conditions.
 - i. Corrective action, if required, taken to meet acceptance.
 - j. Verification of corrective action signed by the Contractor, equipment supplier, and Owner's representative.
 - k. Instrument calibration dates of all instruments used in testing.
 5. Provide three (3) bound final reports prior to Project final completion.
- E. Electrical Equipment and Connections Testing Program:
1. Contractor to perform testing on Electrical equipment, connections, and motors in accordance with 26 08 13 - Acceptance Testing.
- F. Other Testing:
1. Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.
 2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.
 - a. The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.
- G. Infrared Thermography Testing Program:
1. Perform infrared thermography testing for equipment specified in other Divisions during the Equipment Demonstration Period.
 - a. Perform on all rotating and reciprocating equipment having drivers 25 hp or greater.
 2. Additional requirements for infrared thermography monitoring and testing equipment:
 - a. Temperature range: -10 to 350 degrees C.
 - b. Accuracy: ± 2 percent or 2 degrees C, whichever is greater.

- c. Repeatability: ± 1 percent or 1 degree C, whichever is greater.
 - d. Temperature indication resolution: 0.1 degrees C.
 - e. Minimum focus distance: 0.3 meters.
 - f. Output in color palettes: JPEG, BMP, or other digital format compatible with Windows.
3. Perform inspection per ASTM E1934.
 - a. Operate VFD driven equipment at 100 percent speed during thermographic inspection.
 4. Acceptability of electrical connections and components based on temperature comparison between components and ambient air temperatures not greater than 10 degrees C per ASTM E1934.
 5. Acceptability of motors and equipment bearings based on temperature rise not greater than 5 DEGC above the equipment and/or bearing manufacturers published criteria.
- H. Equipment Field Vibration Monitoring and Testing Program:
1. Perform vibration monitoring and testing for equipment specified in other Divisions during the Equipment Demonstration Period.
 2. Perform field vibration testing on each item of rotating and reciprocating equipment having driver 50 HP and greater
 3. Acceptability of equipment conditions, except pumps, based on ISO 1940-1 Balance Quality Grade G6.3 criteria.
 4. Acceptability of pumping equipment to be based on current ANSI/HI criteria:
 - a. ANSI/HI 11.6-2012 for Submersible Pumps in a Wet-pit or Dry-pit configuration.
 - b. ANSI/HI 9.6.4-2016 for all other centrifugal pumps.
 5. Utilize an Engineer approved 3rd party testing agency to perform vibration monitoring and testing on equipment.
 6. For variable speed equipment provide vibration testing at no more than 3 percent increments of maximum speed throughout entire operating range.
 7. Provide machinery condition diagnosis based on an acceptable machinery vibration severity guide or machinery fault guide analysis provided by the testing agency.
 8. Tolerances for pumping equipment shall be per HI published standards.
 9. Repair or replace equipment shown to be out of range of the specified tolerance until the equipment meets the specified normal operation range required in the machinery fault guide analysis.
 10. Document testing with written report.
 - a. Report to include initial testing results, acceptance criteria, corrective action taken to meet acceptance, verification of corrective action and acceptance report and baseline.
 - b. Natural frequency of installed equipment utilizing an impact hammer.
 - c. Report to include graphical plots of vibration signature for each test point at a scale which illustrates all vibration levels greater than 0.025 ips RMS.

3.6 DEMONSTRATION

- A. Demonstrate equipment in accordance with Section 01 75 00.

3.7 ABBREVIATION TABLE

A. As indicated on the Drawings.

EXHIBIT A
MANUFACTURER FIELD SERVICE REPORT

This field service report is generic in nature. An electronic copy of this form will be furnished upon request from the Engineer. This report is to reflect that all requirements of the Operations and Maintenance Manual and the individual equipment specification requirements have been performed for the installation and operation and also to provide a baseline for amperage draw for each phase, vibration readings, rotation, alignment and all other applicable tests required to insure that the equipment has been installed properly. A MFSR will be required for each individual piece of equipment requiring a MFSR.

Definitions of Reports:

Initial service report: Required for construction preparations. Equipment delivered to site is in good condition and conforms to specification requirements. Anchor bolts, hardware and ancillary items (piping, flanges, conduits, fuel/power supply) are compatible with equipment.

Interim service report: Required for equipment installation onto base or foundation. Piping connections, electrical and control connections or structural attachment are complete. For equipment stored on site over four weeks, interim service report will document that manufacturer's long-term storage procedures have been incorporated and equipment has not been damaged, nor coatings deteriorated.

Final service report is to be completed when equipment can be started, electrical amperage and voltage draw measured, cold and hot alignments performed, vibration testing and monitoring performed and the equipment is found to be in compliance with Manufacturer's operating parameters and the requirements of the individual equipment specifications.

PROJECT: _____

Report Status:

Initial Service Report completed and submitted on _____

Interim Service Report completed and submitted on _____

Final Service Report completed and submitted on _____

Commencement of Warranty _____

I Description

A. Equipment Name and Identification: _____

B. Serial Number: _____

C. Specification Section Number: _____

D. Manufacturer: _____

E. Representative: _____

F. Type of Service: Initial [_____] Interim [_____] Final [_____]

II General Review

A. The above referenced equipment/material/supplies have been inspected, checked, and adjusted. Yes [_____] No [_____]

Summary: _____

B. The above referenced equipment/material/supplies were placed upon properly prepared or suitable substrate. N/A [_____] Yes [_____] No [_____]

Summary: _____

C. The above referenced equipment/material/supplies are free from any undue stress imposed by any connected piping, anchor bolts or any other load. N/A [_____] Yes [_____] No [_____]

Summary: _____

D. The above referenced equipment/material/supplies have operated under design conditions. N/A [_____] Yes [_____] No [_____]

Summary: _____

E. The above referenced equipment/material/supplies have been installed in accordance with the manufacturer's recommendations and the Procurement Documents, require no corrective work, and are hereby approved. Yes [_____] No [_____]

Summary: _____

F. The above referenced equipment/material/supplies are acceptable to the manufacturer as installed providing the following corrective action(s) are performed:

1. _____

2. _____

3. _____

4. _____

5. _____

III Inspection Checklist

Item	Acceptable (Yes/No)	Readings/Comments
Bearings (1)		
Belts (tension reading)		
Lubrication Levels		
Vibration (1) (2) (MILS/SEC)		
Infrared Thermography (1) (2)		
Starting AMPS		
Full Load AMPS		
Volts		
Rotation		
Jacket Temperature (DEGF)		
Seal Water Flow Rate (GPH or GPM)		
Seal Water Pressure (PSI)		
O-rings/Packing		

Item	Acceptable (Yes/No)	Readings/Comments
Alignment (1)		
Anchor Bolts		
Anchor Bolt Torque		
Grout		
Substrate Approval		
Sound level (4 feet from unit) (1) (dB)		
Other		

(1) Inspection or testing reports must be attached.

(2) Provide vibration testing and monitoring procedures for Engineer's review and approval prior to testing.

IV O&M Manuals

- A. The O&M manual as presented contains all information required for proper operation, maintenance, and instruction of this system. N/A [_____] Yes [_____] No [_____]

Summary: _____

V Preventive Maintenance

- A. The preventive maintenance summary outlined in the O&M manual is acceptable for operation of the system throughout the warranty period. N/A [_____] Yes [_____] No [_____]

Summary: _____

VI Operator Training/Classroom Instruction

- A. Training and instruction have been performed in accordance with the requirements of the Procurement Documents. N/A [_____] Yes [_____] No [_____]

- B. Final Training/Classroom Instruction Completed on: _____

Summary: _____

VII Remarks

VIII Certification

I hereby certify, that I, [____], am a duly authorized representative of the manufacturer, that I am empowered by the manufacturer to inspect, approve, and operate his equipment, and that I am authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as modified herein. I also certify that all information contained herein is true and accurate.

By: _____
(Authorized Representative)

For: _____

Date: _____

IX Acknowledgments

By: _____

For: _____
(Contractor)

Date: _____

By: _____

For: _____
(Engineer)

Date: _____

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Methods of installing and sealing openings and penetrations in construction.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - d. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - e. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - f. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
 - g. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - h. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - i. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 501, Class 1 Locations.
 - b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
 - c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 DEFINITIONS

- A. Corrosive Areas: For the purpose of this specification section, the following areas are defined as corrosive:
1. Areas indicated on Drawings.
- B. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.
- C. Washdown Areas: Areas having floor drains or hose bibbs.

1.4 SUBMITTALS

A. Shop Drawings:

1. For each structure provide dimensioned or scaled (minimum 1/8 inches = 1 foot) plan view drawings containing the following information:
 - a. Vertical and horizontal location of all required openings and penetrations.
 - b. Size of all openings and penetrations.
 - c. Opening type.

- d. Seal type.
2. Manufacturer's installation instructions for standard manufactured products.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe Sleeves:
 1. Areas listed as Corrosive Areas in PART 1:
 - a. Stainless steel, Type 304L.
 - b. Penetrations 24 inches diameter or less: ASTM A269, ASTM A312 or ASTM A554, Schedule 40.
 - c. Penetrations larger than 24 inches diameter: Stainless steel, ASTM A666, Minimum 1/4 inches thickness.
 2. All other Areas:
 - a. Steel, Hot-dipped galvanized after fabrication.
 - b. Penetrations 24 inches diameter or less: ASTM A53, Schedule 40.
 - c. Penetrations larger than 24 inches diameter: ASTM A36, Minimum 1/4 inches thickness.
- B. Modular Mechanical Seals:
 1. Acceptable manufacturers:
 - a. Link-Seal.
 2. 304 stainless steel bolts, nuts and washers.
- C. Sheet Metal Sleeves:
 1. Areas listed as Corrosive Areas in PART 1: Stainless steel: ASTM A240, Type 304L.
 2. All other areas: Galvanized steel: ASTM A653, G90.
 3. Minimum 12 GA.
- D. Commercial Wall Castings:
 1. Ductile iron, ASTM A536.
 2. Grade equal to connecting piping system.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
 1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
 2. For commercial castings, cast water stop/anchor with wall pipe.
 3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
 4. For fabricated units, diameter of plate or flange to be 4 inches larger than outside diameter of sleeve, pipe or ductwork.
 5. For commercial castings, waterstop/anchor size to be manufacturer standard.
 6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.
- B. Factory or shop-coat painted components.

3.2 INSTALLATION AND APPLICATION

- A. Seal openings and penetrations in non-fire-resistance-rated construction.

- B. Obtain prior approval from Engineer when any opening larger than 100 square inches must be made in existing or newly completed construction.
- C. Perform HVAC penetrations in accordance with NFPA 90A.
- D. Perform electrical penetrations in accordance with NFPA 70, Article 501.
- E. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
 - 1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.
- F. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
 - 1. In non-washdown areas, install sleeves with ends flush with finished surfaces.
- G. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.
- H. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.
- I. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.
- J. Where pipes, conduits or ducts are removed where passing through grating:
 - 1. Metal grating:
 - a. Provide banding at perimeter and cover opening with 1/4 inches plate of the same material of the grating.
 - 2. FRP grating:
 - a. Provide full depth cover meeting same loading requirement as existing material or replace grating section.
- K. Do not cut into or core drill any beams, joists, or columns.
- L. Do not install sleeves in beams, joists, or columns.
- M. Do not install recesses in beams, joists, columns, or slabs.
- N. Field Cutting and Coring:
 - 1. Saw or core drill with non-impact type equipment.
 - 2. Mark opening and drill small 3/4 inches or less holes through structure following opening outline.
 - 3. Sawcut opening outline on both surfaces.
 - a. Knock out within sawcuts using impact type equipment.
 - b. Do not chip or spall face of surface to remain intact.
 - c. Do not allow any overcut with saw kerf.
- O. Precast-Prestressed Concrete Construction:
 - 1. Do not cut openings or core drill vertically or horizontally through stems of members.
 - 2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
 - 3. Cast openings and sleeves into flanges of units.
 - 4. Cast openings larger than 6 inches in diameter or 6 inches maximum dimension in units at time of manufacture.
 - 5. Cast openings smaller than 6 inches in diameter or 6 inches maximum dimensions in flanges of units at time of manufacture or field cut.

- P. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.
- Q. Where area is blocked out to receive sheet metal sleeve at later date:
 - 1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
 - a. Size blockout based on sleeve size required plus 4 to 6 inches each side of sleeve for concrete encasement.
 - b. Provide #4 dowels at 12 inches spacing along each side of blockout with minimum of two dowels required per side.
 - 2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
 - a. Size blockout based on sleeve size required plus 2 to 4 inches each side of sleeve for concrete encasement.
- R. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.
- S. Refer to Drawings for location of fire-rated walls, floors, and ceilings.
 - 1. Utilize firestopping materials and procedures specified in Specification Section 07 84 00 inches conjunction with scheduled opening type to produce the required fire rating.
- T. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.
- U. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.
- V. Modular Mechanical Seals:
 - 1. Utilize one seal for concrete thickness less than 8 inches and two seals for concrete, 8 inches thick or greater.
 - 2. Utilize two seals for piping 16 inches diameter and larger if concrete thickness permits.
 - 3. Install seals such that bolt heads are located on the most accessible side of the penetration.
- W. Backer Rod and Sealant:
 - 1. Provide backer rod and sealant for modular mechanical seal applications.
 - a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.3 SCHEDULES

- A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
 - 1. Provide the following opening and penetration types:
 - a. Type A - Block out 2 inches larger than outside dimensions of duct, pipe, or conduits.
 - b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
 - c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
 - d. Type D - Commercial type casting or fabrication.
 - e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
 - f. Type F - Integrally cast pipe, duct or conduit.
 - g. Type G - Saw cut or line-drill and remove area 1 inch larger than outside dimensions of duct, pipe or conduit.
 - h. Type H - Core drill.

- i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
 - j. Type J - Grating Banding for any field cut openings.
 2. Provide seals of material and method described as follows.
 - a. Category 1 - Modular Mechanical Seal.
 - b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings.
 - c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
 - d. Category 4 - Backer rod and sealant.
 - e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
 - f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 inches larger than opening.
 - g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
 - h. Category 8 - Banding for all grating openings and banding and cover plate of similar materials for abandoned openings.
 3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.
 4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

**SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE
FOR NEW CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I ⁽¹⁾	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I ⁽¹⁾	7 Not Req 7	C F I ⁽¹⁾	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H ⁽²⁾ I ⁽¹⁾	4 3 4	F H ⁽²⁾ I ⁽¹⁾	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I ⁽¹⁾	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I ⁽¹⁾	1 Not Req Not Req 1	F I ⁽¹⁾	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H ⁽²⁾	1 Not Req Not Req 1	C F H ⁽²⁾ I ⁽¹⁾	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A B C	6 6 6	A B D H ⁽²⁾	5 5 Not Req 5	C H ⁽²⁾	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

**SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE
FOR EXISTING CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B E	7 Not Req	B ⁽¹⁾ E ⁽³⁾ H ⁽²⁾	7 Not Req 7	B ⁽¹⁾ E ⁽³⁾ H ⁽²⁾	7 Not Req 7
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H ⁽²⁾	3 3	G H ⁽²⁾	3 3
Through walls where one side is a hazardous area	B E	7 Not Req	B ⁽¹⁾ B ⁽³⁾⁻ E H ⁽²⁾	7 1 Not Req 7	B ⁽¹⁾⁽³⁾ E H ⁽²⁾	7 Not Req 7
Through exterior wall below grade above water table	B	7	B ⁽¹⁾ B ⁽³⁾ H ⁽²⁾	7 1 7	B ⁽¹⁾⁽³⁾ H ⁽²⁾	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H ⁽²⁾	1 Not Req 1	B ⁽¹⁾⁽³⁾ E H ⁽²⁾	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req	E	Not Req	E	Not Req
Through exterior wall above grade	G	6	G ⁽¹⁾⁽³⁾ H ⁽²⁾	5 5	G ⁽¹⁾⁽³⁾ H ⁽²⁾	5 7
Roof penetrations	G	2	G ⁽¹⁾⁽³⁾ H ⁽²⁾	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G ⁽¹⁾⁽³⁾ H ⁽²⁾	4 4	G ⁽¹⁾⁽³⁾ H ⁽²⁾	4 4
Grating openings and penetrations	J	8	J	8	J	8

- (1) Multiple piping 3 inches and smaller or multiple conduits.
(2) Single pipe 3 inches and smaller or single conduit.
(3) Single pipe or conduit larger than 3 inches.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for cutting and patching Work.

B. Scope:

1. Contractor shall perform cutting and coring, and rough and finish patching of holes and openings in existing construction.
2. Provide cutting, coring, fitting, and patching, including attendant excavation and fill, required to complete the Work, and to:
 - a. remove and replace defective Work;
 - b. remove samples of installed Work as specified or required for testing;
 - c. remove construction required to perform required alterations or additions to existing construction;
 - d. uncover the Work for Engineer's observation of covered Work, testing, or inspection by testing entities, or observation by authorities having jurisdiction;
 - e. connect to completed Work not performed in proper sequence;
 - f. remove or relocate existing utilities and piping that obstruct the Work in locations where connections are to be made;
 - g. make connections or alterations to existing or new facilities.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:

1. Cutting and Patching Request:

- a. Submit written request to Engineer, well in advance of executing cutting or alteration that affects one or more of the following:
 - 1) Design function or intent of Project.
 - 2) Work of Owner or other contractors retained by Owner.
 - 3) Structural capacity or integrity of an element of the Project, building, or structure.
 - 4) Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 5) Efficiency, operational life, maintenance, or safety of operational elements.
 - 6) Visual qualities of elements that will be exposed to view after completion of the Work.
- b. Request shall include:
 - 1) Identification of Project and Contract designation.
 - 2) Description of affected Work of Contractor and work of others (if any) retained by Owner.
 - 3) Necessity for cutting.
 - 4) Effect on work or operations of Owner and other contractors (if any) retained by Owner, and on structural and weatherproof integrity of Project, building, or structure.
 - 5) Description of proposed Work, indicating: scope of cutting and patching; trades that will execute the cutting and patching Work; materials and equipment to be used;

- extent of refinishing; schedule of operations; alternatives (if any) to cutting and patching, and net effect on aesthetics following completion of finishing Work.
- 6) Indication of entity responsible for cost of cutting and patching, when applicable.
 - 7) Written permission of other prime contractors (if any) whose work will or may be affected.
2. Recommendation Regarding Cutting and Patching:
 - a. Should conditions of work or schedule indicate a change of materials or specified methods, furnish Submit written recommendation to Engineer including:
 - 1) Conditions indicating change.
 - 2) Recommendations for alternative materials or alternatives to specified methods.
 - 3) Material manufacturer's printed recommendations for the proposed product and recommendations of manufacturer's technical representative for the specific application(s). The latter shall be on technical representative's letterhead and shall explicitly indicate the Project and specific cutting and patching application(s) to which the recommendation(s) apply.
 - 4) Items required with request for approval of substitute, in accordance with the substitution request requirements of the Contract Documents.
 3. Product Data:
 - a. Submit manufacturer's published data for the protective compound to be applied to core-drilled surfaces and cut concrete surfaces.
 - b. When not required under other Specifications sections, submit manufacturer's published data on materials to be used for finishing around the cut or patched area(s), together with indication of the location(s) where each is proposed for use.
 - c. Furnish Submittals for patching materials under the associated Specifications section. Submittal to include letter of recommendation from product manufacturer's technical representative indicating on technical representative's letterhead, explicitly indicating:
 - 1) Project name and facility name;
 - 2) specific cutting and patching application(s) to which the recommendations apply;
 - 3) that product manufacturer's technical representative has personally observed and is familiar with conditions in the work area(s) of the subject cutting and patching;
 - 4) materials that are the subject of the Submittal are appropriate for the condition(s) of the proposed patch and will remain durable in the patch's final exposure upon Substantial Completion; and.
 - 5) patching material manufacturer's technical representative's recommendations for surface preparation, installation of patching material(s), and curing.
- B. Informational Submittals: Submit the following:
1. Written Notification of Cutting and Patching:
 - a. Furnish as a Submittal written indication designating the day and time that the construction associated with cutting and patching will be uncovered to allow for observation. Do not begin cutting or patching operations until submittal is accepted by Engineer.
 2. X-ray Investigations:
 - a. Proposed method of investigation. Submit and obtain Engineer's acceptance prior to performing x-ray inspections.
 - b. Report of x-ray evaluation of slabs, floors, and walls to be cut or core-drilled.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials – General:

1. Provide materials that comply with the Contract Documents.
 2. If not shown or indicated in the Contract Documents, use materials identical to existing materials affected by cutting and patching Work.
 3. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, provide materials whose installed performance will equal or surpass that of existing materials.
 4. Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using materials that do not void required or existing warranties.
- B. Compound Applied to Core-Drilled Surfaces and Cut Concrete Surfaces:
1. After core-drilling or sawcutting (as applicable) and before installing the utility or equipment through the penetration, coat exposed concrete and exposed steel with solvent-free, two-component, protective, epoxy resin coating.
 2. Color shall approximate the finish color of the existing surface to be coated.
 3. Product and Manufacturer: Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - a. Sikagard 62, by Sika Corporation.
 - b. Or equal.
- C. Grout Materials:
1. Comply with Section 03 00 05 - Concrete.
- D. Epoxy Bonding Adhesive:
1. Provide two-component, moisture-insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.
 2. Comply with Section 03 00 00 - Concrete.
 3. Product and Manufacturer: Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - a. Euco No.452 MV by Euclid Chemical Co.
 - b. Sikadur 32, Hi-Mod by Sika Corporation.
 - c. Or equal.
- E. Epoxy Patch Material:
1. Engage the manufacturer's representative to observe and recommend a suitable patching material of the actual construction conditions.
 2. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - a. Depth of patch greater than 3/4 inches:
 - 1) Five Star MP Epoxy Patch.
 - 2) Or equal.
 - b. Depth of patch between 1/8 inches and 3/4 inches:
 - 1) Five Star Fluid Epoxy.
 - 2) Or equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Assessment – General:
1. Examine surfaces to be cut or patched, and conditions under which cutting or patching will be performed before starting cutting or patching Work.
 2. Report unsatisfactory or questionable conditions to Engineer in writing.

3. Do not proceed with cutting or patching Work until unsatisfactory conditions are corrected.
- B. Non-Destructive Investigation:
1. In advance of cutting or coring through existing slabs or walls, use x-ray or other non-destructive methods accepted by Engineer to determine location of reinforcing steel, electrical conduits, and other items embedded in slabs and walls.
 2. Submit to Engineer written report of findings of evaluation.
 3. Perform x-ray investigation and submit results to Engineer sufficiently in advance of cutting Work to allow time to identify and implement alternatives, if changes to the Work are necessary because of conduit or other features in floor or wall.

3.2 PREPARATION

- A. Provide temporary support required to maintain structural integrity of facilities, to protect adjacent work from damage during cutting, and to support the element(s) to be cut.
- B. Protection of Existing Construction during Cutting and Patching:
1. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project and facility that will be exposed during cutting and patching operations.
 2. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 3. Do not cut existing pipe, conduit, ductwork, or other utilities serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 CUTTING AND PATCHING – GENERAL

- A. Perform cutting and coring in such manner that limits extent of patching required.
- B. Structural Elements:
1. Do not cut or patch structural elements in manner that would change the element's structural load-carrying capacity as load deflection ratio.
- C. Operating Elements:
1. Do not cut or patch operating elements in manner that would reduce their capacity to perform as intended.
 2. Do not cut or patch operating elements or related components in manner that would increase maintenance requirements or decrease operational life or safety.
- D. Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using methods that do not void required or existing warranties.
- E. Provide adequate temporary covering over openings (whether cut or core-drilled) where not in use. Avoid creating tripping hazards for openings provided in floors and slabs.

3.4 CORING

- A. Use core-drilling to make penetrations through concrete and masonry walls, slabs, or arches, unless otherwise accepted by Engineer in writing.
- B. Coring:
1. Perform coring with non-impact rotary tool using diamond core-drills. Size holes for pipe, conduit, sleeves, equipment or mechanical seals, as required, to be installed through the penetration.
 2. Do not core-drill through electrical conduit or other utilities embedded in walls or slabs without approval of Engineer. To extent possible, avoid cutting reinforcing steel in slabs and walls.
- C. Protection:

1. Protect existing equipment, utilities, and adjacent areas from water and other damage caused by or resulting from core-drilling operations.
2. After core-drilling and before installing the utility or equipment through the penetration, coat exposed concrete and steel with protective coating material indicated in Paragraph 2.1.B of this Specification Section. Apply protective coating in accordance with manufacturer's instructions.

D. Cleaning:

1. After core-drilling, vacuum or otherwise remove slurry and tailings from the work area.

3.5 CUTTING

A. Cutting – General:

1. Cut existing construction using methods least-likely to damage elements retained and adjoining construction and that provide proper surfaces to receive subsequent installation or repair.
2. In general, use hand tools or small power tools suitable for sawing or grinding. When possible, avoid using hammering and avoid chopping. Carefully chip out concrete where necessary and as indicated in the Contract Documents.
3. Cut holes and slots as small as possible, neatly to the size required, and with minimum disturbance of adjacent surfaces.
4. Prior to starting cutting, provide adequate bracing of area to be cut.
5. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed side.
6. Use equipment of adequate size to remove the cut panel or "coupon".

B. Cutting – Concrete and Masonry:

1. Cut through concrete and masonry using concrete wall saw with diamond saw blades.
2. On both sides of the element being cut, provide for control of slurry generated during sawing.
3. Concrete Cutting:
 - a. Make openings by sawing through existing concrete. Core drill with 6 inches diameter core at the corners of openings to avoid overcutting at corners.
 - b. When the cut-out concrete or "coupon" cannot be removed in one piece, or where concrete is too thick for saw to penetrate fully, break out concrete after initial saw cuts.
 - c. Where saw cutting is not possible:
 - 1) Make openings by drilling holes around perimeter of required opening and subsequently carefully chip out concrete.
 - 2) Holes shall be sufficient in quantity to prevent damage to remaining concrete.
4. Sizing and Repair of Cut Concrete Surfaces:
 - a. Where reinforcing steel is cut, [for openings indicated on the Drawings,] remove existing reinforcing steel back to 1.5 inches below concrete surface. When using heat or torching to remove ends of reinforcing steel, remove adjacent, heat-damaged concrete prior to patching. Sides of resulting hole to be patched shall be approximately perpendicular to finished concrete surface. Provide bonding adhesive on surfaces of resulting holes and fill resulting holes with non-shrink grout in accordance with the Contract Documents.
 - b. Oversize required openings in existing concrete by one inch on all sides and build back to required opening size by providing epoxy grout bonded to existing concrete.
 - c. Where oversizing the cut opening by one inch is not possible, cut the opening to the required dimensions. After cutting concrete and before installing subsequent construction on or through the opening, coat exposed concrete and steel with protective

coating material indicated in Paragraph 2.1.B of this Specifications Section. Apply protective coating in accordance with manufacturer's instructions.

d. Where indicated, finish remaining surfaces as indicated in Section 03 00 00 - Concrete.

3.6 PATCHING

A. Patching – General:

1. Patch large openings to be filled with concrete in accordance with the Contract Documents. Before installing new concrete, apply bonding adhesive in accordance with manufacture's recommendations.
2. Where large openings to be filled with concrete are indicated on the Drawings as requiring reinforcing steel, provide reinforcing steel as shown and indicated in the Contract Documents. Where openings in existing reinforced concrete are larger than 2 feet in diameter or 2 feet by 2 feet and the Drawings or elsewhere in the Contract Documents do not expressly require reinforcing steel for the opening, submit a request for interpretation to Engineer and obtain Engineer's response before proceeding.
3. Where concrete infill or grout repair materials are not used, patch using epoxy patch material indicated in Paragraph 2.1.D of this section unless otherwise indicated on Drawings.
4. Patch construction by filling, repairing, refinishing, closing-up, and similar operations following performance of other Work.
5. Patch with durable seams that are as inconspicuous as possible. Provide materials and comply with installation requirements indicated in the Contract Documents and the published installation instructions of the material's manufacturer.
6. Patch to provide airtight and watertight connections to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
7. Where feasible, test patched areas to demonstrate integrity of installation.

B. Restoration:

1. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that eliminates evidence of patching and refinishing.
2. For continuous surfaces, refinish to nearest intersection.
3. For an assembly, refinish the entire unit that was patched.
4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 CLEANING

A. Cleaning and Restoration:

1. Perform cleaning promptly after associated cutting, coring, and patching.
2. Clean areas and spaces where cutting, coring, or patching were performed.
3. Clean piping, conduit, and similar constructions before applying paint or other finishing materials.
4. Restore damaged coverings of pipe and other utilities to original condition.

END OF SECTION

SECTION 01 74 00 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

- A. General
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least <once><twice> each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
 - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.
 - 3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

3.2 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.
 2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 3. Remove petrochemical spills, stains, and other foreign deposits.
 4. Remove tools, construction equipment, machinery, and surplus material from the site.
 5. Remove snow and ice to provide safe access to the building.
 6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 8. Broom clean concrete floors in unoccupied spaces.
 9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
 10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

11. Remove labels that are not permanent labels.
 12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
 15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 16. Clean ducts, blowers, and coils if units were operated without filters during construction
 17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
 18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
 19. Leave the Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 01 74 00

SECTION 01 75 00
CHECKOUT AND START-UP PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for checkout and startup of equipment, systems, and facilities.

B. Scope:

1. Contractor shall initially check out, start up, and place equipment and systems installed under the Contract into successful operation, in accordance with the material and equipment manufacturers' written instructions, Suppliers' recommendations at the Site, and the Contract Documents.
2. Provide the following:
 - a. All labor, tools, materials, and equipment required to complete equipment and system checkout and startup.
 - b. Chemicals, lubricants, and other required operating fluids necessary for checkout, startup, and initial operation of the Work.
 - c. Filters and other temporary or consumable items necessary for checkout, startup, and initial operation of the Work.
 - d. Fuel, electricity, water, and other temporary utilities and temporary facilities necessary for checkout and startup of equipment and systems, unless otherwise specified.
3. The General Conditions, as may be modified by the Supplementary Conditions, and Section 01 77 19 - Closeout Requirements, address requirements for documenting Substantial Completion.

C. Related Sections include but are not necessarily limited to:

1. Section 01 78 23 - Operation and Maintenance Data
2. Section 01 61 03 - Equipment - Basic Requirements.
3. Section 01 77 19 - Closeout Requirements.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate checkout and startup with other contractors, as necessary.
2. Do not start up equipment or system(s) for continuous operation until all components of that equipment item or system, including instrumentation and controls, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.
3. Subject to the constraints of this Specifications section, Owner will furnish sufficient personnel to assist Contractor in starting up equipment and system(s), but responsibility for proper operation of the Work is Contractor's.
4. Supplier shall be present during checkout, startup, and initial operation, unless otherwise acceptable to Engineer or otherwise required by the Contract Documents.
5. For startup of heating equipment, air conditioning equipment, and other equipment and systems that provide temperature control, that are dependent upon the time of year, return to the Site at beginning of next heating or cooling season (as applicable) to recheck and start the appropriate equipment and system(s).
6. Do not start up equipment and system(s), without submitting acceptable preliminary operations and maintenance manuals by Contractor in accordance with the Contract Documents.

B. Checkout and Startup Planning Meeting:

1. Contractor, with appropriate Subcontractors and Suppliers, shall attend and participate in a meeting with Owner, facility manager, and Engineer to discuss planning, scheduling, and coordination of checkout and startup activities.
2. Upon mutual concurrence of Owner, facility manager, Engineer, and Contractor, meeting may be concurrent with the training scheduling planning meeting.
3. Meeting shall be held by the earlier of: (1) not less than 60 days prior to first scheduled training session for the equipment and system(s) to be checked out and started-up, and (2) not less than 60 days prior to the checkout and startup of the associated equipment and system(s).
4. Attend meeting prepared to knowledgably and effectively discuss:
 - a. Status of the Work and schedule-to-complete for requirements prerequisite to checkout and startup.
 - b. Schedule for and status of training required for each equipment item and system.
 - c. Schedule for checkout, startup, and field quality control activities for the subject Work.
 - d. Status and quantities of required consumables, lubricants, and utility services necessary for checkout and startup.
5. Meeting will be chaired by Engineer. Engineer will prepare and distribute a record of topics discussed and decisions made during the meeting. If meeting is concurrent with the training planning meeting required, Contractor shall chair and prepare minutes of the training scheduling planning portion of the meeting and furnish its draft minutes to Engineer to incorporate into the overall minutes.
6. Comply with decisions made at the meeting and the Contract Documents.

C. Sequencing:

1. Comply with Drawings and specifications, regarding staging (phasing) of the Work and allowable shutdowns.

D. Scheduling:

1. Progress Schedule:
 - a. Clearly indicate in the Progress Schedule planned and actual dates for checkout, startup, and field quality control activities, including all demonstration testing activities addressed in this Specifications section and elsewhere in the Contract Documents. Separately indicate checkout, startup, and field quality control activities for each equipment item and system.
 - b. Perform startup and field quality control activities on the associated, scheduled dates, unless otherwise acceptable to Owner, facility manager, and Engineer.
2. Restrictions for Scheduling:
 - a. Checkout of materials, equipment, and systems by Contractor that do not involve or require Owner's or facility manager's personnel may be performed at any time during normal working hours. Where required by the Contract Documents or requested by Engineer, perform checkout in the presence of Engineer or Resident Project Representative (RPR).
 - b. Startup, including initial operation of materials, equipment, and systems, shall not be initiated on: Monday, Friday, Saturday, Sunday, Owen's holidays, the day immediately prior to a holiday, or the day immediately following a holiday, unless otherwise acceptable to Owner, facility manager, and Engineer.
 - c. Unless otherwise indicated in the Contract Documents or acceptable to Owner, facility manager, and Engineer, perform all startup during normal working hours of the day shift.

- d. To the extent practicable, where extended-duration startup or field quality control activities are required by the Contract, avoid having such activities extend into evening, night, weekend, or holiday hours.
 - e. Owner reserves the right to require a minimum [seven] days' notice of rescheduled startup when Contractor cannot perform the associated activities as scheduled.
3. Operation and Maintenance Data:
 - a. Comply with Section 01 78 23 - Operation and Maintenance Data.
 - b. A preliminary copy of all operation and maintenance manuals shall be received by Engineer prior to the start of the demonstration period.
 4. Training:
 - a. Comply with specifications.
 5. Spare Parts, Tools, and Extra Materials.
 - a. Comply with specifications, for furnishing spare parts, tools, and extra materials to Owner and for documenting Owner's or facility manager's (as applicable) receipt of such items.
 - b. Deliver to Owner or facility manager (as applicable) all required spare parts, tools, and extra materials prior to commencing the demonstration period, unless earlier delivery is required elsewhere in the Contract Documents.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Do not start up equipment or systems or place into initial operation until required operating permits are obtained from authorities having jurisdiction.
2. Where Owner (with or without assistance of Engineer) has applied for and obtained initial approvals or permits necessary for operation, Contractor shall furnish information and assistance to Owner or Engineer for Owner to secure final approvals from authorities having jurisdiction for required operating permits.

B. Qualifications:

1.4 DEFINITIONS

A. The following defined terms are used in this Specifications Section:

1. Instrumentation Supplier: Entity retained by Contractor, Subcontractor, or Supplier to furnish instrumentation or controls that will be part of the completed Work, including manufacturers, manufacturer representatives, wholesalers, retailers, and others, including entities retained to perform systems integration Work.
2. Project Classified System (PCS): An established, distinct part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, cabling, materials, and incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system. PCSs may be specifically indicated in this Specifications section or elsewhere in the Contract Documents.
3. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
 - a. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
 - b. Equipment start-up.
 - c. Personnel training.
4. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow] through the facility and starts up and operates the facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components

and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Data collection and reporting log for each required Demonstration Period.

B. Informational Submittals: Submit the following:

1. Progress Schedules indicating dates for checkout, startup, and field quality control activities.
2. Completed checkout and startup log required in Paragraph 3.2.C of this Specifications section.
3. Manufacturer's installation check letters (also known as Manufacturer's Field Services Report) required in Paragraph 3.2.C of this Specifications section.
4. Instrumentation Supplier's Instrumentation Installation Certificate, required in Paragraph 3.2.C of this Specifications section.
5. Letter verifying completion of all pre-demonstration startup activities, required in Paragraph 3.2.C of this Specifications section.
6. Report of data collected during each required Demonstration Period.
7. Qualifications Statements:
 - a. Qualifications, including resume' and copy of license, of Contractor-retained licensed operator.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 CHECKOUT AND STARTUP – GENERAL

A. Facility Startup Divided into Two Periods:

1. Pre-Demonstration Period including:
 - a. Obtain Engineer's approval or acceptance (as applicable) of Submittals required prior to checkout and startup, including all Shop Drawings, Samples, source quality control (shop testing) Submittals, preliminary operation and maintenance manuals, and other Submittals required by the Contract Documents, other than Submittals that cannot be furnished until after startup.
 - b. Complete the Work to a point ready for checkout and startup, including operation available in all manual, automatic, and other modes.
 - c. Checkout and initial field quality control activities that can be performed prior to startup of the equipment or system.
 - d. Startup of the associated Work.
 - e. Field quality control activities for the subject Work as indicated elsewhere in the Specifications and other Contract Documents, other than this section.
 - f. Training of operations and maintenance personnel.
2. Demonstration Period, including:
 - a. Demonstration of functional integrity of equipment, system, or PCS.

3.2 PRE-DEMONSTRATION PERIOD

- A. Prior to the Pre-Demonstration Period, complete the Work to the point where it is ready for checkout and startup.
- B. Checkout.

1. Comply with Section 01 61 03 - Equipment - Basic Requirements, including provisions concerning installation checks
- C. Startup:
1. Comply with requirements for startup of materials, equipment, and systems indicated in the associated Specification sections and elsewhere in the Contract Documents.
 2. Prepare the Work so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
 3. Perform startup [to extent possible] without introducing process flow.
 4. Introduce process flow to complete startup for the following:
 5. Procedures include but are not necessarily limited to the following:
 - a. Test or check and correct deficiencies of:
 - 1) Power, control, and monitoring circuits for continuity prior to connection to power source.
 - 2) Voltage of all circuits.
 - 3) Phase sequence.
 - 4) Cleanliness of connecting piping systems.
 - 5) Alignment of connected machinery.
 - 6) Vacuum and pressure of all closed systems.
 - 7) Lubrication.
 - 8) Valve orientation and position status for manual operating mode.
 - 9) Tankage for integrity using clean water.
 - 10) Pumping equipment using process flow.
 - 11) Instrumentation and control signal generation, transmission, reception, and response.
 - 12) Tagging and identification systems.
 - 13) Proper connections, alignment, calibration and adjustment.
 - b. Calibrate safety equipment.
 - c. Manually rotate or move moving parts to assure freedom of movement.
 - d. "Bump-start" electric motors to verify proper rotation.
 - e. Perform other tests, checks, and activities required to make the Work ready for Demonstration Period.
 - f. Checkout and Startup Log:
 - 1) Prepare a log showing each equipment item and system requiring checkout and startup. Indicate in the log activities to be accomplished during checkout and startup.
 - 2) Provide a place for Contractor to record date and person performing required checkout and startup. Indicate associated date(s), personnel, and employer of each.
 - 3) Submit completed checkout and startup log to Engineer and obtain Engineer's acceptance.
 6. Obtain Suppliers' certifications of the installed and operational Work, without restrictions, and submit to Engineer:
 - a. Manufacturer's installation check letters (sometimes referred to as Manufacturer's Field Services Report).
 - b. Instrumentation Supplier's Instrumentation Installation Certificate.
 7. Letter verifying completion of all pre-demonstration startup activities including receipt of all specified items from Suppliers as final item prior to initiation of Demonstration Period.
 8. Personnel Training:

3.3 DEMONSTRATION PERIOD

A. Demonstration Period – General:

1. Demonstrate the operation and performance of mechanical, electrical, instrumentation, and control interfaces of the Work undergoing the Demonstration Period, in accordance with the Contract Documents.
2. Duration of Demonstration Period: 120 consecutive hours.
3. If, during the Demonstration Period, the aggregate time used for repair, alteration, or unscheduled adjustments to any part of the Work that renders the affected Work inoperative or operation outside of recommended ranges exceeds 10% of the Demonstration Period, the demonstration of operation and performance will be deemed unacceptable and Contractor shall provide appropriate adjustments and remedies and re-perform the Demonstration Test, at no additional cost to Owner or facility manager, until acceptable results are obtained. Re-performance of the Demonstration Period shall comply with the same requirements as the original Demonstration Period.
4. Perform the demonstration of operation and performance of the Work under full operational conditions.
5. Owner's or Facility Manager's Personnel:
 - a. Owner or facility manager (as applicable) will make available operations personnel to make process decisions affecting facility performance and compliance with applicable operating permits.
 - b. Owner's or facility manager's assistance will be available only for process decisions.
 - c. Contractor will perform all other functions associated with the Demonstration Period including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period in accordance with the Contract Documents.
6. Owner or facility manager reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, and similar actions and events during the Demonstration Period to verify the operation and performance of the Work in automatic, manual, and other types of operating modes, backup systems, and alternate operating modes.
7. Prior to Starting Demonstration Period:
 - a. Prepare data collection and reporting log for sampling, analytical data, and data to be obtained by manually recording data from field or panel indicators. Not less than 30 days prior to the start of the Demonstration Period, submit the data collection and reporting log to Engineer for acceptance.
8. Timing of Start and End of Demonstration Period:
 - a. Schedule the end of the Demonstration Period at a convenient time such as midnight, so the Owner or facility manager can assume operational responsibility on a new day beginning immediately after completion of the Demonstration Period.
 - b. Time of beginning and ending Demonstration Period shall be agreed upon by Contractor, Owner (and facility manager, if other than Owner), and Engineer in advance of initiating Demonstration Period.

B. Demonstration Period, Evaluation, and Acceptance:

1. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's or facility manager's questions, provide final field instruction on select systems (where appropriate) and to respond to problems or failures of the Work.
2. Responsibilities for Sampling and Data Collection:
 - a. Use the data collection and reporting log format accepted by Engineer. Indicate data clearly and legibly.
3. Responsibilities for Data Reporting:
 - a. Submit data collected to Engineer for evaluation of acceptability of results.

4. Data Evaluation:
 - a. Engineer, in consultation with Owner and facility manager (as applicable) as necessary, will evaluate the data collected during the Demonstration Period and other information obtained during the Demonstration Period for compliance with the Contract Documents.
 - b. Engineer will advise Contractor in writing of whether the data and information obtained indicate that the Demonstration Period was successfully completed.

END OF SECTION

SECTION 01 77 19
CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for:
1. Substantial Completion.
 2. Final inspection.
 3. Request for final payment and acceptance of the Work.

1.2 SUBSTANTIAL COMPLETION

- A. Substantial Completion – General:
1. Prior to requesting inspection for Substantial Completion, perform the following for the substantially completed Work:
 - a. Materials and equipment for which Substantial Completion is requested shall be fully ready for their intended use, including full operating and monitoring capability in automatic, manual, and other operating modes set forth in the Contract Documents.
 - b. Permanent provisions for safety and protection, shown and indicated in the Contract Documents and associated with the substantially completed Work or for personnel accessing and using the substantially completed Work, shall be in place and ready for their intended use.
 - c. Complete field quality control Work, including inspections and testing at the Site, indicated in Specifications sections for individual materials and equipment items and related Contract Documents. Submit results of, and obtain Engineer's acceptance of, field quality control tests and inspections required by the Contract Documents.
 - d. Complete checkout and startup in accordance with Section 01 75 00 - Checkout and Startup Procedures, requirements of the Specifications for the various materials and equipment in the substantially completed Work, and related Contract Documents.
 - e. Cleaning for Substantial Completion shall be completed in accordance with Section 01 74 00 - Cleaning.
 - f. Spare parts, tools, and extra materials shall be delivered and accepted in accordance with the Contract Documents and documentation of Owner's acceptance thereof has been submitted to Engineer in acceptable form.
 - g. Training of the facility's operations and maintenance personnel shall be completed in accordance with the Contract Documents.
 - h. Submit and obtain Engineer's acceptance of final operations and maintenance manuals in accordance with Section 01 78 23 - Operation and Maintenance Data.
 - i. Obtain and submit to Engineer all required permits, inspections, and approvals of authorities having jurisdiction for the substantially completed Work to be occupied and used by Owner.
 - j. Complete other tasks that the Contract requires be completed prior to Substantial Completion.

2. Procedures for requesting and documenting Substantial Completion are in the General Conditions, as may be modified by the Supplementary Conditions.
3. Sample letter for Contractor's request for inspection for Substantial Completion is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project and the needs of Contractor's request.
4. Unless decided otherwise by Owner and Engineer, form of certificate of Substantial Completion will be EJCDC C-625, "Certificate of Substantial Completion" (2018 edition or later), prepared by Engineer.
5. Refer to the Agreement for requirements regarding consent of surety to partial release of or reduction in retainage.

1.3 FINAL INSPECTION

A. Final Inspection – General:

1. Prior to requesting final inspection, verify that all the Work is fully complete and ready for final payment. Partial checklist for this purpose is attached to this Specifications section.
2. Sample letter for Contractor to request final inspection is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project.
3. Procedures for requesting and documenting the final inspection are in the General Conditions, as may be modified by the Supplementary Conditions, and as augmented in this Specifications section.

1.4 REQUEST FOR FINAL PAYMENT AND ACCEPTANCE OF THE WORK

A. Procedure:

1. After successful completion of the final inspection, submit request for final payment in accordance with the Agreement and General Conditions, as may be modified by the Supplementary Conditions, and this Specifications section.
2. Acceptance of the Work:
 - a. Upon Engineer's concurrence that the Work is complete and ready for final payment (as a result of the final inspection and other communications between the parties and Engineer) and receipt of the final Application for Payment, accompanied by other required Contract closeout documentation, all in accordance with the Contract Documents, Engineer will issue to Owner and Contractor a notice of acceptability of the Work, in accordance with the General Conditions, as may be modified by the Supplementary Conditions.
 - b. Unless decided otherwise by Owner and Engineer, form of acceptance will be EJCDC C-626, "Notice of Acceptability of Work", (2018 edition or later).
 - c. Nothing other than receipt of such notice of acceptability from Engineer constitutes acceptance of the Work.
 - d. Receipt of Engineer's notice of acceptability of the Work does not relieve Contractor of Contractor's continuing obligations under the Contract, including correction period obligations, warranty obligations, indemnification obligations, insurance requirements, and Contractor's other obligations following acceptance of the Work by Engineer and final payment. Such obligations shall commence and remain in effect as indicated elsewhere in the Contract Documents.

B. Request for final payment shall include:

1. Documents required in the General Conditions, as may be modified by the Supplementary Conditions.
2. List, on Contractor's letterhead, of all Change Proposals, Claims, and disputes that Contractor believes are unsettled. If there are no such Change Proposals, Claims, or disputes, so indicate in writing.
3. Consent of Surety to Final Payment:
 - a. Acceptable form includes AIA G707, "Consent of Surety to Final Payment" (1994 or later edition), or other form acceptable to Owner.
4. Releases of Liens:
 - a. Submit complete and legally effective releases (satisfactory to Owner) of all Liens filed in connection with the Work, regardless of whether such Lien was filed by Contractor, Subcontractor, or Supplier.
 - b. Each release of Lien shall be signed by an authorized representative of the entity submitting the release of Lien, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
5. Waivers of Lien Rights:
 - a. Submit legally-binding waivers of rights to file Liens, acceptable to Owner, as required in the General Conditions (as may be modified by the Supplementary Conditions) from Contractor and each Subcontractor and Supplier that furnished or provided labor, material, or equipment totaling \$1,000 or more for the Work.
 - b. Furnish final list of Subcontractors and Suppliers indicating final amount of the associated subcontract or purchase order for each. Include on the list all lower-tier Subcontractors and Suppliers retained by higher-tier Subcontractors and Suppliers.
 - c. Each waiver of Lien rights shall be signed by an authorized representative of the entity submitting waiver of Lien rights, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
 - d. Waiver of Lien rights may be conditional upon receipt of final payment.
 - e. Required Affidavits: Submit the following:
 - 1) Affidavit of payment of debts and claims, submitted by Contractor. Acceptable form includes AIA G706, "Contractor's Affidavit of Payment of Debts and Claims" (1994 or later edition), or other form acceptable to Owner, and;
 - 2) Affidavit of release of Liens, submitted by Contractor. Acceptable form includes AIA G706A, "Affidavit of Release of Liens" (1994 or later edition).
 - 3) Each affidavit shall be signed by an authorized representative of Contractor and shall bear Contractor's corporate seal, as applicable.
 - f. In the event Contractor is unable to obtain one or more required waivers of Lien rights, recourse is set forth in the General Conditions, as may be modified by the Supplementary Conditions.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

- A. Request closeout inspections via e-Builder as specified by Owner.

END OF SECTION

HDR Project No. 10369469
Documents

Missouri Office of Administration
X2307-02 Lake of the Ozarks State Park Water and Sewer Improvements

Site #5306 "Infrastructure" #7815306238
CLOSEOUT REQUIREMENTS
01 77 19 - 4

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for Contractor-furnished, manufacturers' operation and maintenance (O&M) data, including:
 - a. Required operation and maintenance data groupings into operation and data manuals and timing of such Submittals.
 - b. Requirements for paper copies of operation and maintenance data and related Electronic Documents.
 - c. Content of operation and maintenance data Submittals.

B. Scope:

1. Contractor shall submit operation and maintenance data, and related information, in accordance with this Section and requirements elsewhere in the Contract Documents, as instructional and reference information for use by: (a) Owner's operation and maintenance personnel, and (b) others retained by or working for Owner or facility manager.
2. In addition to operation and maintenance data expressly required elsewhere in the Contract Documents, also submit operation and maintenance data for:
 - a. All equipment and systems, including facility equipment, conveying equipment, fire suppression systems, plumbing equipment, HVAC equipment, electrical equipment, communications equipment, electronic safety and security systems, utility equipment, transportation equipment, waterway and marine equipment, and process equipment, and other equipment.
 - b. Valves, gates, actuators, and related accessories.
 - c. Instrumentation and control devices and systems.
 - d. Building materials, systems, and finishes that need post-construction troubleshooting, cleaning, or maintenance, such as roofing, doors, windows, louvers, flooring, paint and coatings, other finishes, and other items.

C. Related Requirements:

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 75 00 - Checkout and Startup Procedures.
3. Section 01 78 36 - Warranties.

1.2 SUBMITTALS

A. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data:
 - a. Submit operation and maintenance data, required by the Contract Documents, grouped into operation and maintenance manual Submittals indicated in Table 01 78 23-A.

- b. Where operation and maintenance data required by the Contract Documents, is not expressly indicated in table 01 78 23-A, obtain written clarification or interpretation from Engineer prior to preparing and transmitting such Submittal.
- c. For each required operation and maintenance manual Submittal, furnish preliminary Submittal and final Submittal. Timing of preliminary and final operation and maintenance manual Submittals, and differences between preliminary and final Submittals, are indicated in this Section.

**Table 01 78 23-A
Required Groupings of Operation and Maintenance Data Submittals**

Name of O&M Manual/Data	For Materials or Equipment Specified in Section(s)
Lift Station Pumps	Div 43

B. Timing of Submittals and Quantity Required:

1. Preliminary Operation and Maintenance Manual Submittals:
 - a. Paper Copies: Three copies, exclusive of copies required for Contractor's use.
 - b. Electronic Documents.
 - c. Submit to entity indicated in Section 01 33 00 – Submittal Procedures, by the earlier of: 90 days following approval of Shop Drawings and product data Submittals, or 14 days prior to starting training of operation and maintenance personnel, or 14 days prior to field quality control testing at the Site.
 - d. Do not perform checkout, startup, and training without Engineer's acceptance of preliminary operation and maintenance data Submittals for the associated Work.
2. Final Operation and Maintenance Manual Submittals: Furnish final Submittal prior to Substantial Completion of the associated Work, unless submittal is required prior to an interim Milestone.
 - a. Paper Copies: Three copies, exclusive of copies required for Contractor's use.
 - b. Electronic Documents.
 - c. Work will not be eligible for Substantial Completion until associated, required final operation and maintenance data Submittals are accepted by Engineer.
 - d. If Contractor (whether or not via Subcontractor or Supplier), revises program code or configuration files between acceptance of Submittal by Engineer and end of the Contract's correction period and Contractor's general warranty obligation, furnish updated program code and configuration files to Owner. Before modifying program code and configuration files after Substantial Completion, verify with facility manager that Owner- or facility manager modifications of program code or configuration files were incorporated into the modified files, subject to the provisions of this Section.

1.3 PAPER COPIES OF O&M MANUALS

A. Binding and Cover:

1. Bind each operation and maintenance manual in durable, permanent, stiff-cover binder(s), comprising one or more volumes per copy, as necessary.
2. Binders shall be not less than one inch wide and maximum of three inches wide. Binders for each copy of each volume shall be same size and color.
3. Binders shall be locking three-ring ("D"-ring) type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front and back of each volume.
4. Do not overfill binders.
5. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
6. Indicate the following information on cover of each volume:
 - a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS". For submittal of preliminary operation and maintenance data, include the word, "PRELIMINARY" in the title.
 - b. Name or type of material or equipment covered in the manual.
 - c. Volume number, if more than one volume is submitted, listed as "Volume _____ of _____", with appropriate volume-designating numbers filled in.
 - d. Name of Project and, when applicable, Contract name and number.
 - e. Name of building or structure, as applicable.
7. Provide the following information on spine of each volume:
 - a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS". For submittal of preliminary operation and maintenance data, include the word, "PRELIMINARY" in the title.
 - b. Name or type of material or equipment covered in the manual.
 - c. Volume number, when more than one volume is submitted, listed as "Volume _____ of _____", with appropriate volume-designating numbers filled in.
 - d. Project name and building or structure name.

B. Pages:

1. Print pages in paper copies of operation and maintenance manuals on 30-pound (minimum) paper, 8.5-inch by 11-inch size.
2. Reinforce binding holes in each individual paper sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of manuals, reinforcing of pages within booklet or pamphlet is not required.
3. Furnish each page with binding margin not less than 3/4-inch wide.
4. Properly punch each paper page with holes suitable for associated binding. Provide not less than 3/8-inch of paper between outer edge of punched holes and edge of paper. Manuals with improperly punched holes will be returned to Contractor as unacceptable.
5. In paper copies of manuals, each page in each copy shall be properly bound-through by the binder's rings or posts. Paper manuals where some pages are not so bound will be returned to Contractor as unacceptable.

C. Drawings:

1. Bind into operation and maintenance manuals drawings, diagrams, and illustrations up to and including 11-inch by 17-inch size, with reinforcing and punched holes specified for paper pages.
 2. Drawings or sheets larger than 11-inch by 17-inch shall be:
 - a. Paper Copies: Neatly folded and inserted into clear plastic pockets bound into the manual. Neatly and permanently label each pocket with printed text indicating content and drawing numbers. Include not more than two drawings or sheets per pocket.
 - b. Electronic Documents Copies: Included in electronic file at appropriate location.
- D. Copy Quality and Document Clarity:
1. Provide original-quality copies. Documents in operation and maintenance manuals shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals with copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable.
 2. Clearly mark, using ink, to indicate all components of materials and equipment on catalog pages for ease of identification. In standard or pre-printed documents, indicate options furnished and cross out inapplicable content. Using highlighters to so indicate options furnished is unacceptable.
- E. Organization:
1. Indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

1.4 ELECTRONIC DOCUMENTS O&M MANUALS

- A. Electronic Documents of Operation and Maintenance Manuals:
1. Each Electronic Document copy of operation and maintenance data shall include all information included in the corresponding paper copy.
 2. Submit Electronic Documents operation and maintenance data in accordance with Section 01 33 00 - Submittal Procedures.
 3. File Format:
 - a. Unless otherwise required by Section 01 33 00 - Submittal Procedures, operation and maintenance data Electronic Documents shall be "portable document format" (PDF) files.
 - b. Electronic Documents shall be electronically searchable upon delivery.
 - c. Electronic Documents shall not be password-protected and shall not be protected against Owner's or facility manager's copying and printing such files for Owner's or facility manager's use in operating and maintaining the facility.
 - d. Electronic Documents shall open to its first page.
 - e. Submit each operation and maintenance manual as a single Electronic Document file, unless file size is over-large, in which case divide into as few separate files, each with similar filename, as possible.
 - f. Within each Electronic Document, provide bookmarks for the following:
 - 1) Each chapter and subsection indicated in the corresponding printed copy document's table of contents.

- 2) Each figure.
- 3) Each table.
- 4) Each appendix and attachment.

1.5 CONTENT OF OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manual Content – General:

1. Prepare each operation and maintenance manual specifically for the Project. Include in each manual all pertinent instructions, as-constructed drawings as applicable, bills of materials, technical information, installation and handling requirements, maintenance and repair instructions, and other information required for complete, accurate, and comprehensive data for safe and proper operation, maintenance, and repair of materials and equipment furnished for the Project. Include in manuals specific information required in the Specification Section for the material or equipment, data required by Laws and Regulations, and data required by authorities having jurisdiction.
2. Provisions of this Article were written for equipment. Where operation and maintenance data are required for building products, such as finishes, openings, thermal and moisture protection, and similar items, comply with this Article to the extent practical and reasonable for the associated item.
3. Completeness and Accuracy:
 - a. Operation and maintenance manuals that include language stating or implying that the manual's content may be insufficient or stating that the manual's content is not guaranteed to be complete and accurate are unacceptable.
 - b. Operation and maintenance manuals shall be complete and accurate.
 - c. Operation and maintenance manuals shall indicate the specific alternatives and features furnished, and the specific operation and maintenance provisions for the material or equipment furnished.
4. Provide dividers and include manufacturer's information, diagrams, schematics, and equipment cutaways. Avoid submitting catalog excerpts unless they are the only document available showing identification or description of particular component of the equipment. Where published documents, included in operation and maintenance data, pertain to multiple models or types, mark the literature to indicate specific material or equipment supplied. Marking may be in the form of checking, arrows, or underlining to indicate pertinent information, or by crossing out or other means of obliterating information that does not apply to the materials and equipment furnished.
5. Identify each equipment item consistent with names and identification numbers shown or indicated in the Contract Documents, rather than manufacturer's model numbers.
6. Neatly type data not furnished in computer-printed text. Handwriting, except for strikeouts, arrows, and the like, is unacceptable.
7. Include copy of warranty in accordance with the Contract Documents, including Section 01 78 36 - Warranties.
8. Include copy of proposed service contract, when applicable.
9. When copyrighted material is used in operation and maintenance manuals, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

B. Differences Between Preliminary and Final Operation and Maintenance Manuals:

1. In preliminary operation and maintenance manuals, include flysheet or placeholder for information to be included in final operation and maintenance manual Submittal.
 2. In final operation and maintenance manuals, include information such as the following, as applicable for the associated materials and equipment:
 - a. Equipment data that requires collection after startup, for example: (1) system and equipment balancing reports, including those for HVAC systems; and (2) final settings for electrical switchgear, automatic transfer switches, and circuit breakers; and (3) materials and equipment field testing results.
 - b. Equipment startup reports and Suppliers' field service reports (the latter on form in Section 01 75 00 - Checkout and Startup Procedures).
- C. Initial Documents in Operation and Maintenance Manuals:
1. Table of Contents:
 - a. Provide table of contents in each volume of each operation and maintenance manual.
 - b. In table of contents and not less than once in each chapter or section, identify materials and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near beginning of each volume. Using material or equipment model or catalog designations for identifying items is unacceptable.
 2. Equipment Record:
 - a. Provide "Equipment Record" section of operation and maintenance manual immediately following the table of contents. "Equipment Record" section is not required for operation and maintenance data for other than equipment (such as building materials and finishes).
 - b. Provide "Equipment Record" on forms included as this Section's Attachments 1, 2, and 3.
 - c. For instrumentation and control equipment, International Society of Automation (ISA) data sheets are acceptable in lieu of the forms included as this Section's Attachments 1, 2, and 3.
 - d. This Section's Attachments 1, 2, and 3 are available from Engineer as "fillable PDF forms".
 - e. Complete in detail each section of "Equipment Record". Merely referencing the associated equipment's operation and maintenance data for nameplate, maintenance, spare parts, lubricants, or other required information, is unacceptable.
 - f. For equipment or systems with multiple, separate components (for example, motor and gearbox), fully completed "Equipment Record" is required for each component.
 - g. Operation and maintenance data Submittals without complete and accurate "Equipment Record" sheets are unacceptable.
 3. Supplier's Field Service Reports:
 - a. Include in final operation and maintenance manuals copies of associated Supplier's field services reports in accordance with Section 01 75 00 - Checkout and Startup Procedures.
 - b. Include Supplier's completed field service reports in operation and maintenance manual in section immediately following "Equipment Record" section.
- D. Operation and Maintenance Instructions:

1. Safety Considerations:
 - a. Submit written descriptions of safety considerations relating to operation and maintenance procedures for materials and equipment.
 - b. Describe safety devices and alarms provided with materials and equipment and proper operation and use.
 - c. Indicate procedures for proper, safe operating and maintenance of materials and equipment furnished, including manufacturer's recommended personal protection equipment, apparatus, and devices not furnished under the Contract.
 - d. Describe recommended safety-related training for personnel operating and maintaining the subject materials or equipment.
 - e. Include in appendix to operation and maintenance manual manufacturers' relevant "safety data sheets" (SDS), formerly "material safety data sheets" (MSDS).
 - f. Engineer's review of operation and maintenance data expressly does not extend to adequacy, completeness, and accuracy of SDS or other safety and protection practices and procedures indicated in the operation and maintenance data.
2. Operation:
 - a. Include in operation and maintenance data Submittals complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; and regulation and control. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.
 - b. Include pre-startup instructions and checklists and complete startup instructions for each material and equipment item.
 - c. Indicate recommended operating instructions for all operating modes and conditions, with associated recommendations for safe operation.
 - d. Explain available controls and instrumentation and associated function(s).
 - e. Indicate required shutdown checklists and procedures for: normal shutdown, emergency shutdown, and long-term shutdowns.
 - f. Troubleshooting instructions.
3. Maintenance – General:
 - a. Include in operation and maintenance data complete, written instructions for necessary and recommended maintenance, including mechanical maintenance and electrical/instrumentation and controls maintenance, as applicable.
 - b. Include in operation and maintenance data complete instructions for necessary assembly, disassembly, installation, re-installation, storage, and shipping for materials and equipment.
 - c. Tools: Include list of required maintenance tools and equipment.
 - d. Spare Parts and Extra Materials:
 - 1) Submit complete instructions for ordering replaceable parts, including reference numbers (such as shop order number or serial number) that will expedite the ordering process.
 - 2) Submit manufacturer's recommended inventory levels for spare parts, extra stock materials, and consumable supplies for the initial two years of operation. Consumable supplies are items consumed or worn by operation of materials or equipment, and items used in maintaining the operation of

material or equipment, including items such as lubricants, seals, reagents, and testing chemicals used for calibrating or operating the equipment. Include estimated delivery times, shelf life limitations, and special storage requirements.

3) Also refer to this Article's provision, "Bills of Materials", below, for additional requirements regarding ordering replacement parts.

4. Routine and Preventative Maintenance:

- a. Submit complete, detailed, written instructions for routine and preventive maintenance including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life. Instructions shall include:
 - 1) Written explanations with illustrations for each routine and preventive maintenance task such as inspection, adjustment, anchor bolt torque checks, lubrication, calibration, cleaning, replacement of filters, and the like.
 - 2) Recommended schedule for each routine and preventive maintenance task.
 - 3) Lubricants:
 - a) Provide lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.
 - b) Table of alternative lubricants.

5. Major Maintenance:

- a. Include detailed, written instructions and illustrations for required periodic (non-routine, non-preventative) maintenance.
- b. Indicate relative level of training and expertise required to perform such maintenance and recommended tools and equipment.

6. Special Maintenance:

- a. Include maintenance instructions for long-term shutdowns and storage.

E. Bills of Materials:

- 1. Include in operation and maintenance manuals complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis. Bills of material shall indicate:
- 2. Manufacturer's name, physical address, telephone number, internet website address.
- 3. Manufacturer's local service representative's or local parts supplier's name, physical address, telephone number, internet website address, and e-mail addresses.
- 4. Manufacturer's shop order and serial number(s) for materials, equipment or assembly furnished.
- 5. For each part or piece include the following information:
 - a. Parts cross-reference number. Cross-reference number shall be used to identify the part on assembly drawings, Shop Drawings, or other type of graphic illustration where the part is clearly shown or indicated.
 - b. Part name or description.

- c. Manufacturer's part number.
 - d. Quantity of each part used in each assembly.
 - e. Current unit price of the part at the time the operation and maintenance manual is submitted. Price list shall be dated.
- F. Record Copy of Shop Drawings, Product data, and Other Previously Approved and Accepted Submittals:
- 1. Submit original-quality copies of each approved and accepted (as applicable) Shop Drawing, product data Submittal, written results of source quality control activities, and other Submittals, updated to indicate as-installed condition. Do not include prior Submittals that were not approved or were not accepted. Reduced drawings are acceptable only when reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.
- G. Electrical Schematics, Diagrams, and Information:
- 1. Submit complete electrical schematics and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.
 - 2. Include as-constructed drawings of layouts of electrical panels (such as switchgear and motor control centers) and control panels.
- H. NFPA 70 (National Electric Code) Documentation:
- 1. Include in operation and maintenance manuals for electrically-powered equipment documented calculations of: (1) arc-fault current, equipment available fault current and (2) short-circuit current rating (SCCR), provided as part of equipment Submittals.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

- A. The following, bound after this Section's "End of Section" designation, are part of this Section:
- 1. Attachment 1 - Equipment Data and Spare Parts Summary form (one page)
 - 2. Attachment 2 - Recommended Maintenance Summary form (one page)
 - 3. Attachment 3 - Lubrication Summary form (one page)



Equipment Data and Spare Parts Summary

Project Name			Specification Section:		
Equipment Name			Year Installed:		
Project Equipment Tag No(s).					
Equipment Manufacturer				Project/Order No.	
Address				Phone	
Website		Web Site		E-mail	
Local Representative/Service Center					
Address				Phone	
Website				E-mail	

MECHANICAL NAMEPLATE DATA

Equip.			Serial No.		
Make			Model No.		
ID No.	Frame No.	HP	RPM	Cap.	
Size	TDH	Imp. Size	CFM	PSI	
Other:					

ELECTRICAL NAMEPLATE DATA

Equip.			Serial No.					
Make			Model No.					
ID No.	Frame No.	HP	V.	Amp.	Hertz	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

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Lubrication Summary

Equipment Description	Project Equip. Tag No(s).
-----------------------	---------------------------

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type	Manufacturer		Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

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SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. General requirements for warranties required in the various Specifications.
 2. Provisions addressing:
 - a. Suppliers' standard warranties.
 - b. Suppliers' special or extended warranties.
 - c. Implied warranties.
 - d. Commencement and duration of warranties.

1.2 SUBMITTALS

- A. General:
1. For each item of equipment furnished under the Contract, submit Supplier's standard warranty, regardless of whether such warranty or Submittal thereof is required by the associated Specifications for that item. Submit such warranties for materials where such Submittal is required in the Specifications for the material.
 2. For each item of material or equipment where Supplier's special (or extended) warranty is required by the Contract Documents, submit appropriate special warranty that complies with the Contract Documents.
 3. Supplier's warranties shall be specifically endorsed to Owner, Contractor, and the entity purchasing the item (if other than Contractor) by the entity issuing such warranty.
 4. Submit Suppliers' standard warranties and special warranties as Submittals in accordance with the Schedule of Submittals accepted by Engineer.

1.3 CONTRACTOR'S GENERAL WARRANTY AND CORRECTION PERIOD OBLIGATIONS

- A. Contractor's General Warranty and Guarantee: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.
- B. Contractor's Warranty of Title: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.
- C. Correction Period: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

1.4 SUPPLIERS' WARRANTIES FOR MATERIALS AND EQUIPMENT

- A. Warranty Types:
1. Required by the General Conditions:
 - a. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, Contractor's general warranty and guarantee and requirements for the Contract's correction period.
 - b. Disclaimers and limitations in specific materials and equipment warranties do not limit Contractor's general warranty and guarantee, nor does such affect or limit Contractor's performance obligations under the correction period.
 2. Material or equipment manufacturer's standard warranty is pre-printed, written warranty published by item's manufacturer and specifically endorsed by manufacturer to the entities indicated in this Specifications Section's Article 1.2.
 3. Special warranty is written warranty that either extends the duration of material or equipment manufacturer's standard warranty or provides other, increased rights to Owner

and other beneficiaries (if any) of such warranty. Where the Contract Documents indicate specific requirements for warranties that differ from the manufacturer's standard warranty for that item, special warranty is implied.

B. Requirements for Special Warranties:

1. Submit written special warranty document that contains appropriate provisions and identification, ready for signature by material or equipment manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section. Submit draft warranty with Submittals required prior to fabrication and shipment of the item from the Supplier's facility.
2. Manufacturer's Standard Form: Modified to include Project-specific information and properly signed by product manufacturer and other entities as appropriate.
3. Specified Form: When specified forms for special warranties are included in the Contract Documents, prepare written document, properly signed by item manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section, using the required form.
4. Refer to the Specifications for content and requirements for submitting special warranties.

1.5 IMPLIED WARRANTIES

A. Warranty of Title and Intellectual Property Rights:

1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is applicable to the Work and to materials and equipment incorporated therein.
2. Provisions on intellectual property rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Warranty of Merchantability:

1. Notwithstanding any other provision of the Contract to the contrary, implied warranties of merchantability required by Laws and Regulations apply to the materials and equipment incorporated into the Work.

C. Warranty of Fitness-for-Purpose:

1. Implied warranty of fitness-for-purpose for materials and equipment to be incorporated into the Work, for which specific material or features are indicated in the Contract Documents, is hereby disclaimed by Owner and Contractor.
2. Implied warranty of fitness-for-use for materials and equipment to be incorporated into the Work, as indicated in Laws and Regulations, remains in full force and effect.
3. When Supplier is aware of, or has reason to be aware of, specified materials or features of the Work that are contrary to the intended use, purpose, service, application, or environment in which the material or item will be used, submit request for interpretation in accordance with Section 01 26 00 - Contract Modification Procedures. Where appropriate, such request for interpretation shall indicate the apparent discrepancy and propose appropriate, alternative materials or equipment.

1.6 COMMENCEMENT AND DURATION OF WARRANTIES

A. Commencement of Warranties:

1. Contract correction period and Contractor's general warranty commence as indicated in the General Conditions, as may be modified by the Supplementary Conditions.
2. Suppliers' standard warranties and special warranties commence running on the date that the associated item is certified by Engineer as substantially complete in accordance with the Contract Documents. In no event shall special warranties commence running prior to Engineer's review and acceptance of special warranty Submittal for the item.
3. Implied warranties commence in accordance with Laws and Regulations.

B. Duration of Warranties:

1. Duration of correction period is set forth in the General Conditions, as may be modified by the Supplementary Conditions.
2. Duration of Contractor's general warranty and guarantee is in accordance with Laws and Regulations.
3. Duration of Suppliers' standard warranties is in accordance with the applicable standard warranty document accepted for the Project by Engineer.
4. Duration of required Suppliers' special warranties shall be in accordance with the requirements of the Contract Documents for the subject item.
5. Duration of implied warranties shall be in accordance with Laws and Regulations.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General provisions applicable to all demolition and removals.
2. Civil/site demolition and removals.
3. Architectural and structural demolition and removals.
4. Mechanical demolition and removals
5. Electrical demolition and removals.
6. Disposal of demolition debris, materials, and equipment.

B. Scope:

1. Contractor shall provide all labor, materials, equipment, tools, and incidentals as shown, specified and required for demolition, removals, and disposal Work.
2. The Work under this Specifications section includes, but is not necessarily limited to:
 - a. Demolition and removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work may include demolition of structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, piping, electrical and mechanical systems and equipment, pavement, curbs, sidewalks, gutters, fencing, and similar existing materials, equipment, and items.
3. Demolitions and removals indicated in other Specifications sections shall comply with requirements of this Specifications section.
4. Perform demolition Work within areas shown or indicated.
5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition and removals Work.

C. Related Requirements:

1. Section 31 10 00 - Site Clearing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Fire Protection Association (NFPA):
 - a. 241, Safeguarding Construction, Alteration, and Demolition Operations.

B. Regulatory Requirements:

1. Demolition, removals, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T – Demolition), and all other Laws and Regulations.
2. Comply with requirements of authorities having jurisdiction.

C. Qualifications:

1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician(s) legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.
2. Plumbing Removals: Entity and personnel performing plumbing removals shall be plumber(s) legally qualified to perform plumbing construction and plumbing work in the jurisdiction where the Site is located.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Review procedures under this and other Specifications sections and coordinate the Work that will be performed with or before demolition and removals.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Procedure Submittals:
 - a. Demolition and Removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and removal Work, including:
 - 1) Plan for coordinating shut-offs, capping, temporary services, and continuing utility services.
 - 2) Other proposed procedures as applicable.
 - 3) Equipment proposed for use in demolition operations.
 - 4) Recycling/disposal facility(ies) proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
 - 5) Planned demolition operating sequences.
 - 6) Detailed schedule of demolition Work in accordance with the Schedule accepted by Engineer.
2. Notification of Intended Demolition Start: Submit in accordance with Paragraph 3.1.A of this Specifications Section.
3. Field Quality Control Test Results:
 - a. Results of megger-testing of existing motors to remain Owner's property.
4. Qualifications Statements:
 - a. Name and qualifications of entity performing electrical removals, including copy of licenses required by authorities having jurisdiction.
 - b. Name and qualifications of entity performing plumbing removals,

1.5 SITE CONDITIONS

- #### **A. Owner makes no representation of condition or structural integrity of area(s) to be demolished or where removals are required by the Contract Documents.**

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Notification:

1. Not less than 48 hours prior to commencing demolition or removal, advise Engineer in writing of planned start of demolition Work. Do not start removals without permission of Engineer.
2. Where demolition or removals has potential to affect adjacent properties, occupants, streets, or other public thoroughfare, transportation facilities, and utilities, furnish required notices to owners and occupants of properties, buildings, and structures that may be affected by the demolition of removal.
3. In accordance with Laws and Regulations, furnish to authorities having jurisdiction, including emergency services as necessary, appropriate notices of planned demolition and removals.

4. Submit to Engineer copies of notices furnished to adjacent property owners, occupants, and authorities having jurisdiction.
- B. Protection of Adjacent Areas and Facilities:
1. Perform demolition and removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not interfere with use of, and free and safe access to and from, structures and properties unless allowed by the Contract Documents otherwise allowed in writing by Owner.
 2. Closing or obstructing of roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Conduct the Work with minimum interference to vehicular and pedestrian traffic.
 3. Provide temporary partitions between demolition work areas and (a) areas that will be occupied during demolition and removals, and (b) areas accessible to the public or visitors. Temporary partitions shall be sturdy, braced plywood in good condition, of dimensions sufficient to adequately screen demolition work from view of occupants, public, and visitors. Maintain temporary partitions in place until demolition and removals work in the subject area is complete or until other Work requires removal of temporary partitions.
 4. Provide appropriate temporary barriers, lighting, sidewalk sheds, and other necessary protection.
 5. Repair damage to facilities that are to remain which such damages results from Contractor's operations.
- C. Existing Utilities: In addition to requirements of the General Conditions, Supplementary Conditions, and Division 01 Specifications, perform the following:
1. Should unforeseen, unknown, or incorrectly shown or indicated Underground Facilities be encountered, Contractor responsibilities shall be in accordance with the General Conditions as may be modified by the Supplementary Conditions. Cooperate with utility owners in keeping adjacent services and facilities in operation.
 2. Sanitary Sewerage: Before proceeding with demolition, locate and cap all sewer lines and service laterals discharging from the building or structure being demolished.
 3. Storm Water Sewerage: Existing storm water system shall remain in place until demolition of existing building or structure is complete. Upon completing demolition, cut and cap storm sewerage at locations shown on the Drawings. Remove existing storm water piping and related structures between points of cutting, and backfill, restore to grade, and stabilize the area over the removed facilities in accordance with the Contract Documents.
 4. Water Piping and Related Facilities: Before proceeding with demolition, locate and cap all potable and non-potable waterlines and service laterals serving the building or structure being demolished. Ensure compliance with Laws and Regulations regarding water quality.
 5. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as fuel and gas; compressed air; heating, ventilating, and air conditioning; electric; and communications; and service laterals serving the building or structure being demolished.
 6. Shutdown of utility services shall be coordinated by Contractor, assisted by Owner as required relative to contacting utility owners.
- D. Remediation:
1. If unanticipated Hazardous Environmental Condition is believed to be encountered during demolition and removals, comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

3.2 DEMOLITION - GENERAL

- A. Locate construction equipment used for demolition Work and remove demolished materials and equipment to avoid imposing excessive loading on supporting and adjacent walls, floors, framing, facilities, and Underground Facilities.

B. Pollution Controls:

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level.
2. Do not use water when water may create hazardous or objectionable conditions such as icing, flooding, or pollution.
3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions and Section 01 74 00 - Cleaning.

C. Explosives:

1. Explosives are not allowed at the Site. Do not use explosives for demolition and removal Work.

D. Comply with Section 01 73 29 - Cutting and Patching and NFPA 241.

E. Building or Structure Demolition and Removals:

1. Unless otherwise approved by Engineer, proceed with demolition from top of building or structure to the ground. Complete demolition Work above each floor or tier before disturbing supporting members of lower levels.
2. Demolish concrete and masonry in small sections.
3. Remove structural framing members and lower to ground using hoists, cranes, or other suitable methods. Do not throw or drop to the ground.
4. Break up and remove foundations, mats, and slabs-on-grade unless otherwise shown or indicated as remaining in place.
5. Temporary Bracing and Supports:
 - a. Provide temporary bracing and supports sufficient to maintain safety, stability, and resist all loads to which the structure may be subject during demolition and removals, until entirety is permanently removed or permanently stabilized.
 - b. Temporary bracing and supports shall be sufficient for associated dead load, live load, transient loading, and dynamic loads such as wind, seismic, and other loads to which the temporary bracing or support may be subject.
 - c. Where appropriate, retain a professional structural engineer, duly licensed and registered in the same jurisdiction as the Site, to design temporary bracing and supports.

F. Salvage and Ownership:

1. Materials and equipment to remain Owner's property shall be:
 - a. Carefully removed and appropriately handled by Contractor to avoid damage and invalidation of warranties in effect. Brace motors attached to flexible mountings until reinstallation or delivery to Owner's storage location. Fully remedy to pre-construction condition or replace items damaged during removal or handling by Contractor.
 - b. Removed as functional units, together with all appurtenances required for operation.
 - c. Cleaned, listed, and tagged for storage.
 - d. Protected from damage.
 - e. Delivered to designated storage location at the Site or other site indicated in the Contract Documents, at place designated by Engineer or Owner.
2. Items to be and delivered to Owner are as indicated in Table 02 41 00-A.

Table 02 41 00-A – Items to be Salvaged

Equipment Name/ Designation	Equipment Location	Deliver to Owner's Location

Equipment Name/ Designation	Equipment Location	Deliver to Owner's Location

3. Preparation of Owner's existing equipment for storage:
 - a. Where appropriate, identify each component with markings or tags to indicate its position in the assembly and the assembly of which it is part.
 - b. Place small parts in appropriate, durable boxes and clearly mark contents on the outside of box or container.
 - c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.
 - d. Grease grease-lubricated bearings.
 - e. Replace breather plugs with solid plugs.
 - f. Megger-test motor windings: Attach report of the test results to the associated motor and submit copy to Engineer.
 - g. Attach unit to suitable crate bottom.
 - h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit with tape.
 - i. Construct crate of wood slats around top and sides of unit.
 - j. Attach permanent instruction tag to outside of crate stating "This unit has been prepared for storage. Replace oil, vent plugs, and lubricant in accordance with manufacturer's instructions before start-up."

- G. Finishing of Surfaces Exposed by Removals: Unless otherwise shown or indicated in the Contract Documents, surfaces of walls, floors, ceilings, and other areas exposed by removals, and that will remain as finished surfaces, shall be repaired and re-finished with materials that match existing adjacent surface, or as otherwise approved by Engineer.

3.3 STRUCTURAL REMOVALS

- A. Remove structures to lines and grades shown or indicated, unless otherwise directed by Engineer. Where limits are not shown or indicated, limits shall be four inches outside item to be installed. Removals beyond limits shown or indicated shall be at Contractor's risk and expense and such excess removals shall be reconstructed to satisfaction of Engineer without additional cost to Owner.

- B. Recycling and Reuse of Demolition Materials:
 1. All concrete, brick, tile, masonry, roofing materials, reinforcing steel, structural metals, miscellaneous metals, plaster, wire mesh, and other items contained in or upon building or structure to be demolished shall be removed, transported, and disposed of away from the Site, unless otherwise approved by Engineer.
 2. Do not use demolished materials as fill or backfill adjacent to structures, in pipeline trenches, or as subbase under structures or pavement.

- C. After removing concrete and masonry walls or portions thereof, mats, slabs, and similar construction that ties in to the Work or to existing construction, neatly repair the junction point to leave exposed only finished edges and finished surfaces.

- D. Where parts of existing structures are to remain in service following demolition, remove the portions shown or indicated for removal, repair damage, and leave the building or structure in proper condition for the intended use.
 1. Remove concrete and masonry to the lines shown or indicated by sawing, drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp,

straight corners that will result in neat joints with new construction and be satisfactory for the purpose intended.

2. Do not damage reinforcing bars beyond the area of concrete and masonry removal. Do not saw-cut beyond the area to be removed.
3. Reinforcing bars that are exposed at surfaces of removed concrete and masonry that will not be covered with new concrete or masonry shall be removed to 1.5 inches below the final surface. Repair the resulting hole, with repair mortar for concrete and grout for masonry, to be flush with the surface.
4. Where existing reinforcing bars are shown or indicated to extend into new construction, remove existing concrete so that reinforcing bars are clean and undamaged.

E. Removal of Anchorages and Protruding Metals:

1. Where equipment or material anchored to concrete or masonry are removed and anchors are not to be re-used, and where existing metals (and to be removed) protrude from concrete, remove the anchors and other metal to not less than 1.5 inches beneath surface of concrete or masonry member. Repair the resulting hole, using repair mortar for concrete and grout for masonry, to be flush with the surface.
2. Alternately, when the anchor is stainless steel, the anchor may be cut flush with the surface of the concrete or masonry, when so approved by Engineer.

F. Jambs, sills and heads of windows, passageways, doors, or other openings (as applicable) cut-in to the Work or to existing construction shall be dressed with masonry, concrete, or metal to provide smooth, finished appearance.

G. Where anchoring materials, including bolts, nuts, hangers, welds, and reinforcing steel, are required to attach the Work to existing construction, provide such materials under this Specifications section, unless specified elsewhere in the Contract Documents.

3.4 MECHANICAL REMOVALS

A. Mechanical demolition and removal Work includes dismantling and removing existing:

1. Piping systems and ductwork systems.
2. Mechanical equipment and appurtenances.
3. Mechanical elements of instrumentation and control systems, such as sensors and transmitters and similar items.
4. Mechanical removals include cutting and capping as required, except that cutting of existing piping and ductwork to make connections is included under Section 01 73 29 - Cutting and Patching; Specifications sections in which requirements for coordination with Owner's operations are indicated; and applicable Specifications of Division 40 - Process Interconnections, and others as applicable.
5. Mechanical removals as required herein apply to systems exposed to view, hidden from view, and Underground Facilities. Mechanical removals may require work in spaces that may be classified confined spaces.

B. Life-Safety Systems:

1. Retain existing life-safety systems, including but not limited to fire suppression systems, in place for as long as possible prior to performing associated demolition and removals.
2. Where demolishing buildings or structures equipped with life-safety systems, remove or deactivate life-safety systems only in the area where active demolition operations are in progress.

C. Demolition and Removals of Piping, Ductwork, and Similar Items:

1. Scope:
 - a. Safety purge piping and tanks (as applicable) of chemicals, fuel, solids, liquids, and gases (as applicable) and make safe for removal and capping. Discharge contents of

- existing piping appropriately while avoiding damaging property; restricting access to or use of property; and creating unsafe, unsanitary, nuisances, and noisome conditions.
- b. To the extent shown or indicated, remove existing piping conveying water (potable and non-potable), waste and vent, fuel (liquids and gases), heating fluids (such as water-glycol solutions), chemicals, solids and slurries, sludge, wastewater, other fluids, and processes gases, and other piping.
 - c. Remove piping to the nearest structurally sound (or “solid”) piping support, and provide caps on ends of remaining piping.
 - d. Where piping to be demolished passes through existing walls to remain, cut off and cap pipe on each side of the wall.
2. Caps, Closures, Blind Flanges, and Plugs – General (All Piping and Ducts):
 - a. Provide closure pieces, such as blind flanges and caps, where shown or required to complete the Work.
 - b. Where used in this Specifications section, the term “cap” means the appropriate type closure for the piping or ductwork being closed, including caps, blind flanges, and other closures.
 - c. Caps shall be compatible with the piping or ductwork on which the cap is installed, fluid-tight and gastight, and appropriate for the fluid or gas conveyed in the pipe or duct.
 - d. Unless otherwise shown or indicated, caps shall be mechanically fastened, fused, or welded to pipe or duct. Plug piping with means other than specified in this Specifications section only when expressly so shown or indicated in the Contractor Documents or when allowed by Engineer.
 3. Underground Facilities:
 - a. When Underground Facilities are altered or removed, properly cut and cap piping left in place, unless otherwise shown or indicated.
 4. Waste and Vent Piping; Ductwork:
 - a. Remove waste and vent piping, and ductwork to extent shown and cap as required.
 - b. Where demolished vent piping, stacks, and ductwork passes through existing roofing, patch the roof with the same or similar materials as existing, and fully compatible with existing materials. Completed patch shall be watertight and comply with roofing manufacturer’s recommendations.
 5. Potable Water Piping; Plumbing; Fire Suppression Piping and Systems; Heating Piping:
 - a. Modifications to potable water piping, fire suppression systems, other plumbing piping, and heating system piping shall comply with Laws and Regulations.
 - b. All portions of potable water systems that have been modified or opened shall be hydrostatically tested and disinfected in accordance with the Contract Documents, and Laws and Regulations. Hydrostatically test other, normally-pressurized, plumbing and fire suppression piping and heating piping systems.
- D. Equipment Demolition and Removals:
1. To the extent shown or indicated and as required for the Work, remove existing mechanical equipment, including (but not limited to):
 - a. Facility equipment, such as food service equipment, laundry equipment, dumbwaiters, and similar facility items.
 - b. Conveying equipment such as elevators, escalators, and similar general-use conveying systems.
 - c. Fire suppression and plumbing equipment.
 - d. Heating, ventilating, and air conditioning equipment.
 - e. Standby power generators.
 - f. Security systems equipment.
 - g. Transportation-related equipment.

- h. Flow control gates and valves.
 - i. Hoisting equipment.
 - j. Bulk materials conveying equipment.
 - k. Process heating and cooling equipment.
 - l. Blowers, compressors, air filters, air dryers, and similar equipment.
 - m. Pumps.
 - n. Tanks.
 - o. Process equipment, including purification equipment, pollution control and solid waste equipment, and treatment process equipment.
 - p. Turbines.
 - q. Appurtenances (including motors, drive systems, controls, cooling water and seal water systems) as shown, indicated, and required for completion of the Work.
2. Where required, disassemble equipment to avoid imposing excessive loading on supporting walls, floors, framing, facilities, and Underground Facilities. Disassemble equipment as required for access through and egress from building or structure. Disassembly and removal shall comply with Laws and Regulations. Provide required means to remove equipment from building or structure.
 3. Remove control panels, operator stations, and instruments associated with equipment being removed, unless shown or indicated otherwise.
 4. Tanks and Equipment Containing Process Material:
 - a. Purge contents in accordance with Paragraph 3.5.A of this Specifications Section and other requirements of the Contract Documents, as applicable.
 - b. When removing generators, remove associated fuel storage tanks unless otherwise indicated to remain.
 - c. Where contents of tank or equipment item may pose a potential hazard, such as hydrocarbon fuels or chemicals, properly dispose of contents in accordance with Laws and Regulations and the Contract Documents.
 - d. Where tank or equipment contains wastewater or liquid sludge, and the Site is a wastewater treatment facility, transport and dispose of stored contents onsite at location acceptable to Owner and facility manager (if other than Owner) unless otherwise indicated in the Contract Documents. If Site is other than a wastewater treatment facility, dispose of contents appropriately in accordance with Laws and Regulations.
 - e. Where tank or equipment contains solid or slurry-type material, remove, handle, and transport the contents and appropriately dispose of the materials offsite in accordance with Laws and Regulations, unless otherwise indicated in the Contract Documents.
 5. Remove equipment supports as applicable, anchorages, base, grout, and piping. Remove anchorage systems in accordance with the "Structural Removals" Article in this Specifications section.
 6. Remove small-diameter piping back to header unless otherwise indicated.
 7. Remove access platforms, ladders, and stairs related to equipment being removed, unless otherwise shown or indicated.
 8. Instrumentation and Control Systems Removal:
 - a. Remove instrumentation and controls equipment in accordance with this Specifications section's requirements for mechanical removals and electrical removals.
 9. Reuse and Sale of Removed Equipment:
 - a. Entities indicated below may be interested in acquiring removed equipment:
 - 1) D.H. Griffin Companies Used Equipment Sales division, Greensboro, North Carolina.
 - 2) EcReCon, Inc., Penn's Grove, New Jersey.
 - 3) Federal Equipment Company, Cleveland, Ohio.

- 4) Phoenix Equipment Corporation, Red Bank, New Jersey.
- b. Comply with this Specifications section's "Disposal of Demolition Debris" Article for restrictions on sales of removed items.

3.5 ELECTRICAL REMOVALS

- A. Electrical demolition Work includes removing existing:
 1. Disconnecting cabling from motors, electrical sources, control panels, control stations, instrumentation and control items, and similar devices and equipment.
 2. Conduits, raceways, cable trays, hangers and supports, cabling, and related items.
 3. Switches, panelboards, control stations, and similar items.
 4. Transformers, distribution switchboards, control panels, motors, starters, variable speed controllers, and similar items.
 5. Lighting fixtures and related items.
 6. Utility poles, site lighting standards, and overhead cabling.
 7. Appurtenances and miscellaneous electrical equipment, as shown, specified, or required.
- B. Electrical Removals – General:
 1. Comply with Laws and Regulations, including the National Electric Code.
 2. Lock Out and Tagging:
 - a. Contractor shall lock out and tag circuit breakers and switches operated by Owner and shall verify that affected cabling are de-energized to ground potential before commencing electrical removals Work.
 - b. Upon completion of electrical removals Work, remove the locks and tags and promptly advise Resident Project Representative (RPR) or Engineer and [Owner] [facility manager] that existing facilities are available for use.
 3. Remove existing electrical equipment, fixtures, and systems to avoid damaging systems to remain, to keep existing systems in operation, and to maintain integrity of grounding systems.
 4. Disconnect and remove motors, control panels, and other electrical gear where shown or indicated.
 5. Store removed motors, microprocessors and electronics, and other electrical gear to be reused in accordance with its manufacturer's recommendations and requirements of the Contract Documents.
- C. Motor Control Centers and Switchgear:
 1. Remove or modify motor control centers and switchgear as shown or indicated.
 2. Modified openings shall be cut square and dressed smooth to dimensions required for installation of equipment.
- D. Removal of Cabling, Conduits, Raceways and Similar Items:
 1. Verify the function of each cable before disconnecting and removing.
 2. Remove cabling, conduits, hangers and supports, and similar items back to the power source or control panel, unless otherwise shown or indicated.
 3. Remove cabling, conduits, and similar items where shown or indicated for removal. Abandoned conduits concealed in floor, ceiling slabs, or in walls shall be cut flush with the slab or wall (as applicable) at point of entrance, suitably capped, and the area repaired in a flush, smooth manner acceptable to Engineer.
 4. Disassemble and remove exposed conduits, junction boxes, other electrical appurtenances, and their supports.
 5. Repair all areas of the Work to prevent rusting on exposed surfaces.
 6. Underground Electric:

- a. Conduits in Underground Facilities not scheduled for reuse shall be suitably capped watertight where each enters building or structure to remain.
 - b. Where shown or indicated, remove direct-burial cabling. Openings in buildings for entrance of direct-burial cabling shall be patched with repair mortar or other material approved by Engineer for such purpose, and made watertight.
- E. Electrical Service Entrances and Outdoor, Overhead Electrical Utilities:
- 1. Existing poles and overhead cabling shall be removed or abandoned as shown and specified.
 - 2. Completely remove from the Site poles not owned by electric utility, including site lighting standards and appurtenances, shown or indicated for removal.
 - 3. Existing substation(s) and poles owned by electric utility will be removed by the electric utility.
 - 4. Make necessary arrangements with electric utility owner for removal of utility owner's transformers and metering equipment after new electrical system has been installed and energized.
- F. Lighting fixtures, wall switches, receptacles, starters, and other miscellaneous electrical equipment, not designated as remaining as Owner's property, shall be removed and properly disposed off-Site as required in accordance with Laws and Regulations.

3.6 DEMOLITION OF SITE IMPROVEMENTS

- A. Pavement, Sidewalks, Curbs, and Gutters:
- 1. Demolition of asphalt or concrete pavement, sidewalks, curbs, and gutters, as applicable, shall terminate at cut edges. Edges shall be linear and have a vertical cut face.
 - 2. To cut pavement, sidewalks, curbs, and gutters, use machinery or tools that provides a smooth-cut edge, appropriate for the required. Where cut edges are not smooth, repair the cut edge to remain to provide a smooth, even appearance.
- B. Fencing, Guardrails, and Bollards:
- 1. Remove to the limits shown or indicated on the Drawings.
 - 2. Completely remove below-grade posts and concrete.
- C. Manholes, Vaults, Chambers, and Handholes:
- 1. Remove to the limits shown or indicated on the Drawings.
 - 2. If not shown or indicated on the Drawings, remove to not less than three feet below finished grade indicated on the Drawings.
- D. Underground Facilities Other than Manholes, Vaults, Chambers, and Handholes:
- 1. Remove to the extent shown or indicated on the Drawings.
 - 2. Unless otherwise shown or indicated, cap ends of piping to remain in place in accordance with the "Mechanical Removals" Article in this Specifications section.
- E. Landscaping: Comply with Section 31 10 00 - Site Clearing.
- F. Other Site Improvements: When the Contract Documents require removal of other site improvements not addressed above, copy with Contract requirements for removal of buildings or structures.

3.7 DISPOSAL OF DEMOLITION DEBRIS

- A. Disposal – General:
- 1. Promptly remove from the Site all debris, waste, rubbish, material, and equipment resulting from demolition and removal operations. Promptly upon completion of demolition and removal operations, remove from the Site construction equipment used in demolition Work.

2. Do not sell at the Site demolition materials or removed equipment. If materials, equipment or debris will be sold by Contractor, remove the items from the Site and perform the sale or transaction elsewhere, in accordance with Laws and Regulations.
 3. Cleaning and Removal of Debris: Comply with the General Conditions, Supplementary Conditions, and Section 01 74 00 - Cleaning.
- B. Transportation and Disposal:
1. Non-Hazardous Materials, Equipment, and Debris: Properly transport and dispose of non-hazardous demolition materials, equipment, and debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations. Non-hazardous material does not contain Constituents of Concern such as (but not limited to) asbestos, PCBs, petroleum, hazardous waste, radioactive material, or other material designated as hazardous in Laws or Regulations.
 2. Hazardous Materials, Equipment, and Debris: When handling and disposal of items containing Constituents of Concern is included in the Work, properly transport and dispose of such items in accordance with the Contract Documents and Laws and Regulations.
- C. Submit to Engineer information required in this Specification Section on proposed facility(ies) where demolition materials, equipment, and debris will be recycled. Upon request, Engineer or Owner, shall be allowed to visit recycling facility(ies) to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist Engineer and Owner.

END OF SECTION

SECTION 03 00 05
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete and grout.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):

- a. 117, Specification for Tolerances for Concrete Construction and Materials.
- b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- c. 212.3R, Chemical Admixtures for Concrete.
- d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- e. 304.2R, Placing Concrete by Pumping Methods.
- f. 305.1, Hot Weather Concreting.
- g. 306.1, Cold Weather Concreting.
- h. 318, Building Code Requirements for Structural Concrete.
- i. 347, Guide to Formwork for Concrete.
- j. CT-13, Concrete Terminology.

2. ASTM International (ASTM):

- a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- d. A1064, Standard Specification for Steel Wire and Welded Wire Replacement, Plain and Deformed, for Concrete.
- e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- f. C33, Standard Specification for Concrete Aggregates.
- g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- h. C94/C94M, Standard Specification for Ready-Mixed Concrete.
- i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
- k. C150, Standard Specification for Portland Cement.
- l. C172, Standard Practice for Sampling Freshly Mixed Concrete.
- m. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- n. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- o. C260, Standard Specification for Air-Entraining Admixtures for Concrete.

- p. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - q. C494, Standard Specification for Chemical Admixtures for Concrete.
 - r. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - s. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
 - t. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - u. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - v. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - w. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - x. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - y. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - z. E96, Standard Test Methods for Water Vapor Transmission of Materials.
 - aa. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- 3. Corps of Engineers (COE):
 - a. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
 - 4. National Ready Mixed Concrete Association (NRMCA).
 - 5. National Sanitation Foundation (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
- B. Quality Control:
- 1. Concrete testing agency:
 - a. Contractor to employ and pay for services of a testing laboratory to:
 - 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - b. Concrete testing agency to meet requirements of ASTM E329.
 - 2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
 - 3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
 - 4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
- C. Qualifications:
- 1. Ready mixed concrete batch plant certified by NRMCA.
 - 2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the state where the Project is located.

1.3 DEFINITIONS

- A. Per ACI CT-13 except as modified herein:
 - 1. Concrete fill: Non-structural concrete.
 - 2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
 - 3. Exposed concrete: Exposed to view after construction is complete.
 - 4. Indicated: Indicated by Contract Documents.
 - 5. Nonexposed concrete: Not exposed to view after construction is complete.
 - 6. Required: Required by Contract Documents.
 - 7. Specified strength: Specified compressive strength at 28 days.
 - 8. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Concrete mix designs proposed for use.
 - a. Concrete mix design submittal to include the following information:
 - 1) Sieve analysis and source of fine and coarse aggregates.
 - 2) Test for aggregate organic impurities.
 - 3) Test for deleterious aggregate per ASTM C1293.
 - 4) Proportioning of all materials.
 - 5) Type of cement with mill certificate for cement.
 - 6) Type of fly ash with certificate of conformance to specification requirements.
 - 7) Slump.
 - 8) Air content.
 - 9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - 10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturers and types:
 - 1) Joint fillers.
 - 2) Curing agents.
 - 3) Chemical sealer.
 - 4) Bonding and patching mortar.
 - 5) Construction joint bonding adhesive.
 - 6) Nonshrink grout with cure/seal compound.
 - 3. Reinforcing steel:
 - a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
 - b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
 - c. Obtain approval of Shop Drawings by Engineer before fabrication.
 - d. Mill certificates.
 - 4. Scaled (minimum 1/8 inches per foot) drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint dimensions.

5. Strength test results of in place concrete including slump, air content and concrete temperature.
6. Certifications:
 - a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
 - b. Certification that the material and sources submitted in the mix design will be used in the concrete for this project.
7. Test reports:
 - a. Cement mill reports for all cement to be supplied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:

1. Cement and pozzolan:
 - a. Store in moistureproof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 inches of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:

1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to [Owner's Representative] [Engineer] at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Numerical sequence of the delivery.
 - 7) Amount of water added.
2. Reinforcing steel:
 - a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
 - b. Mark numbers to match Shop Drawing mark number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - 1. Nonshrink, nonmetallic grout:
 - a. Sika "SikaGrout 212."
 - b. Euclid Chemical "NS Grout."
 - c. Master Builders Solutions "Masterflow 713."
 - 2. Expansion joint fillers:
 - a. Permaglaze Co.
 - b. Rubatex Corp.
 - c. Williams Products, Inc.
 - 3. Form coating:
 - a. Richmond "Rich Cote."
 - b. Industrial Lubricants "Nox-Crete Form Coating."
 - 4. Cementitious concrete coating:
 - a. Aquafin International.
 - b. Master Builders Solutions.
 - c. Euclid Chemical Company.
 - 5. Chemical sealer:
 - a. L&M Construction Chemicals, Inc.
 - b. Euclid Chemical Company.
 - c. Dayton Superior.

2.2 MATERIALS

- A. Portland Cement: Conform to ASTM C150 Type II.
- B. Fly Ash:
 - 1. ASTM C618, Class F or Class C.
 - 2. Nonstaining.
 - a. Hardened concrete containing fly ash to be uniform light gray color.
 - 3. Maximum loss on ignition: 4%.
 - 4. Compatible with other concrete ingredients.
 - 5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
- C. Admixtures:
 - 1. Air entraining admixtures: ASTM C260.
 - 2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 - 3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:

- a. 0.10 all concrete.
 - 4. Do not use calcium chloride.
 - 5. Pozzolanic admixtures: ASTM C618.
 - 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
- D. Water: Potable, clean, free of oils, acids and organic matter.
- E. Aggregates:
- 1. Normal weight concrete: ASTM C33, except as modified below.
 - 2. Fine aggregate:
 - a. Clean natural sand.
 - b. No manufactured or artificial sand.
 - 3. Coarse aggregate:
 - a. Crushed rock, natural gravel, or other inert granular material.
 - b. Maximum amount of clay or shale particles: 1%.
 - 4. Gradation of coarse aggregate:
 - a. Lean concrete and concrete topping: Size #7.
 - b. All other concrete: Size #57 or #67.
- F. Concrete Grout:
- 1. Nonshrink, nonmetallic grout:
 - a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
 - e. In accordance with COE CRD-C621.
 - 2. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at jobsite.
- G. Reinforcing Steel:
- 1. Reinforcing bars: ASTM A615, Grade 60.
 - 2. Welded wire reinforcement:
 - a. ASTM A185 or ASTM A1064.
 - b. Minimum yield strength: 60,000 psi.
 - 3. Column spirals: ASTM A82 or ASTM A1064.
- H. Forms:
- 1. Prefabricated or job built.
 - 2. Wood forms:
 - a. 5/8 or 3/4 inches 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
 - 3. Metal forms:
 - a. Metal forms may be used except for aluminum in contact with concrete.
 - b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

4. Chamfer strips: Clear white pine, surface against concrete planed.
- I. Form Ties:
 1. Commercially fabricated for use in form construction.
 - a. Field fabricated ties are unacceptable.
 2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
 3. 3/4 inches minimum to 1 inch maximum diameter cones on both ends.
 4. Embedded portion of ties to be not less than 1-1/2 inches from face of concrete after ends have been removed.
 5. Cone size:
 - a. 3/4 inches minimum to 2 1/2 inches maximum diameter cones on both ends.
 - b. Depth of cone not to exceed the concrete reinforcing cover.
 6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
 - J. Chairs, Runners, Bolsters, Spacers, and Hangers:
 1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
 - K. Chemical Floor Sealer:
 1. Colorless low VOC water-based solution containing acrylic copolymers.
 - a. ASTM C1315, Class B, minimum 30% solids.
 2. L&M Construction Chemicals Inc. Dress & Seal WB 30.
 - L. Cementitious Concrete Coating:
 1. Polymer modified Portland cement based coating for concrete and masonry.
 - a. Waterproof.
 - b. Resistant to both positive and negative hydrostatic pressure.
 - c. Breathable.
 2. Master Builders Solutions "Masterseal 581 Thoroseal".
 - a. Color:
 - 1) Interior surfaces: Standard gray.
 - 2) Exterior surfaces: Custom color to match concrete surface.
 - 3) Texture: Fine.
 - M. Membrane Curing Compound:
 1. ASTM C309, Type 1D, Class A or B.
 2. Fugitive dye shall dissipate over time and exposure.
 3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
 - N. Expansion Joint Filler:
 1. In contact with water or sewage:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
 2. Exterior driveways, curbs and sidewalks:
 - a. Asphalt expansion joint filler.
 - b. ASTM D994.
 3. Other use:

- a. Fiber expansion joint filler.
- b. ASTM D1751.

2.3 CONCRETE MIXES

A. General:

- 1. All concrete to be ready mixed concrete conforming to ASTM C94/C94M.
- 2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
- 3. All concrete to be normal weight concrete [except where lightweight concrete is indicated on Drawings].
- 4. Provide pozzolan content for all cast-in-place construction.

B. Strength:

- 1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
All other general use concrete	Normal weight	4000 PSI

* Minimum 28-day compressive strength.

C. Air Entrainment:

- 1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 inches or 3/4 inches	6 ±1-1/2
<3/4 inches	6-1/2 ±1-1/2

- 2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 inches maximum, 1 inch minimum:

- 1. Measured at point of discharge of the concrete into the concrete construction member.
- 2. 8 inches maximum after addition of superplasticizer (if used).
- 3. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
- 4. Pumped concrete:
 - a. Provide additional water at batch plant to allow for slump loss due to pumping.
 - b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ratio is not exceeded.
- 5. Slump may be adjusted in the field through the use of water reducers.
 - a. Coordinate dosage and mixing requirements with concrete supplier.
- 6. Determine slump per ASTM C143.

E. Selection of Proportions:

- 1. General:
 - a. Proportion ingredients to:
 - 1) Produce proper workability, durability, strength, and other required properties.
 - 2) Prevent segregation and collection of excessive free water on surface.

2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	[MINIMUM] [TARGET] CEMENT, MAXIMUM AGGREGATE SIZE			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	1/2 inches	3/4 inches	1 inches	
4000	564	564	564	0.45
4500	611	611	--	0.42

3. Fly ash:

- a. For cast-in-place concrete only, a maximum of 25% by weight of Portland cement content per cubic yard may be replaced with fly ash at rate of 1 pound fly ash for 1 pound of cement.
- b. When fly ash is used, the water to cementitious materials ratio shall not exceed the maximum value specified herein.

4. Concrete mix proportioning methods for normal weight concrete:

- a. Proportion mixture to provide desired characteristics using one of methods described below:

1) Method 1 (Trial Mix):

- a) Per ACI 318, Chapter 5, except as modified herein.
- b) Air content within range specified above.
- c) Record and report temperature of trial mixes.
- d) Proportion trial mixes per ACI 211.1.

2) Method 2 (Field Experience):

- a) Per ACI 318, Chapter 5, except as modified herein:
- b) Field test records must be acceptable to Engineer to use this method.
- c) Test records shall represent materials, proportions and conditions similar to those specified.

5. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Chapter 5 of ACI 318 using the standard deviation of the proposed concrete production facility.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:

1. Contractor is responsible for design and erection of formwork.
2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
 - a. Allowable tolerances: As recommended in ACI 347.
3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 - b. Do not place floor drains through beams.
4. Openings:
 - a. Provide openings in formwork to accommodate work of other trades.
 - b. Accurately place and securely support items built into forms.

5. Chamfer strips: Place 3/4 inches chamfer strips in forms to produce 3/4 inches wide beveled edges on permanently exposed corners of members.
6. Clean and adjust forms prior to concrete placement.
7. Tighten forms to prevent mortar leakage.
8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

B. Reinforcement:

1. Position, support and secure reinforcement against displacement.
2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
5. Extend reinforcement to within 2 inches of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 inches of the edge.
6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
7. Do not weld reinforcing bars.
8. Welded wire reinforcement:
 - a. Install welded wire reinforcement in maximum practical sizes.
 - b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
 - 1) One spacing of cross wires plus 2 inches.
 - 2) 1.5 x development length.
 - 3) 6 inches.
 - c. Development length: ACI 318 basic development length for the specified fabric yield strength.

C. Construction, Expansion, and Contraction Joints:

1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.
 - a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in Paragraph below, submit proposed construction joint location in conformance with this Specification Section.
2. Unplanned construction joints will not be allowed.
3. Locate wall vertical construction joints at 30 feet maximum.
4. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SQFT.
5. Locate construction joints in columns and walls:
 - a. At the underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
 - b. Haunches, drop panels, and column capitals are considered part of the supported floor or roof and shall be placed monolithically therewith.
 - c. Column based need not be placed monolithically with the floor below.
6. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
7. At least 48 hours shall elapse between placing of adjoining concrete construction.
8. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
9. Before new concrete is placed, dampen concrete surfaces.

D. Embedments:

1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
 2. Use setting diagrams, templates and instructions for locating and setting.
- E. Placing Concrete:
1. Place concrete in compliance with ACI 304R and ACI 304.2R.
 2. Place in a continuous operation within planned joints or sections.
 3. Begin placement when work of other trades affecting concrete is completed.
 4. Place concrete by methods which prevent aggregate segregation.
 5. Do not allow concrete to free fall more than 4 feet.
 6. Where free fall of concrete will exceed 4 feet, place concrete by means of tremie pipe or chute.
- F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.
- G. Protection:
1. Protect concrete from physical damage or reduced strength due to weather extremes.
 2. In cold weather comply with ACI 306.1 except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Do not place heated concrete that is warmer than 80 degrees F.
 - c. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 degrees F for seven days or 70 degrees F for 3 days.
 - d. Do not allow concrete to cool suddenly.
 3. In hot weather comply with ACI 305.1 except as modified herein.
 - a. At air temperature of 90 degrees F and above, keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 degrees F at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 pounds/SF/HR as determined from ACI 305.1, Figure 2.1.5.
- H. Curing:
1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
 2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
 3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
 4. Provide curing for minimum of seven days.
 5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
 6. In hot weather follow curing procedures outlined in ACI 305.1.
 7. In cold weather follow curing procedures outlined in ACI 306.1.
 8. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Allow the preceding coat to completely dry prior to applying the next coat.
 - c. Apply the first coat of curing compound immediately after form removal.

- d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
- I. Form Removal:
- 1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
 - 2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

A. Tolerances:

- 1. Class A: 1/8 inches in 10 feet.
- 2. Class B: 1/4 inches in 10 feet.

B. Surfaces Exposed to View:

- 1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
 - a. To be covered with a coating or covering material applied directly to concrete.
 - b. Scheduled for grout cleaned finish.
- 2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
- 3. Cementitious concrete coating:
 - a. Form facing material shall produce a smooth, hard, uniform texture.
 - 1) Use forms specified for surfaces exposed to view.
 - b. Prepare the surface in accordance with manufactures printed installation instructions.
 - c. Brush on coating to entire surface.
 - 1) As a mixing liquid for the coating, use bonding agent and water mixture as recommended by the manufacture.
 - 2) Apply two (2) coats at 2 pound/SQYD per coat.
 - d. When second coat is set, float to a uniform texture with a sponge coat.
 - e. Provide this finish at the following locations:
 - 1) Walls, columns, exposed to view.

C. Surfaces Not Exposed to View:

- 1. Patch voids, air pockets and honeycomb areas with cement grout.
- 2. Fill tie holes with nonshrink, nonmetallic grout.

D. Slab Float Finish:

- 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
- 2. Do not use water to aid in finishing.
- 3. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
- 4. During or after first floating, check planeness of entire surface with a 10 feet straightedge applied at not less than two different angles.
- 5. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
- 6. Refloat slab immediately to a uniform sandy texture.

E. Troweled Finish:

- 1. Float finish surface.

2. Next power trowel, and finally hand trowel.
 3. Do not use water to aid in finishing.
 4. Produce a smooth surface which is relatively free of defects with first hand troweling.
 5. Perform additional trowelings by hand after surface has hardened sufficiently.
 6. Final trowel when a ringing sound is produced as trowel is moved over surface.
 7. Thoroughly consolidate surface by hand troweling.
 8. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
 9. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.
- F. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

3.3 GROUT

A. Preparation:

1. Nonshrinking, nonmetallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 hours prior to grouting.

B. Application:

1. Nonshrinking, nonmetallic grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce flowable grout.
 - c. Place in accordance with manufacturer's instructions.
 - d. Completely fill all spaces and cavities below the bottom of baseplates.
 - e. Provide forms where baseplates and bedplates do not confine grout.
 - f. Where exposed to view, finish grout edges smooth.
 - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
 - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
 - i. Wet cure grout for seven days, minimum.

3.4 FIELD QUALITY CONTROL

A. Contractor will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.

1. Contractor to cooperate with Owner in obtaining and testing samples.

B. Tests During Construction:

1. Strength test:
 - a. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
 - 1) Cylinder size: Per ASTM C31.
 - a) 4 inches cylinders may not be used for concrete mixes with concrete aggregate size larger than 1 inch.
 - 2) Quantity:
 - a) 6 inches diameter by 12 inches high: Four cylinders.
 - b) 4 inches diameter by 8 inches high: Six cylinders.
 - b. Field cure one (1) cylinder for the seven day test.
 - 1) Laboratory cure the remaining.

- c. Test cylinders in accordance with ASTM C39.
 - 1) 6 inches diameter cylinders:
 - a) Test two cylinders at 28 days for strength test result and the one field cured sample at seven days for information.
 - b) Hold remaining cylinder in reserve.
 - 2) 4 inches diameter cylinders:
 - a) Test three cylinders at 28 days for strength test result and the one field cured cylinder at seven days for information.
 - b) Hold remaining cylinders in reserve.
 - d. Strength test result:
 - 1) Average of strengths of two 6 inches diameter cylinders or three 4 inches diameter cylinders from the same sample tested at 28 days.
 - 2) If one cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
 - 3) Should all cylinders in any test show any of above defects, discard entire test.
 - e. Frequency of tests:
 - a) One strength test to be taken not less than once a day, nor less than once for each 60 cubic yards or fraction thereof placed in any one day.
 - b) Once for each 5000 square feet of slab or wall surface area placed each day.
 - c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five strength tests for each concrete mix, tests shall then be made from at least five randomly selected batches or from each batch if fewer than five batches are provided.
2. Slump test:
 - a. Per ASTM C143.
 - b. Determined for each strength test sample.
 - c. Additional slump tests may be taken.
 3. Air content:
 - a. Per ASTM C231, ASTM C173, and ASTM C138.
 - b. Determined for each strength test sample.
 4. Temperature: Determined for each strength test sample.
- C. Evaluation of Tests:
1. Strength test results:
 - a. Average of 28-day strength of two cylinders from each sample.
 - 1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.
 - 2) If both cylinders show any of above defects, test will be discarded.
- D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
 2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.

a. Perform additional tests and/or corrective measures at no additional cost to Owner.

E. Concrete tolerances per ACI 117.

3.5 SCHEDULES

A. Form Types:

1. Surfaces exposed to view:
 - a. Prefabricated or job-built wood forms.
 - b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
 - c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
 - d. Construct forms sufficiently tight to prevent leakage of mortar.
2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
3. Other types of forms may be used:
 - a. For surfaces not restricted to plywood or lined forms.
 - b. As backing for form lining.

B. Grout:

1. Nonshrinking, nonmetallic grout: General use.

C. Concrete:

1. Normal weight concrete: All concrete.
2. General use concrete: All other locations.

D. Concrete Finishes:

1. Slab finishes:
 - a. Use following finishes as applicable, unless otherwise indicated:
 - 1) Floated finish: Surfaces intended to receive roofing, concrete topping, lean concrete, concrete fill and waterproofing.
 - 2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.
 - 3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

END OF SECTION

SECTION 26 05 00
ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for electrical systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 03 - Concrete.
 - 2. Section 01 61 03 - Equipment - Basic Requirements.
 - 3. Section 03 15 19 - Anchorage to Concrete.
 - 4. Section 10 14 00 - Identification Devices.
 - 5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 - 6. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM, Aluminum Design Manual.
 - 2. American Institute of Steel Construction (AISC):
 - a. Steel Construction Manual.
 - 3. American National Standards Institute (ANSI).
 - 4. ASTM International (ASTM):
 - a. A36/A36M, Standard Specification for Carbon Structural Steel.
 - b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C2, National Electrical Safety Code (NESC).
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 7. National Electrical Manufacturers Association (NEMA):
 - 8. Underwriters Laboratories, Inc. (UL).
- B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.
 - 1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
 - 2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.

1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
4. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
5. Hazardous areas: Class I, II or III areas as defined in NFPA 70.
6. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.
2. General requirements:
 - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
 - b. Include data sheets that include manufacturer's name and product model number.
 - 1) Clearly identify all optional accessories.
 - c. Acknowledgement that products are NRTL listed or are constructed utilizing NRTL recognized components.
 - d. Manufacturer's delivery, storage, handling and installation instructions.
 - e. Product installation details.
 - f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
 - g. See individual specification sections for any additional requirements.
3. Fabrication and/or layout drawings:
 - a. Concrete and reinforcing steel, per Division 03 requirements.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 78 23 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content process of Operation and Maintenance Manuals.

- C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
 1. Outdoor areas:
 - a. Wet.

- b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
- 2. Indoor areas:
 - a. Dry.
 - b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.
- B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

- A. Electrical Equipment Support Pedestals and/or Racks:
 - 1. Manufacturers:
 - a. Modular strut:
 - 1) Unistrut Building Systems.
 - 2) B-Line by Eaton.
 - 3) Globe Strut.
 - 4) Superstrut by Thomas & Betts.
 - 2. Material requirements:
 - a. Modular strut:
 - 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
 - 2) Stainless steel: AISI Type 316.
 - 3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.
 - 4) Aluminum: AA Type 6063-T6.
 - b. Structural members (e.g., I beams, L and C channels):
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - 2) Aluminum: AA Type 6061-T6 or 6063-T6.
 - c. Mounting plates:
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - 2) Aluminum: AA Type 6063-T6.
 - d. Mounting hardware:
 - 1) Galvanized steel.
 - 2) Stainless steel.
 - e. Anchorage per Specification Section 03 15 19.
 - f. Concrete and reinforcing steel: See Division 03 specifications.
- B. Equipment pads (interior and exterior):
 - 1. Concrete and reinforcing steel: See Division 03 specifications.
- C. Field touch-up of galvanized surfaces.
 - 1. Zinc-rich primer.
 - a. One coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.
- B. Install equipment in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. IEEE C2.
 - 3. The manufacturer's instructions.
- C. In general, conduit routing is not shown on the Drawings.
 - 1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
 - 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- D. When complete branch circuiting is not shown on the Drawings:
 - 1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
 - 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
 - 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
 - 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- F. Install equipment plumb, square and true with construction features and securely fastened.
- G. Install electrical equipment, including pull and junction boxes, minimum of 6 inches from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.
- I. Device Mounting Schedule:
 - 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
 - a. Light switch (to center): 46 inches.
 - b. Receptacle in architecturally finished areas (to center): 18 inches.
 - c. Receptacle on exterior wall of building (to center): 18 inches.
 - d. Receptacle in non-architecturally finished areas (to center): 46 inches.
 - e. Telephone outlet in architecturally finished areas (to center): 18 inches.
 - f. Telephone outlet for wall-mounted phone (to center): 46 inches.
 - g. Safety switch (to center of operating handle): 54 inches.
 - h. Separately mounted motor starter (to center of operating handle): 54 inches.
 - i. Pushbutton or selector switch control station (to center): 46 inches.
 - j. Panelboard (to top): 72 inches.

- J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
 - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 inches in equipment location with the Engineer's approval.
- K. Provide electrical equipment support system per the following area designations:
 - 1. Dry areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
 - 2. Wet areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
 - 3. Corrosive areas:
 - a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.
 - 4. Highly corrosive areas:
 - a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
- L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
 - 1. Do not cut, or weld to, building structural members.
 - 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- M. Provide non-metallic corrosion resistant spacers to maintain 1/4 inches separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.
- N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
- P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- Q. Identify electrical equipment and components in accordance with Specification Section 10 14 00.
- R. Provide field markings and/or documentation of available short-circuit current (available fault current) and related information for equipment as required by the NFPA 70 and other applicable codes.
- S. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - 1. Determine the SCCR rating by one of the following methods:
 - a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.

- b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
 3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

- A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
 1. See Specification Section 01 73 20 for openings and penetrations in structures.
- B. Replace equipment and systems found inoperative or defective and re-test.
- C. Cleaning:
 1. See Specification Section 01 74 00.
- D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
 1. Repair galvanized components utilizing a zinc rich paint.
 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
 4. Repair surfaces which will be inaccessible after installation prior to installation.
 5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

- A. Demonstrate equipment in accordance with Specification Section 01 75 00.

END OF SECTION

SECTION 26 05 09

MOTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Induction motors.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 01 61 03 - Equipment - Basic Requirements.
 - 2. Section 26 05 26 - Grounding.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Bearing Manufacturers Association (ABMA).
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 841, Standard for Petroleum and Chemical Industry - Premium-Efficiency, Severe-Duty, Totally-Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up To and Including 370 kW (500 hp).
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. MG 1, Motors and Generators.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
- B. Miscellaneous:
 - 1. When motors are furnished with driven equipment, the driven equipment supplier shall be responsible for assembling the motor and driven equipment as a complete unit, correctly aligned and coupled with the coupling or sheave specified on the driven equipment data sheet, and designing for vibration, special, or unbalanced forces resulting from equipment operation.
 - a. See Specification Section 01 61 03 for requirements.
 - 2. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and ensure their compatibility.

1.3 DEFINITIONS

- A. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.
- B. Abbreviations:
 - 1. DPGF - Dripproof Fully Guarded.
 - 2. ODP - Open Dripproof.
 - 3. RTD - Resistance Temperature Detector.
 - 4. TEFC - Totally Enclosed Fan Cooled.
 - 5. TENV - Totally Enclosed Non-ventilated.
 - 6. WP-I - Weather Protected Type I.
 - 7. WP-II - Weather Protected Type II.
 - 8. Motor controllers:
 - a. FVNR - Full Voltage Non-Reversing.

- b. RVAT - Reduced Voltage Autotransformer.
- c. RVPR - Reduced Voltage Primary Reactor.
- d. RVSS - Reduced Voltage Solid State.
- e. VFD - Variable Frequency Drive.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
 - a. Identify each motor by driven machine identification.
 - b. Motor manufacturer and model number.
 - c. Complete motor nameplate data.
 - d. Weight.
 - e. NEMA design type.
 - f. Enclosure type.
 - g. Frame size.
 - h. Winding insulation class and temperature rise.
 - i. Starts per hour.
 - j. Performance data:
 - 1) Motor speed-torque curve superimposed over driven machine speed-torque curve during start-up acceleration and at rated terminal voltage and minimum permissible or specified terminal voltage for all motors over 25 HP.
 - 2) Time-current plots with acceleration verses current and thermal damage curves at the operating and ambient temperatures and at rated terminal voltage and minimum permissible or specified terminal voltage for all motors over 25 HP.
 - 3) Guaranteed minimum efficiencies at 100%, 75% and 50% of full load.
 - 4) Guaranteed minimum power factor at 100%, 75% and 50% of full load.
 - 5) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
 - 6) Starting, full load and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
 - k. Bearing data and lubrication system.
 - l. Thermal protection system including recommended alarm and trip settings for winding and bearing RTDs.
 - m. Maximum permissible capacitor (kVAC) that can be connected to the motor.
2. Fabrication and/or layout drawings:
 - a. Dimensioned outline Drawing.
 - b. Connection diagrams including accessories (strip heaters, thermal protection, etc.).
3. Certifications:
 - a. When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
4. Test reports:
 - a. Motor test reports for all testing required in this Specification Section.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
2. Installation instructions.

3. Operation and maintenance instructions.
4. Recommended spare parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment during shipment, handling, and storage by suitable boxes, crates, or other complete enclosures.
 1. Protect equipment from exposure to elements and keep thoroughly dry.
- B. Protect painted surfaces against impact, abrasion, discoloration, and other damage.
 1. Repaint damaged painted surfaces to satisfaction of Engineer.
- C. Store all motors in a clean and dry indoor location until final installation.
- D. Where space heaters are provided in motors, provide temporary electrical power and operate heaters during storage and after motors are installed in permanent location until equipment is placed in service.
- E. For storage longer than one month, see manufacturer's storage instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. ABB Baldor-Reliance.
 2. General Electric.
 3. Hyundai Heavy Industries.
 4. Marathon.
 5. Siemens.
 6. TECO-Westinghouse Motor Company.
 7. Toshiba U.S.
 8. Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEIC).
 9. U.S. Motors by Nidec Motor Corporation.
 10. WEG.

2.2 EQUIPMENT

- A. General Requirements:
 1. Standards: NEMA MG 1.
 2. Identify each motor by the driven machine identification.
 3. An embossed or engraved stainless steel nameplate, with the required NFPA 70 and NEMA data, to be permanently attached to the motor.
 4. Maximum motor loading shall not exceed motor nameplate horsepower rating, exclusive of service factor.
 5. All motors shall be sized to carry continuously all loads, which may be imposed through their full range of operation.
 6. Altitude: For applications above 3300 feet, motors to be specifically designed and certified for operation at the specified altitude.
 7. NEMA MG 1, Design B (unless otherwise required), constant speed squirrel-cage induction type having normal starting torque with low starting current.
 8. Suitable for the starting method indicated (e.g., full voltage, autotransformer, solid state reduced voltage, VFD, etc.).

9. Where frequent starting occurs, design for frequent starting duty equivalent to duty service required by driven equipment.
10. Lifting devices: Motors weighing 265 pounds or more shall have suitable lifting eyes for installation and removal.
11. Grounding:
 - a. Lug suitable to terminate ground wire in terminal box, sized as indicated on the Drawings.
 - b. Frame ground pad on medium voltage induction motors.
12. Stator windings: Copper.
13. Rotor cage: Aluminum or copper.
14. Motor leads shall be non-wicking with permanent identifiers.
15. Totally enclosed motor to have one-way breather drains.
16. Efficiency:
 - a. Meet NEMA MG 1 (NEMA Premium) efficiencies.
 - b. If motor type, horsepower or speed is not included in the NEMA requirements for NEMA Premium, provide manufacturers "premium energy efficient" design.
17. Power factor:
 - a. Minimum of 80% lagging at full load, except on motors with speed slower than 900 rpm.
 - b. Power factor correction capacitors to be utilized when indicated on the Drawings.
18. Service factor:
 - a. 100 hp or less: 1.15.
 - b. Greater than 100 hp: 1.0 unless noted otherwise.
 - c. Inverter duty: 1.0.
19. Standards: NEMA MG 1.

2.3 FRACTIONAL INDUCTION MOTORS

- A. Electrical Ratings:
 1. Appropriate for the voltage system indicated, single phase, 60 Hz.
 2. Dual voltage rated motors (e.g., 115/230 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
- B. Enclosure: TENV or TEFC, rolled steel enclosure permitted.
- C. Bearings: Lubricated-for-Life ball bearings.
- D. Insulation: Class F insulation with temperature rise not to exceed the insulation class.
- E. Thermal Protection: Integral manual or automatic reset thermal protector.

2.4 INDUCTION MOTORS, 600 VOLT AND LESS

- A. Horizontal Shaft:
 1. Electrical rating:
 - a. Appropriate for the voltage system indicated, 3 PH, 60 Hz.
 - b. Dual voltage rated motors (e.g., 230/460 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
 2. Enclosure:
 - a. Cast iron (exception: fan covers can be steel).
 - b. Type: DPGF, TEFC, WP-I or WP-II as indicated in the schedule.
 3. Terminal box:
 - a. Gasketed.
 - b. Diagonally split.

- c. Field adjustable in 90 degrees increments.
 - d. Oversized to accept the required conductors and conduits.
 - e. Located on "F1" side unless specifically indicated to be on the "F2" side.
 - f. Separate terminal box with terminal blocks for winding thermal protection devices (RTD and thermocouples).
4. Bearings:
- a. 5 hp and less: Lubricated-for-Life ball bearings.
 - b. Greater than 5 hp:
 - 1) Relubricatable.
 - 2) Antifriction.
 - 3) Minimum rated ABMA L-10 life of 10 years or 100,000 hours.
5. Insulation:
- a. Class F insulation with Class B temperature rise.
 - b. Dipped and baked with non-hydroscopic varnish or epoxy.
6. Accessories: See the ACCESSORIES Article in PART 2 and the SCHEDULES Article in PART 3.
7. Modifications:
- a. Inverter duty:
 - 1) At a minimum, applied to motors connected to a VFD.
 - 2) Windings insulated for 1600 peak volts and voltage rise times of 0.1 microseconds.
 - 3) Nameplate identification of meeting NEMA MG 1 Part 31 requirements.
 - 4) Have the following minimum turndown ratio without the use of a blower to provide continuous supply of cooling air over the motor.
 - a) Variable torque: 10:1.
 - b) Constant torque: 6:1.
 - 5) Insulated drive end bearing on all motors.
 - 6) Motors 100 hp and larger, insulated non-drive and bearings.
 - 7) Shaft grounding ring on all motors:
 - a) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
 - b) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
 - b. Severe duty:
 - 1) Standard: IEEE 841.
 - 2) All cast iron enclosure.
 - 3) Terminal box threaded and gasketed.
 - 4) Internal and external epoxy base paint system.
 - 5) Drain and breather.
- B. Vertical Solid or Hollow Shaft:
- 1. Electrical rating:
 - a. Appropriate for the voltage system indicated, 3 PH, 60 Hz.
 - b. Dual voltage rated motors (e.g., 230/460 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
 - 2. Enclosure:
 - a. Cast iron.
 - b. Type: DPGF, TEFC, WP-I or WP-II as indicated in the schedule.

3. Terminal box:
 - a. Gasketed.
 - b. Diagonally split.
 - c. Oversized to accept the required conductors and conduits.
 - d. Separate terminal box with terminal blocks for winding thermal protection devices.
4. Bearings (Solid Shaft):
 - a. Relubricatable.
 - b. Antifriction.
 - c. Minimum rated AMBA L-10 life of 10 years or 100,000 hours.
5. Bearings (Hollow Shaft):
 - a. Relubricatable.
 - b. Antifriction.
 - c. Oil or grease lubricated thrust bearings.
 - d. Grease lubricated guide bearings.
 - e. Minimum rated ABMA L-10 life of 10 years or 100,000 hours.
6. Insulation:
 - a. Class F insulation with Class B temperature rise.
 - b. Dipped and baked with non-hydroscopic varnish or epoxy.
7. Accessories: See the ACCESSORIES Article in PART 2 and the SCHEDULES Article in PART 3.
8. Modifications:
 - a. Inverter duty:
 - 1) At a minimum, applied to motors connected to a VFD.
 - 2) Windings insulated for 1600 peak volts and voltage rise times of 0.1 microseconds.
 - 3) Nameplate identification of meeting NEMA MG 1 Part 31 requirements.
 - 4) Have the following minimum turndown ratio without the use of a blower to provide continuous supply of cooling air over the motor.
 - a) Variable torque: 10:1.
 - b) Constant torque: 6:1.
 - 5) Insulated drive end bearing on all motors.
 - 6) Motors 100 hp and larger the non-drive end shall have an insulated bearing carrier.
 - 7) Shaft grounding ring on all motors:
 - a) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
 - b) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
 - b. Severe duty:
 - 1) Standard: IEEE 841.
 - 2) All cast iron enclosure.
 - 3) Terminal box threaded and gasketed.
 - 4) Internal and external epoxy base paint system.
 - 5) Drain and breather.

2.5 INDUCTION MOTORS, GREATER THAN 600 VOLT

- A. Same as Induction Motors, 600 Volt and Less except for the following:
 1. Windings: Form wound.
 2. Insulation:

- a. Vacuum Pressure Impregnation (VPI) or Continuous Resin Flow Impregnation (CRFI).
- b. Epoxy encapsulated.
- 3. NEMA MG 1 Type II terminal housing suitable for shielded cable.
- 4. Bearing RTDs.
- 5. Bearing vibration detectors.
- 6. Accessory leads wired to separate terminal boxes.
 - a. Separate terminal boxes or boxes with a barrier shall be used to separate accessories leads of 50 V and less and accessories leads of higher voltages.

2.6 ACCESSORIES

A. Thermal Protection:

- 1. Thermostats:
 - a. One winding thermostat per phase for shutdown.
 - b. One bearing oil thermostat for shutdown.
 - c. Snap action, bi-metallic, temperature-actuated switch type.
 - d. Normally closed, wired in series.
 - e. Automatic reset.
 - f. Switch point shall be pre-calibrated by the manufacturer.
- 2. Thermistors:
 - a. One winding thermostat per phase for shutdown mounted in end turns.
 - b. Positive temperature coefficient type.
 - c. Normally closed, wired in series.
 - d. 115 V rated.
- 3. Thermocouples:
 - a. Two winding thermocouples per phase for alarm/shutdown mounted in end turns.
 - b. Two bearing oil thermocouples for alarm/shutdown.
 - c. Copper constantan type.
- 4. RTDs:
 - a. One winding RTDs per phase.
 - b. One bearing RTD per bearing.
 - c. 100 OHM platinum.

B. Space Heaters:

- 1. Silicone rubber strip type, 120 V rated.
- 2. Provided on:
 - a. All motors 10 hp and larger mounted outdoors.
 - b. Indoor motors in humid environments as indicated.

2.7 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA, IEEE and manufacturer procedures.

- 1. The test shall include but not necessarily be limited to the following:
 - a. Routine test:
 - 1) No-load current and speed at rated voltage and frequency.
 - 2) Locked rotor current.
 - 3) Winding resistance.
 - 4) Vibration check.
 - 5) High potential.

- b. Complete test (in addition to the routine tests):
 - 1) Rated load temperature rise.
 - 2) Winding resistance.
 - 3) Slip test, measured in percent slip.
 - 4) Locked rotor amperes (3 PH, full voltage).
 - 5) Locked rotor torque.
 - 6) Breakdown torque.
 - 7) Efficiencies tabulated at 100, 75, and 50% of full load.
 - 8) Power factor tabulated at 100, 75, and 50% of full load.
- B. Motors to be tested:
 - 1. As indicated in the schedule.
 - 2. All motors, at a minimum, to receive a routine test.
- C. The Owner reserves the right to select and have tested any motor included within the project.
 - 1. If motor passes testing requirements, the Owner shall be responsible for any shipping and testing costs incurred.
 - 2. Costs shall be determined by current freight rates and manufacturer's published rates at the time of the test.
 - 3. If motor fails test, Supplier shall be responsible for all costs incurred.
 - 4. If two successive motors fail the test, the Owner has the right to reject any or all motors from that manufacturer.
 - 5. The Owner also reserves the right to witness any routine or complete tests at the Owner's expense.
 - 6. Notify the Owner a minimum of 14 days in advance of the testing.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: See Specification Section 01 61 03.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Material and installation requirements for:
 - a. Conduits.
 - b. Conduit fittings.
 - c. Conduit supports.
 - d. Wireways.
 - e. Outlet boxes.
 - f. Pull and junction boxes.
- B. Related Specification Sections include but are not necessarily limited to:
1. Section 26 05 00 - Electrical - Basic Requirements.
 2. Section 26 05 43 - Electrical - Exterior Underground.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. Aluminum Association (AA).
 2. American Iron and Steel Institute (AISI).
 3. ASTM International (ASTM):
 - a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit and Fittings.
 - f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit and Fittings.
 5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
 - a. C80.1, Electric Rigid Steel Conduit (ERSC).
 - b. C80.3, Steel Electrical Metallic Tubing (EMT).
 - c. C80.5, Electrical Aluminum Rigid Conduit (ERAC).
 - d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 7. Underwriters Laboratories, Inc. (UL):

- a. 1, Standard for Flexible Metal Conduit.
- b. 6, Electrical Rigid Metal Conduit - Steel.
- c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
- d. 360, Standard for Liquid-Tight Flexible Metal Conduit.
- e. 467, Grounding and Bonding Equipment.
- f. 514A, Metallic Outlet Boxes.
- g. 514B, Conduit, Tubing, and Cable Fittings.
- h. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
- i. 797, Electrical Metallic Tubing - Steel.
- j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
- k. 1203, Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
- l. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- m. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Specification Section 26 05 00 for additional requirements.
 - 2. Fabrication and/or layout drawings:
 - a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rigid metal conduits and electrical metallic tubing:
 - a. Allied Tube and Conduit.
 - b. Western Tube and Conduit Corporation.
 - c. Wheatland Tube.
 - d. Patriot Aluminum Products, LLC.
 - 2. PVC coated rigid metal conduits:
 - a. Robroy Industries.
 - b. Atkore - Calbond
 - 3. Rigid nonmetallic conduit:
 - a. Prime Conduit.
 - b. Cantex, Inc.
 - c. Osburn Associates, Inc.
 - d. Champion Fiberglass, Inc.
 - e. United Fiberglass of America, Inc.

4. Flexible conduit:
 - a. AFC Cable Systems.
 - b. Anamet, Inc.
 - c. Electri-Flex Company.
 - d. International Metal Hose Company.
 - e. Southwire Company, LLC.
5. Wireway:
 - a. Hoffman Engineering.
 - b. Wiegmann by Hubbell.
 - c. Square D by Schneider Electric.
6. Conduit fittings and accessories:
 - a. Appleton by Emerson Electric Co.
 - b. Carlon by Thomas & Betts.
 - c. Cantex, Inc.
 - d. Crouse-Hinds by Eaton.
 - e. Killark by Hubbell.
 - f. Osburn Associates, Inc.
 - g. O-Z/Gedney by Emerson Electric Co.
 - h. Raco by Hubbell.
 - i. Steel City by Thomas & Betts.
 - j. Thomas & Betts.
7. Support systems:
 - a. Unistrut by Atkore International, Inc.
 - b. B-Line by Eaton.
 - c. Kindorf by Thomas & Betts.
 - d. Minerallac Company.
 - e. CADDY by Pentair.
 - f. Superstrut by Thomas & Betts.
8. Outlet, pull and junction boxes:
 - a. Appleton by Emerson Electric Co.
 - b. Crouse-Hinds by Eaton
 - c. Killark by Hubbell.
 - d. O-Z/Gedney by Emerson Electric Co.
 - e. Steel City by Thomas & Betts.
 - f. Raco by Hubbell
 - g. Bell by Hubbell.
 - h. Hoffman Engineering.
 - i. Wiegmann by Hubbell.
 - j. B-Line by Eaton.
 - k. Adalet.
 - l. RITTAL North America LLC.
 - m. Stahlin by Robroy Enclosures.

2.2 RIGID METAL CONDUITS

- A. Rigid Galvanized Steel Conduit (RGS):
 1. Mild steel with continuous welded seam.

2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
 3. Threads galvanized after cutting.
 4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
 5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.
- B. PVC-Coated Rigid Steel Conduit (PVC-RGS):
1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
 - a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
 - b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
 2. Nominal 2 mil, minimum, urethane interior coating.
 3. Urethane coating on threads.
 4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
 5. Female Ends:
 - a. Have a plastic sleeve extending a minimum of one pipe diameter or 2 inches, whichever is less beyond the opening.
 - b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
 6. Pass high temperature water PVC coating adhesion test and be ETL Verified PVC-001.
 7. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6, NEMA RN 1.
- C. Rigid Aluminum Conduit (RAC):
1. AA Type 6063 aluminum alloy, T-1 temper.
 2. Maximum copper content of 0.10%.
 3. Extruded, seamless.
 4. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.5, UL 6.

2.3 ELECTRICAL METALLIC TUBING (EMT)

- A. Mild steel with continuous welded seam.
- B. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
- C. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
- D. Standards: NFPA 70 Type EMT, NEMA/ANSI C80.3, UL 797.

2.4 RIGID NONMETALLIC CONDUIT

- A. Schedules 40 (PVC-40) and 80 (PVC-80):
 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
 2. Rated for direct sunlight exposure.
 3. Fire retardant and low smoke emission.
 4. Shall be suitable for use with 90 degrees C wire and shall be marked "maximum 90 degrees C".
 5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.
- B. Fiberglass:
 1. Epoxy based resin system using an anhydride curing agent.
 2. Continuous E-glass roving.
 3. Winding angle approximately 54.75 degrees.
 4. Smooth internal walls with all fibers imbedded in the epoxy.

5. Above grade rated: Halogen free additive for flame spread and smoke control.
6. Ultraviolet inhibitor: Carbon black.
7. Two-step curing process.
8. Tensile strength: 11,000 psi per ASTM D2105.
9. Dimensions: Iron Pipe Size (IPS).
10. Wall thickness:
 - a. Standard: 3/4 inches to 4 inches nominal size.
 - b. Medium: 5 inches to 6 inches nominal size.
 - c. Extra Heavy for "bullet proof" and Class 1, Division 2 areas: 3/4 inches to 6 inches nominal size.
11. Integral bell and spigot.
12. Conduits and fittings to be joined with an interference joint and epoxy adhesive creating a concrete and water tight connection.
13. Standard: NFPA 70 Type RTRC, NEMA TC14.AG, NEMA TC14.BG, UL 2420, UL.

2.5 FLEXIBLE CONDUIT

- A. Flexible Galvanized Steel Conduit (FLEX):
 1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
 2. Standard: NFPA 70 Type FMC, UL 1.
- B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
 2. Extruded PVC outer jacket positively locked to the steel core.
 3. Liquid and vaportight.
 4. Standard: NFPA 70 Type LFMC, UL 360.

2.6 WIREWAY

- A. General:
 1. Suitable for lay-in conductors.
 2. Designed for continuous grounding.
 3. Covers:
 - a. Hinged or removable in accessible areas.
 - b. Non-removable when passing through partitions.
 4. Finish: Rust inhibiting primer and manufacturer's standard paint inside and out except for stainless steel type.
 5. Standards: UL 870, NEMA 250.
- B. General Purpose (NEMA 1 rated) Wireway:
 1. 14 or 16 gage steel without knockouts.
 2. Cover: Solid, non-gasketed and held in place by captive screws.
- C. Raintight (NEMA 3R) Wiring Trough:
 1. 14 or 16 GA galvanized steel without knockouts.
 2. Cover: Non-gasketed and held in place by captive screws.
- D. Watertight (NEMA 4X rated) Wireway:
 1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.

2. Cover: Fully gasketed and held in place with captive clamp type latches.
 3. Flanges: Fully gasketed and bolted.
- E. Dusttight (NEMA 12 rated) Wireway:
1. 14 GA steel bodies and covers without knockouts and 10 GA steel flanges.
 2. Cover: Fully gasketed and held in place with captive clamp type latches.
 3. Flanges: Fully gasketed and bolted.

2.7 CONDUIT FITTINGS AND ACCESSORIES

- A. Fittings for Use with RGS:
1. General:
 - a. In hazardous locations listed for use in Class I, Groups C and D locations.
 2. Locknuts:
 - a. Threaded steel or malleable iron.
 - b. Gasketed or non-gasketed.
 - c. Grounding or non-grounding type.
 3. Bushings:
 - a. Threaded, insulated metallic.
 - b. Grounding or non-grounding type.
 4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
 5. Couplings:
 - a. Threaded straight type: Same material and finish as the conduit with which they are used on.
 - b. Threadless type: Gland compression or self-threading type, concrete tight.
 6. Unions: Threaded galvanized steel or zinc plated malleable iron.
 7. Conduit bodies (ells and tees):
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) Clip-on type with stainless steel screws.
 - 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
 8. Conduit bodies (round):
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
 9. Sealing fittings:
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. With or without drain and breather.
 - d. Fiber and sealing compound: UL listed for use with the sealing fitting.
 10. Hazardous location flexible coupling (HAZ-FLEX):
 - a. Liquid tight and arc resistant.
 - b. Electrically conductive so no bonding jumper is required.
 - c. Dry and wet areas:
 - 1) Bronze braided covering over flexible brass core.
 - 2) Bronze end fittings.

- 3) Zinc-plated steel or malleable iron unions and nipples.
 - d. Corrosive areas:
 - 1) Stainless steel braided covering over flexible stainless steel core.
 - 2) Stainless steel end fittings.
 - 3) Aluminum unions and nipples.
 - 11. Service entrance head:
 - a. Malleable iron, galvanized steel or copper free aluminum.
 - b. Insulated knockout cover for use with a variety of sizes and number of conductors.
 - 12. Expansion couplings:
 - a. 2 inches nominal straight-line conduit movement in either direction.
 - b. Galvanized steel with insulated bushing.
 - c. Gasketed for wet locations.
 - d. Internally or externally grounded.
 - 13. Expansion/deflection couplings:
 - a. 3/4 inches nominal straight-line conduit movement in either direction.
 - b. 30 degrees nominal deflection from the normal in all directions.
 - c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
 - d. Internally or externally grounded.
 - e. Watertight, raintight and concrete tight.
 - 14. Standards: UL 467, UL 514B, UL 1203.
- B. Fittings for Use with PVC-RGS:
- 1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS" and coated as defined under paragraph "PVC Coated Rigid Steel Conduit (PVC-RGS)."
- C. Fittings for Use with EMT:
- 1. Connectors:
 - a. Straight, angle and offset types furnished with locknuts.
 - b. Zinc plated steel.
 - c. Insulated gland compression type.
 - d. Concrete and raintight.
 - 2. Couplings:
 - a. Zinc plated steel.
 - b. Gland compression type.
 - c. Concrete and raintight.
 - 3. Conduit bodies (ells and tees):
 - a. Body: Copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) Screw down type with steel screws.
 - 2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
 - 4. Standard: UL 514B.
- D. Fittings for Use with FLEX:
- 1. Connector:
 - a. Zinc plated malleable iron.
 - b. Squeeze or clamp-type.

2. Standard: UL 514B.
- E. Fittings for Use with FLEX-LT:
1. Connector:
 - a. Straight or angle type.
 - b. Metal construction, insulated and gasketed.
 - c. Composed of locknut, grounding ferrule and gland compression nut.
 - d. Liquid tight.
 2. Standards: UL 467, UL 514B.
- F. Fittings for Use with Rigid Nonmetallic PVC Conduit:
1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
 - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
 3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.
- G. Fittings for Use with Rigid Nonmetallic Fiberglass Conduit:
1. Coupling and adapters shall be of the same material, thickness, and construction as the conduit.
 2. Epoxy adhesive for joining conduits and fittings shall be supplied by the same manufacturer as the conduit and fittings and shall provide a concrete and water tight connection.
 3. Standard: NFPA 70 Type RTRC, NEMA TC14.AG, NEMA TC14.BG, [NEMA TC.XW] UL 2420, UL 2415 [, UL 2515A].
- H. Weather and Corrosion Protection Tape:
1. PVC based tape, 10 mils thick.
 2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
 3. Used with appropriate pipe primer.

2.8 ALL RACEWAY AND FITTINGS

- A. Mark Products:
1. Identify the nominal trade size on the product.
 2. Stamp with the name or trademark of the manufacturer.

2.9 OUTLET BOXES

- A. Metallic Outlet Boxes:
1. Hot-dip galvanized steel.
 2. Conduit knockouts and grounding pigtail.
 3. Styles:
 - a. 2 inches x 3 inches rectangle.
 - b. 4 inches square.
 - c. 4 inches octagon.
 - d. Masonry/tile.
 4. Accessories:
 - a. Flat blank cover plates.
 - b. Barriers.

- c. Extension, plaster or tile rings.
 - d. Box supporting brackets in stud walls.
 - e. Adjustable bar hangers.
5. Standards: NEMA/ANSI OS 1, UL 514A.
- B. Cast Outlet Boxes:
- 1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
 - 2. Threaded hubs and grounding screw.
 - 3. Styles:
 - a. "FS" or "FD".
 - b. "Bell".
 - c. Single or multiple gang and tandem.
 - d. "EDS" or "EFS" for hazardous locations.
 - 4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
 - 5. Standards: UL 514A, UL 1203.
- C. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

2.10 PULL AND JUNCTION BOXES

- A. NEMA 1 Rated:
- 1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - 2. With or without concentric knockouts on four sides.
 - 3. Flat cover fastened with screws.
- B. NEMA 4 Rated:
- 1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - 2. Seams continuously welded and ground smooth.
 - 3. No knockouts.
 - 4. External mounting flanges.
 - 5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
 - 6. Cover with oil resistant gasket.
- C. NEMA 4X Rated (metallic):
- 1. Body and cover: 14 GA Type 304 or 316 stainless steel.
 - 2. Seams continuously welded and ground smooth.
 - 3. No knockouts.
 - 4. External mounting flanges.
 - 5. Hinged door and stainless steel screws and clamps.
 - 6. Door with oil-resistant gasket.
- D. NEMA 4X Rated (Nonmetallic):
- 1. Body and cover: Ultraviolet light protected fiberglass-reinforced polyester boxes.
 - 2. No knockouts.
 - 3. External mounting flanges.
 - 4. Hinged door with quick release latches and padlocking hasp.
 - 5. Door with oil resistant gasket.
- E. NEMA 7 and NEMA 9 Rated:

1. Cast gray iron alloy or copper-free aluminum with manufacturer's standard finish.
2. Drilled and tapped openings or tapered threaded hub.
3. Cover bolted-down with stainless steel bolts or threaded cover with neoprene gasket.
4. External mounting flanges.
5. Grounding lug.
6. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.

F. NEMA 12 Rated:

1. Body and cover:
 - a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - b. Type 5052 H-32 aluminum, unpainted.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
6. Flat door with oil resistant gasket.

G. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 square feet or heavier than 25 pounds.
2. Split covers when heavier than 25 pounds.
3. Weldnuts for mounting optional panels and terminal kits.
4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

H. Standards: NEMA 250, UL 50.

2.11 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:

1. Material requirements.
 - a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
 - b. Stainless steel: AISI Type 316.
 - c. PVC coat galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.

B. Single Conduit and Outlet Box Support Fasteners:

1. Material requirements:
 - a. Zinc plated steel.
 - b. Stainless steel.
 - c. Malleable iron.
 - d. PVC coat malleable iron or steel: 20 mil PVC coating.
 - e. Steel protected with zinc phosphate and oil finish.

2.12 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:

1. See Specification Section 01 73 20.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

- A. Shall be in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. Manufacturer instructions.
- B. Size of Raceways:
 - 1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
 - 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
 - a. Conduit: 3/4 inches.
 - b. Wireway: 2-1/2 inches x 2-1/2 inches.
- C. Field Bending and Cutting of Conduits:
 - 1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
 - 2. Do not reduce the internal diameter of the conduit when making conduit bends.
 - 3. Prepare tools and equipment to prevent damage to the PVC coating.
 - 4. Degrease threads after threading and apply a zinc rich paint.
 - 5. Debur interior and exterior after cutting.
- D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
- E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
 - 1. Repair galvanized components utilizing a zinc rich paint.
 - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
 - a. Total nominal thickness: 40 mil.
 - 4. Repair surfaces which will be inaccessible after installation prior to installation.
- F. Remove moisture and debris from conduit before wire is pulled into place.
 - 1. Pull mandrel with diameter nominally 1/4 inches smaller than the interior of the conduit, to remove obstructions.
 - 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 - 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.
- I. Fill openings in walls, floors, and ceilings and finish flush with surface.
 - 1. See Specification Section 01 73 20.

3.2 RACEWAY ROUTING

- A. Raceways shall be routed in the field unless otherwise indicated.
 - 1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
 - 2. Run in straight lines parallel to or at right angles to building lines.
 - 3. Do not route conduits:
 - a. Through areas of high ambient temperature or radiant heat.
 - b. In suspended concrete slabs.
 - c. In concrete members including slabs, slabs on grade, beams, walls, and columns unless specifically located and detailed on structural Drawings..
 - 4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.
 - 5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
 - 6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.
- B. All conduits within a structure shall be installed exposed except as follows:
 - 1. As indicated on the Drawings.
 - 2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
 - 3. Conduits in architecturally finished areas shall be concealed.
- C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 feet:
 - 1. Between instrumentation and telecommunication: 1 inch.
 - 2. Between instrumentation and 125 V, 48 V and 24 VDC, 2 inches.
 - 3. Between instrumentation and 600 V and less AC power or control: 6 inches.
 - 4. Between instrumentation and greater than 600 VAC power: 12 inches.
 - 5. Between telecommunication and 125 V, 48 V and 24 VDC, 2 inches.
 - 6. Between telecommunication and 600 V and less AC power or control: 6 inches.
 - 7. Between telecommunication and greater than 600 VAC power: 12 inches.
 - 8. Between 125 V, 48 V and 24 VDC and 600 V and less AC power or control: 2 inches.
 - 9. Between 125 V, 48 V and 24 VDC and greater than 600 VAC power: 2 inches.
 - 10. Between 600 V and less AC and greater than 600 VAC: 2 inches.
 - 11. Between process, gas, air and water pipes: 6 inches.
- D. Conduits shall be installed to eliminate moisture pockets.
 - 1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.
- E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.
- F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.
- G. Provide all required openings in walls, floors, and ceilings for conduit penetration.
 - 1. See Specification Section 01 73 20.

3.3 RACEWAY APPLICATIONS

- A. Permitted Raceway Types Per Wire or Cable Types:

1. Power wire or cables: All raceway types.
 2. Control wire or cables: All raceway types.
 3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
 4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
 5. Telecommunication cables: All raceway types.
- B. Permitted Raceway Types Per Area Designations:
1. Dry areas:
 - a. RGS.
 - b. RAC.
 2. Wet areas:
 - a. RGS.
 - b. RAC.
 - c. Fiberglass (above grade rated).
 3. Corrosive areas:
 - a. PVC-RGS.
 - b. RAC.
 - c. Fiberglass (above grade rated).
 4. Highly corrosive areas:
 - a. PVC-RGS.
 - b. PVC-80.
 - c. Fiberglass (above grade rated).
 5. NFPA 70 hazardous areas:
 - a. RGS.
 - b. RAC when required by other area designations.
- C. Permitted Raceway Types Per Routing Locations:
1. In stud framed walls:
 - a. EMT.
 2. In concrete block or brick walls:
 - a. PVC-40.
 3. Above acoustical tile ceilings:
 - a. EMT.
 - b. NEMA 1 rated wireway.
 4. Embedded in poured concrete walls and floors:
 - a. PVC-40.
 - b. Fiberglass (above or below grade rated).
 - c. Fiberglass (above grade rated) when emerging from concrete into areas designated as wet, corrosive or highly corrosive.
 - d. PVC-RGS when emerging from concrete into areas designated as wet, corrosive or highly corrosive.
 5. Beneath floor slab-on-grade:
 - a. PVC-40.
 - b. Fiberglass (above or below grade rated).
 6. Through floor penetrations, see Specification Section 01 73 20:
 - a. Fiberglass (above grade rated) in areas designated as wet, corrosive or highly corrosive.

- b. PVC-RGS in areas designated as wet, corrosive or highly corrosive.
 - 7. Direct buried conduits and ductbanks:
 - a. PVC-80.
 - b. Fiberglass (above or below grade rated).
 - c. 90 degrees elbows for transitions to above grade:
 - 1) PVC-RGS.
 - 2) Fiberglass (above grade rated).
 - d. Long sweeping bends greater than 15 degrees:
 - 1) PVC-RGS.
 - 2) Fiberglass (above or below grade rated).
 - 8. Concrete encased ductbanks:
 - a. PVC-40.
 - b. PVC-EB.
 - c. Fiberglass (above or below grade rated).
 - d. 90 degree elbows for transitions to above grade:
 - 1) PVC-RGS.
 - 2) Fiberglass (above grade rated).
 - e. Long sweeping bends greater than 15 degrees:
 - 1) RGS for sizes 2 inches and larger.
 - 2) Fiberglass (above or below grade rated).
- D. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above the ceilings.
 - 1. The maximum length shall not exceed:
 - a. 6 feet to light fixtures.
 - b. 3 feet to all other equipment.
- E. FLEX-LT conduits shall be installed as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
 - 1. The maximum length shall not exceed:
 - a. 6 feet to light fixtures.
 - b. 3 feet to motors.
 - c. 2 feet to all other equipment.
- F. HAZ-FLEX coupling shall be installed as the final conduit to motors, electrically operated valves, instrumentation primary elements and electrical equipment that is liable to vibrate.
 - 1. The maximum length shall not exceed:
 - a. 3 feet to motors.
 - b. 2 feet to all other equipment.
- G. NEMA 1 Rated Wireway:
 - 1. Surface mounted in electrical rooms.
 - 2. Surface mounted above removable ceilings tiles of an architecturally finished area.
- H. NEMA 3R Wiring Trough:
 - 1. Surface mounted in exterior locations.
- I. NEMA 4X Rated Wireway:
 - 1. Surface mounted in areas designated as wet and or corrosive.

- J. NEMA 12 Rated Wireway:
 - 1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.
- K. Underground Conduit: See Specification Section 26 05 43.

3.4 CONDUIT FITTINGS AND ACCESSORIES

- A. Conduit Seals:
 - 1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
 - 2. Fill plug and drain shall be accessible.
 - 3. Pour the conduit seals in a two-step process.
 - a. Pour the seal and leave cover off.
 - b. After seal is dry, inspect for proper sealing, install cover and mark (for example, paint or permanent marker) as complete.
- B. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
 - 1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.
- C. Install Expansion Fittings:
 - 1. Where conduits are exposed to the sun and conduit run is greater than 200 feet.
 - 2. Elsewhere as identified on the Drawings.
- D. Install Expansion/Deflection Fittings:
 - 1. Where conduits enter a structure.
 - a. Except electrical manholes and handholes.
 - b. Except where the ductbank is tied to the structure with rebar.
 - 2. Where conduits span structural expansions joints.
 - 3. Elsewhere as identified on the Drawings.
- E. Threaded connections shall be made wrench-tight.
- F. Conduit joints shall be watertight:
 - 1. Where subjected to possible submersion.
 - 2. In areas classified as wet.
 - 3. Underground.
- G. Terminate Conduits:
 - 1. In metallic outlet boxes:
 - a. RGS:
 - 1) Conduit hub and locknut.
 - 2) Insulated bushing and two locknuts.
 - 3) Use grounding type locknut or bushing when required by NFPA 70.
 - b. EMT: Compression type connector and locknut.
 - 2. In NEMA 1 rated enclosures:
 - a. RGS:
 - 1) Conduit hub and locknut.
 - 2) Insulated bushing and two locknuts.
 - 3) Use grounding type locknut or bushing when required by NFPA 70.
 - b. EMT: Compression type connector and locknut.
 - 3. In NEMA 12 rated enclosures:

- a. Watertight, insulated and gasketed hub and locknut.
- b. Use grounding type locknut or bushing when required by NFPA 70.
- 4. In NEMA 4 and NEMA 4X rated enclosures:
 - a. Watertight, insulated and gasketed hub and locknut.
- 5. In NEMA 7 and NEMA 9 rated enclosures:
 - a. Into an integral threaded hub.
- 6. When stubbed up through the floor into floor mount equipment:
 - a. With an insulated grounding bushing on metallic conduits.
 - b. With end bells on nonmetallic conduits.
- H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

- A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
 - 1. Dry or wet and/or hazardous areas:
 - a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
 - b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.
 - 2. Corrosive areas:
 - a. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.
 - b. PVC coated steel system consisting of: PVC coated galvanized steel channels and fittings and conduit clamps with stainless steel nuts and hardware.
 - 3. Highly corrosive areas:
 - a. PVC coated steel system consisting of: PVC coated galvanized steel channels and fittings and conduit clamps with stainless steel nuts and hardware.
 - b. Fiberglass system consisting of: Fiberglass channels and fittings, nuts and hardware and conduit clamps.
 - 4. Conduit type shall be compatible with the support system material.
 - a. Galvanized steel system may be used with RGS.
 - b. Stainless steel system may be used with RGS.
 - c. PVC coated galvanized steel system may be used with PVC-RGS.
 - d. Aluminum system may be used with RAC.
 - e. Fiberglass system may be used with PVC-40 and PVC-80.
- B. Permitted single conduit support fasteners per area designations and conduit types:
 - 1. Architecturally finished areas:
 - a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.
 - b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 - c. Provide anti-rattle conduit supports when conduits are routed through metal studs.
 - 2. Dry or wet and/or hazardous areas:
 - a. Material: Zinc plated steel, stainless steel and malleable iron.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.

3. Corrosive areas:
 - a. Material: Stainless steel and PVC coat malleable iron or steel.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 4. Highly corrosive areas:
 - a. Material: PVC coat malleable iron or steel.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 5. Conduit type shall be compatible with the support fastener material.
 - a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS.
 - b. Stainless steel system may be used with RGS and RAC.
 - c. PVC coated fasteners may be used with PVC-RGS.
 - d. Nonmetallic fasteners may be used with PVC-40, PVC-80 and fiberglass.
- C. Conduit Support General Requirements:
1. Maximum spacing between conduit supports per NFPA 70.
 2. Support conduit from the building structure.
 3. Do not support conduit from process, gas, air or water piping; or from other conduits.
 4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 pounds.
 - a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
 - b. Conduit hangers:
 - 1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
 - c. Do not use suspended ceiling support systems to support raceways.
 - d. Hangers in metal roof decks:
 - 1) Utilize fender washers.
 - 2) Not extend above top of ribs.
 - 3) Not interfere with vapor barrier, insulation, or roofing.
 5. Conduit support system fasteners:
 - a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
 - b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

- A. General:
1. Install products in accordance with manufacturer's instructions.
 2. See Specification Section 26 05 00 and the Drawings for area classifications.
 3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
 4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.
- B. Outlet Boxes:
1. Permitted uses of metallic outlet boxes:
 - a. Housing of wiring devices:
 - 1) Recessed in all stud framed walls and ceilings.

- 2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.
 - b. Pull or junction box:
 - 1) Above gypsum wall board or acoustical tile ceilings.
 - 2) Above 10 feet in an architecturally finished area where there is no ceiling.
 2. Permitted uses of cast outlet boxes:
 - a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, highly corrosive and hazardous areas.
 - b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
 3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.
 4. Set device outlet boxes plumb and vertical to the floor.
 5. Outlet boxes recessed in walls:
 - a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
 - b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
 6. Place barriers between switches in boxes with 277 V switches on opposite phases.
 7. Back-to-back are not permitted.
 8. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.
- C. Pull and Junction Boxes:
1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
 - a. Make covers of boxes accessible.
 2. Permitted uses of NEMA 1 enclosure:
 - a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.
 3. Permitted uses of NEMA 4 enclosure:
 - a. Pull or junction box surface mounted in areas designated as wet.
 4. Permitted uses of NEMA 4X metallic enclosure:
 - a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.
 5. Permitted uses of NEMA 7 enclosure:
 - a. Pull or junction box surface mounted in areas designated as Class I hazardous.
 - 1) Provide PVC coating in corrosive and highly corrosive areas when PVC coated conduit is used.
 6. Permitted uses of NEMA 12 enclosure:
 - a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION

SECTION 26 05 43
ELECTRICAL - EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Manholes.
 - b. Handhole.
 - c. Underground conduits and ductbanks.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 03 - Concrete.
 - 2. Section 03 00 05 - Concrete.
 - 3. Section 26 05 33 - Raceways and Boxes.
 - 4. Section 31 23 33 - Trenching, Backfilling and Compacting for Utilities.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB-17, Standard Specifications for Highway Bridges.
 - 2. ASTM International (ASTM):
 - a. A536, Standard Specification for Ductile Iron Castings.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Society of Cable Telecommunications Engineers (SCTE):
 - a. 77, Specifications for Underground Enclosure Integrity.

1.3 DEFINITIONS

- A. Direct-Buried Conduit(s):
 - 1. Individual (single) underground conduit.
 - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.
- B. Concrete Encased Ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. Provide signed and sealed design computations for manholes and handholes indicating compliance with design load rating.
 - 2. Fabrication and/or layout drawings:
 - a. Provide dimensional drawings of each manhole and handhole indicating all specified accessories and conduit entry locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Prefabricated composite handholes:
 - a. Armorcast Products Company.
 - b. Quazite by Hubbell.
 - c. Synertech by Oldcastle Enclosure Solutions.
 - 2. Precast manholes and handholes:
 - a. Lister Industries Ltd.
 - b. Oldcastle Enclosure Solutions.
 - c. Jensen Precast and Utility Concrete Products.
 - 3. Manhole and handhole and ductbank accessories:
 - a. Cantex, Inc.
 - b. Condux International, Inc.
 - c. Neenah Enterprises, Inc.
 - d. Prime Conduit.
 - e. Thomas and Betts.
 - f. Underground Devices, Inc.
 - g. Unistrut by Atkore International, Inc.

2.2 MANHOLES AND HANDHOLES

- A. Prefabricated Composite Material Handholes:
 - 1. Handhole body and cover: Fiberglass reinforced polymer concrete conforming to all test provisions of SCTE 77.
 - 2. Minimum load ratings: SCTE 77 Tier 5.
 - 3. Open bottom.
 - 4. Stackable design as required for specified depth.
 - 5. Cover:
 - a. Engraved legend of "ELECTRIC" or "COMMUNICATIONS".
 - b. Non-gasketed bolt down with stainless steel penta head bolts.
 - c. Lay-in non-bolt down, when cover is over 100 pounds.
 - d. One or multiple sections so the maximum weight of a section is 125 pounds.
 - 6. Cover lifting hook: 24 inches minimum in length.
- B. Precast Manholes and Handholes:
 - 1. Fiberglass reinforced polymer concrete or steel reinforced cement concrete structures:
 - 2. AASHTO live load rating: H-20 for full deliberate vehicle traffic.
 - 3. Mating edges: Tongue and groove type.
 - 4. Solid bottom with a 12 inches x 12 inches or 12 inches diameter french drain in the bottom of each manhole.
 - 5. Cable pulling eyes opposite all conduit entrances.
 - a. Coordinate exact location with installation contractor.

2.3 CONCRETE MANHOLE AND HANDHOLE ACCESSORIES

- A. Cover and Frame:
 - 1. Cast ductile iron: ASTM A536.

2. AASHTO live load rating: H-20.
 3. Diameter: 30 inches.
 4. Cast the legend "ELECTRICAL" or "COMMUNICATIONS" into manhole and handhole covers.
- B. Cable Racks and Hooks:
1. Material: Heavy-duty nonmetallic (glass reinforced nylon).
 2. Hook loading capacity: 400 pounds minimum.
 3. Rack loading capacity: Four hooks maximum.
 4. Hook deflection: 0.25 inches maximum.
 5. Hooks: Length, as required, with positive locking device to prevent upward movement.
 6. Mounding hardware: Stainless steel.
- C. Cable Pulling Irons:
1. 7/8 inches diameter hot-dipped galvanized steel.
 2. 6000 pound minimum pulling load.

2.4 UNDERGROUND CONDUIT AND ACCESSORIES

- A. Concrete and reinforcing steel: See Division 03 Specifications.
- B. Conduit: See Specification Section 26 05 33.
- C. Duct Spacers/Supports:
1. High density polyethylene or high impact polystyrene.
 2. Interlocking web or mesh design.
 3. Provide 3 inches minimum spacing between conduits.
 4. Accessories, as required:
 - a. Hold down bars.
 - b. Ductbank strapping.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings indicate the intended location of manholes and handholes and routing of ductbanks and direct buried conduit.
1. Field conditions may affect actual routing.
- B. Manhole and Handhole Locations:
1. Approximately where shown on the Drawings.
 2. As required for pulling distances.
 3. As required to keep pulling tensions under allowable cable tensions.
 4. As required for number of bends in ductbank routing.
 5. Shall not be installed in a swale or ditch.
 6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
 7. Locations are to be approved by the Engineer prior to excavation and placement or construction of manholes and handholes.
- C. Install products in accordance with manufacturer's instructions.
- D. Install manholes and handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.

E. Comply with Specification Section 31 23 33 for trenching, backfilling and compacting.

3.2 MANHOLES AND HANDHOLES

A. Prefabricated Composite Material Handholes:

1. For use in areas subjected to occasional non-deliberate vehicular traffic.
2. Place handhole on a foundation of compacted 1/4 to 1/2 inches crushed rock or gravel a minimum of 8 inches thick and 6 inches larger than handholes footprint on all sides.
3. Provide concrete encasement ring around handhole per manufacturers installation instructions (minimum of 10 inches wide x 12 inches deep).
4. Install so that the surrounding grade is 1 inch lower than the top of the handhole.
5. Size: As indicated on the Drawings or as required for the number and size of conduits.
6. Provide cable rails and pulling eyes as needed.

B. Precast Manholes and Handholes:

1. For use in vehicular and non-vehicular traffic areas.
2. Construction:
 - a. Grout or seal all joints, per manufacturer's instructions.
 - b. Support cables on walls by cable racks:
 - 1) Provide a minimum of two racks, install symmetrically on each wall of manholes and handholes.
 - a) Provide additional cable racks, as required, so that both ends of cable splices will be supported horizontally.
 - 2) Equip cable racks with adjustable hooks: Quantity of cable hooks as required by the number of conductors to be supported.
 - c. In each manhole and handhole, drive 3/4 inches x 10 feet long copper clad ground rod into the earth with approximately 6 inches exposed above finished floor.
 - 1) Drill opening in floor for ground rod.
 - 2) Connect all metallic components to ground rod by means of #8 AWG minimum copper wire and approved grounding clamps.
 - 3) Utilize a ground bar in the manhole or handhole if the quantity of ground wires exceeds three.
 - a) Connect ground bar to ground rod with a #2/0 AWG minimum copper wire.
3. Place manhole or handhole on a foundation of compacted 1/4 to 1/2 inches crushed rock or gravel a minimum of 8 inches thick and 6 inches larger than manholes or handholes footprint on all sides.
4. Install so that the top of cover is 1 inch above finished grade.
 - a. Where existing grades are higher than finished grades, install sufficient number of courses of curved segmented concrete block between top of handhole and manhole frame to temporarily elevate manhole cover to existing grade level.
5. After installation is complete, backfill and compact soil around manholes and handholes.
6. Handhole size:
 - a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.
 - b. Minimum floor dimension of 4 feet x 4 feet and minimum depth of 4 feet.
7. Manhole size:
 - a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.
 - b. Minimum floor dimension of 6 feet x 6 feet and a minimum depth of 6 feet.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:

1. Ductbank types per location:
 - a. Reinforced concrete ductbank:
 - 1) Under aircraft pavement.
 - 2) Under railroads.
 - 3) As indicated in the Ductbank Schedule.
 - b. Concrete encased ductbank:
 - 1) Under roads.
 - 2) Conduits containing medium voltage cables.
 - 3) Pad mounted transformer secondaries.
 - 4) Plant process equipment feeders and controls.
 - 5) As indicated in the Ductbank Schedule.
 - c. Direct-buried conduit(s):
 - 1) Area/Roadway lighting.
 - 2) As indicated in the Ductbank Schedule.
2. Do not place concrete or soil until conduits have been observed by the Engineer.
3. Ductbanks shall be sloped a minimum of 4 inches per 100 feet or as detailed on the Drawings.
 - a. Low points shall be at manholes or handholes.
4. During construction and after conduit installation is complete, plug the ends of all conduits.
5. Provide conduit supports and spacers.
 - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 inches and less: 3 feet.
 - 2) 1-1/4 to 3 inches: 5 feet.
 - 3) 3-1/2 to 6 inches: 7 feet.
 - b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 inches and less: 10 feet.
 - 2) 1-1/4 to 2-1/2 inches: 14 feet.
 - 3) 3 inches and larger: 20 feet.
 - c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
6. Stagger conduit joints at intervals of 6 inches vertically.
7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
8. Accomplish underground changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 10 feet.
 - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
9. Furnish manufactured elbows at end of runs as the conduit transitions to above grade.
 - a. Minimum radius of 18 inches for conduits less than 3 inches trade size and 36 inches for conduits 3 inches trade size and larger.
10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
11. After the conduit run has been completed:

- a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
 - 1) Test mandrel:
 - a) Length: Not less than 12 inches.
 - b) Diameter: Approximately 1/4 inches less than the inside diameter of the conduit.
 - b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
 - 12. Pneumatic rodding may be used to draw in lead wire.
 - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
 - b. Extend cord 3 feet beyond ends of conduit.
 - 13. Transition from rigid nonmetallic conduit to rigid metallic conduit, per Specification Section 26 05 33, prior to entering a structure or going above ground.
 - a. Except rigid nonmetallic conduit may be extended directly to manholes, handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment where the conduit is concealed within the enclosure.
 - b. Terminate rigid PVC conduits with end bells.
 - c. Terminate steel conduits with insulated bushings.
 - 14. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable.
 - 15. Placement of conduits stubbing into handholes and manholes shall be located to allow for proper bending radiuses of the cables.
- B. Concrete Encased Ductbank:
- 1. Ductbank system consists of conduits completely encased in minimum 3 inches of concrete and with separations between different cabling types as required in Specification Section 26 05 33 or as detailed on the Drawings.
 - 2. Install so that top of concrete encased duct, at any point:
 - a. Is not less than 24 inches below grade.
 - b. Is below pavement sub-grading.
 - 3. Where identified and for a distance 10 feet either side of the area, the concrete shall be reinforced.
 - a. The reinforcement shall consist of #4 bars and #4 ties placed 12 inches on center, in accordance with Division 03 Specification Sections or as detailed on the Drawings.
 - b. Conduit supports to be staggered to minimize weak vertical shear point.
 - 4. Conduit supports shall provide a uniform minimum clearance of 3 inches between the bottom of the trench and the bottom row of conduit.
 - 5. Conduit separators shall provide a uniform minimum clearance of 3 inches between conduits or as required in Specification Section 26 05 33 for different cabling types.
- C. Direct-Buried Conduit(s):
- 1. Install so that the top of the uppermost conduit, at any point:
 - a. Is not less than 30 inches below grade.
 - b. Is below pavement sub-grading.
 - 2. Provide a uniform minimum clearance of 3 inches between conduits or as required in Specification Section 26 05 33 for different cabling types.
 - a. Maintain the separation of multiple planes of conduits by one of the following methods:
 - 1) Install multilevel conduits with the use of conduit supports and separators to maintain the required separations, and backfill with flowable fill (100 psi) per Specification Section 31 23 33 or concrete per Division 03 specifications.

- 2) Install the multilevel conduits one level at a time.
 - a) Each level is backfilled with the appropriate amount of soil and compaction, per Specification Section 31 23 33, to maintain the required separations.

END OF SECTION

SECTION 26 08 13
ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for acceptance testing.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 01 61 03 - Equipment - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. InterNational Electrical Testing Association (NETA):
 - a. ATS, Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems.
 - 2. Nationally Recognized Testing Laboratory (NRTL).
 - 3. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
 - a. 455-78-B, Optical Fibres - PART 1-40: Measurement Methods and Test Procedures - Attenuation.
- B. Qualifications:
 - 1. Testing firm:
 - a. An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration , and adjusting of systems.
 - b. Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain, according to NIST.
 - 2. Field personnel:
 - a. Minimum of one year field experience covering all phases of electrical equipment inspection, testing, and calibration.
 - b. Relay test technician having previous experience with testing and calibration of relays of the same manufacturer and type used on project and proficient in setting and testing the types of protection elements used.
 - c. Supervisor certified by NETA or NICET.
 - 1) As an alternative, supervising technician may be certified by the equipment manufacturer
 - 3. Analysis personnel:
 - a. Minimum three years combined field testing and data analysis experience.
 - b. Supervisor certified by NETA or NICET.
 - 1) As an alternative, supervising technician may be certified by the equipment manufacturer.
- C. Phasing Diagram:
 - 1. Coordinate with Utility Company for phase rotations and Phase A, B and C markings.
 - a. Create a phasing diagram showing the coordinated phase rotations with generators and motors through the transformers.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Equipment Monitoring and Testing Plan.
- B. Informational Submittals:
 - 1. Prior to energizing equipment:
 - a. Coordinated phasing diagram.
 - b. Photocopies of continuity tests.
 - 2. Within two weeks after successful completion of Demonstration Period (Commissioning Period):
 - a. Single report containing information including:
 - 1) Summary of Project.
 - 2) Information from pre-energization testing.
 - 3) Testing and monitoring reports.

PART 2 - PRODUCTS

2.1 FACTORY QUALITY CONTROL

- A. Provide Electrical equipment with all factory tests required by the applicable industry standards or NRTL.
- B. Factory testing will not be accepted in lieu of specified field acceptance testing requirements.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. General:
 - 1. Complete electrical testing in three phases:
 - a. Pre-energization testing phase.
 - b. Equipment energized with no load.
 - c. Equipment energized under load.
 - 2. Perform testing in accordance with this Specification Section and NETA ATS.
 - 3. Provide field setting and programming of all adjustable protective devices and meters to settings [provided by the Engineer.] [as determined by the approved coordination study.]
 - 4. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
 - a. Contract Drawings and Specifications.
 - b. Related construction change documentation.
 - c. Approved Shop Drawings.
 - d. Approved Operation and Maintenance Manuals.
 - e. Other pertinent information as required.
- B. Equipment Monitoring and Testing Plan:
 - 1. Approved in accordance with Shop Drawing submittal schedule.
 - 2. Included as a minimum:
 - a. Qualifications of firm, field personnel, and analysis personnel doing the Work.
 - b. List and description of testing and analysis equipment to be utilized.
 - c. List of all equipment to be testing, including:

- 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,
- C. Instruments Used in Equipment and Connections Quality Control Testing:
1. Minimum calibration frequency:
 - a. Field analog instruments: Not more than 6 months.
 - b. Field digital instruments: Not more than 12 months.
 - c. Laboratory instruments: Not more than 12 months.
 - d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
 2. Carry current calibration status and labels on all testing instruments.
 3. See individual testing programs for additional instrumentation compliance requirements.
- D. Testing and Monitoring Program Documentation:
1. Provide reports with tabbed sections for each piece of equipment tested.
 2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
 - a. Include legible copies of all forms used to record field test information.
 3. Prior to start of testing, submit one copy of preliminary report format for Engineer review and comment
 - a. Include data gathering and sample test report forms that will be utilized.
 4. In the final report, include as a minimum, the following information for all equipment tested:
 - a. Equipment identification, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,
 - b. Date and time of each test.
 - c. Ambient conditions including temperature, humidity, and precipitation.
 - d. Visual inspection report.
 - e. Description of test and referenced standards, if any, followed while conducting tests.
 - f. Results of initial and all retesting.
 - g. Acceptance criteria.
 - h. "As found" and "as left" conditions.
 - i. Corrective action, if required, taken to meet acceptance.
 - j. Verification of corrective action signed by the Contractor, equipment supplier, and Owner's representative.
 - k. Instrument calibration dates of all instruments used in testing.
 5. Provide three (3) bound final reports prior to Project final completion.
- E. Electrical Equipment and Connections Testing Program:
1. See individual Division 26 Specification Sections for equipment specific testing requirements.
 2. Test all electrical equipment.
 - a. Perform all required NETA testing.
 - b. Perform all required NETA testing plus the optional testing identified with each specific type of equipment in Article 3.2 of this Specification Section.

3.2 SPECIFIC EQUIPMENT TESTING REQUIREMENTS

- A. Switchgear and Switchboards:
 - 1. Perform inspections and tests per NETA ATS 7.1.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- B. Transformers - Small Dry Type:
 - 1. Perform inspections and tests per NETA ATS 7.2.1.1.
 - 2. Perform the following additional tests:
 - a. Record phase-to-phase, phase-to-neutral, and neutral-to-ground voltages at no load after energizing, and at operating load after startup.
 - 3. Adjust tap connections as required to provide secondary voltage within 2-1/2% of nominal under normal load after approval of Engineer.
 - 4. Record as-left tap connections.
- C. Transformers - Large Dry Type:
 - 1. Perform inspections and tests per NETA ATS 7.2.1.2.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 - 3. Perform the following additional tests:
 - a. Record phase-to-phase, phase-to-neutral, and neutral-to-ground voltages at no load after energizing, and at operating load after start-up.
 - 4. Adjust tap connections as required to provide secondary voltage within 2-1/2% of nominal under normal load.
 - 5. Record as-left tap connections.
- D. Transformers - Liquid Filled:
 - 1. Perform inspections and tests per NETA ATS 7.2.2.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 - 3. Perform the following additional tests:
 - a. Record phase-to-phase, phase-to-neutral, and neutral-to-ground voltages at no load after energizing, and at operating load after start-up.
 - 4. Adjust tap changer setting as required to provide secondary voltage within 2-1/2% of nominal under normal load after approval of Engineer.
 - 5. Record as-left tap changer setting.
- E. Transformer Cooling Fans/Temperature Controllers:
 - 1. Verify each temperature sensor is of the correct type and rating and provides the correct output signal at ambient temperature.
 - 2. Using a thermocouple or RTD simulator, verify correct temperature indication and alarm and fan control relay operation by signal injection.
 - 3. Verify operation of controls in manual and automatic mode.
 - 4. Verify operation of all cooling fans, record running current and compare to nameplate value.
 - 5. Verify trip circuit operation where provided.
- F. Cable - Low Voltage:
 - 1. Perform inspections and tests per NETA ATS 7.3.2.
- G. Cable - Medium Voltage:
 - 1. Perform inspections and tests per NETA ATS 7.3.3.

2. Perform Dielectric Withstand Test.
 3. Perform tan delta or partial discharge Baseline Diagnostic Tests.
- H. Cable - Optical Fiber:
1. Perform inspections on tests per TIA/EIA/ANSI 455-78-B, including:
 - a. Optical time domain reflectometer test.
 - b. Power attenuation test.
 - c. Gain margin test.
- I. Busway and Busduct:
1. Perform inspections and tests per NETA ATS 7.4.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- J. Air Interrupter Switches:
1. Perform inspections and tests per NETA ATS 7.5 and NETA ATS 7.6.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS on all medium voltage switches:
 - a. Insulation resistance phase-to-phase, phase-to-ground in open and closed positions and across each open pole.
- K. Medium Voltage Source Transfer System;
1. Perform applicable inspections and test per:
 - a. NETA ATS for Air Interrupter Switches.
 - b. Manufacturer's instructions.
- L. SF6 Insulated Switches:
1. Perform applicable inspections and tests per NETA ATS 7.6.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS:
 - a. Insulation resistance phase-to-phase, phase-to-ground in open and closed positions and across each open pole.
 4. Test [low pressure] [low density] alarm circuit.
- M. Medium Voltage Circuit Breakers:
1. Perform inspections and tests per NETA ATS 7.6.2.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS:
 - a. Control wiring insulation resistance.
 - b. Minimum trip and close voltage.
 - c. Overpotential.
 4. Perform the following additional tests:
 - a. High-potential vacuum integrity test per manufacturer's recommendations.
- N. Low Voltage Power Circuit Breakers:
1. Perform inspections and tests per NETA ATS 7.6.1.2.
 - a. Tests shall include primary current injection testing of all breakers at final settings.

- b. Where short-time or instantaneous settings on large frame breakers are beyond the current capability of field testing, primary injection tests at reduced currents shall be permitted if combined with secondary injection calibration test of trip unit at final settings.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 - 3. Perform the following additional tests:
 - a. Shunt trip devices minimum tripping voltage.
 - 4. Record as-left settings.
- O. Low Voltage Molded Case Circuit Breakers:
 - 1. Perform inspections and tests per NETA ATS 7.6.1.1.
 - 2. Components:
 - a. Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 - b. Thermal magnetic breakers: Visual and mechanical inspection per NETA ATS only.
 - c. Solid state trip type: Visual and mechanical inspection and electrical tests per NETA ATS.
 - 3. Record as-left settings.
- P. Network Protectors:
 - 1. Perform inspections and tests per NETA ATS 7.8.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 - 3. Perform all tests identified as optional per NETA ATS:
 - 4. Perform the following additional tests:
 - a. Verify reverse current sensitivity by opening transformer primary switch with feeder energized and no load on transformer and observing that network protector opens on magnetizing current alone.
- Q. Protective Relays:
 - 1. Perform inspections and tests per NETA ATS 7.9.
 - a. Tests to be performed using secondary injection of 3 PH current and potential at final settings.
 - b. Test at manufacturer's recommended test points and critical timing points identified on relay setting sheet.
 - 2. Perform all tests identified as optional per NETA ATS.
 - 3. Perform the following additional tests:
 - a. Verification of direct trip of associated lockout relay or circuit breaker(s) by using relay test function or shorting trip contact at relay case.
 - b. Microprocessor-based relays:
 - 1) Complete commissioning procedure per manufacturer's instructions, followed by tests of each relay element at final settings.
 - 2) Verification of all internally-programmed logic.
 - c. Verification of all auxiliary input and output signals.
 - d. Verification of power supply/self-diagnostic alarm contact and remote annunciation.
 - 4. Record as-left settings.
- R. Instrument Transformers:
 - 1. Perform inspections and tests per NETA ATS 7.10.

2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS:
 - a. Dielectric withstand test on potential transformers.
- S. Metering:
1. Perform inspections and tests per NETA ATS 7.11.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- T. Grounding:
1. Perform inspections and tests per NETA ATS 7.13.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- U. Ground Fault Protection:
1. Perform inspections and tests per NETA ATS 7.14.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS:
 - a. Control wiring insulation resistance.
 4. Perform the following additional tests for four-wire systems:
 - a. Primary current injection into switchgear bus with test set configured to simulate transformer source and high current jumper used to simulate unbalanced load and ground fault conditions.
 - b. Verify no tripping for unbalanced load on each feeder and each main breaker.
 - c. Verify no tripping for unbalanced load across tie breaker for dual-source schemes.
 - d. Verify tripping for ground fault on load side of feeder each feeder and on each main bus.
 - e. Verify tripping for ground fault on a single feeder and on each main bus through tie breaker(s) for multiple-source schemes.
- V. Motors:
1. Perform inspections and tests per NETA ATS 7.15.
 2. Testing of motors:
 - a. After installation and prior to energizing the motor, perform inspections and tests per NETA ATS 7.15 for all motors 25 HP or above.
 - b. Ensure motor has been lubricated.
 - c. Bump motor to check for correct rotation.
- W. Motor Controllers:
1. Perform inspections and tests per NETA ATS 7.16.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- X. Generators:
1. Perform inspections and tests per NETA ATS 7.15.2.
 2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
- Y. DC Power Systems:
1. Perform inspections and tests per NETA ATS 7.18.

2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
 3. Perform the following optional tests per NETA ATS:
 - a. Cell impedance test.
- Z. Control System Functional Test:
1. Perform test upon completion of equipment acceptance tests.
 2. The test is to prove the correct interaction of all sensing, processing and action devices.
 3. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
 4. Perform the following tests:
 - a. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.
 - b. Verify the correct operation of all sensing devices, alarms and indicating devices.

END OF SECTION

SECTION 26 24 19
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Motor control centers.
 - 2. Separately mounted motor starters (including those supplied with equipment).
 - 3. Manual motor starters.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. International Electrotechnical Commission (IEC).
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
 - b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
 - c. ICS 18, Motor Control Centers.
 - 3. Underwriters Laboratories, Inc. (UL):
 - a. 508, Standard for Industrial Control Equipment.
 - b. 845, Motor Control Centers.
- B. Miscellaneous:
 - 1. Verify motor horsepower loads, other equipment loads, and controls from approved shop drawings and notify Engineer of any discrepancies.
 - 2. Verify the required instrumentation and control wiring for a complete system and notify Engineer of any discrepancies.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 26 05 00 for additional requirements.
 - 2. Fabrication and/or layout drawings:
 - a. Motor control center:
 - 1) Elevation drawing with overall dimensions.
 - 2) Starter and component schedule.
 - 3) Identification of units and their location in the MCC.
 - 4) Location of incoming line terminals.
 - 5) Mounting dimensions.
 - 6) Available conduit entrance areas.
 - 7) Nameplate schedule.
 - 8) Assembly ratings (amps, volts, short circuit, etc.).
 - 9) Unit ladder logic wiring for each unit depicting electrical interlocking and wiring between units (NEMA ICS 18 Class II) and identification of terminals where field

devices or remote control signals are to be terminated (NEMA ICS 18 Class II-S) including industry standard symbology of the field devices as indicated on the Drawings, product specification and/or loop descriptions. Drawings indicate basic control functionality, provide diagrams for the manufacturer's product(s) meeting the required functionality.

- b. Separately mounted combination starters:
 - 1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated including industry standard symbology of the field devices as indicated on the Drawings, specification and/or loop descriptions. Drawings indicate basic control functionality, provide diagrams for the manufacturer's product(s) meeting the required functionality.
 - 2) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- b. Fabrication and/or layout drawings updated with as-built conditions.

C. Informational Submittals:

- 1. Equipment marking and documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Allen-Bradley by Rockwell Automation, Inc.
 - 2. c3controls.
 - 3. Eaton.
 - 4. GE by ABB.
 - 5. Square D by Schneider Electric.
 - 6. Siemens Corporation.

2.2 MOTOR CONTROL CENTERS

A. Ratings:

- 1. 600 V class, 3 PH, 60 Hz with operating voltage and number of wires as indicated on the Drawings.
- 2. Assembly short circuit current and interrupting device rating as indicated on the Drawings.
- 3. Service Entrance Equipment rated when indicated on the Drawings.

B. Construction:

- 1. Standards: UL 845.
- 2. Totally enclosed, dead front, free standing assemblies, bolted together to form a single assembly.
- 3. Fabricate of not less than 14 GA steel with 16 GA steel doors in standardized units.
- 4. Nominal size per section: 20 inches wide, 20 or 21 inches deep, and 90 inches high.
- 5. Enclosure:
 - a. NEMA 1 gasketed.

- b. NEMA 12:
 - 1) Dust-tight and drip-proof.
 - 2) Gasketed material round all doors, door cutouts, cover plates, side, top and back sheets.
 - 3) Gasketed bottom plate.
- c. NEMA 3R non-walk-in:
 - 1) Rainproof and sleet resistant.
 - 2) NEMA 1 gasketed enclosure with an outdoor house erected around it.
- 6. Horizontal wireways:
 - a. At the top, isolated from the main bus
 - b. At the bottom.
 - c. Easily accessible.
 - d. Full length of the MCC.
- 7. Vertical wireway:
 - a. Located in each MCC section that accepts plug-in units.
 - b. Connect to top and bottom wireways.
 - c. Isolated from the unit interiors.
 - d. Accessible through a separate hinged door.
 - e. Cable tie supports to hold wiring in place.
- 8. Unit doors:
 - a. Formed round corners and rolled edges.
 - b. Minimum of two heavy-duty hinges or continuous piano hinge.
 - c. Held closed by means of captive fasteners.
 - d. Fabricate to be a part of the structure and not part of the starter.
- 9. Unit cubicles:
 - a. Draw-out type for motor starters through NEMA Size 5, breakers through 400A frame and fusible switches through 400A.
 - b. Guide rails for supporting and aligning starters.
 - 1) Larger motor starters, breakers and fusible switches to be bused or cabled to the main horizontal bus.
 - c. Operating handle:
 - 1) With the unit stabs engaged and door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
 - 2) Circuit breaker and MCP operators includes a separate TRIPPED position.
 - 3) Mechanical interlock to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism.
 - 4) Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism.
 - 5) Non-defeatable interlock to prevent the installation or removal of a unit unless the disconnect is in the OFF position.
 - 6) Padlockable in the OFF position.
 - d. Control panel:
 - 1) Provide control devices (selector switch, indicating devices, etc.) as indicated on the Drawings per Specification Section 26 09 16.
 - e. Control power:
 - 1) Control power transformer:

- a) 120 V secondary.
 - b) Fused on primary and secondary side.
 - c) Sized for 140% of required load.
 - f. Minimum of one full size space unit (12 inches) for any combination magnetic motor starter or starter without overload relay.
 - g. One-half full size space unit (6 inches) for circuit breakers 100 A and less.
 - h. Effectively baffled to isolate any ionized gases which may occur within unit starter.
 - 10. Externally mounted overload relay pushbutton.
 - 11. Assemblies effectively ventilated to allow relocation of starters and other components:
 - a. Within the assembly and with the same load.
 - b. Without having to compensate for changes in location.
 - 12. Finish: Rust inhibited primer and manufacturer's standard paint inside and out.
 - 13. Provide ample unrestricted space for conduit entry from the bottom.
 - 14. Wiring: NEMA ICS 18 Class II, Type B-D.
- C. Buses:
- 1. Material: Tin-plated copper.
 - 2. Main horizontal bus:
 - a. 600 A unless otherwise indicated on the Drawings.
 - b. Extend the full-length of the MCC with provisions for splicing additional sections to either end.
 - 3. Vertical buses:
 - a. 300 A minimum.
 - b. Securely bolted to the horizontal main bus with joint easily accessible for maintenance.
 - c. Completely isolated and insulated by means of a barrier.
 - d. Extended full length of vertical section to distribute incoming power to each circuit breaker and starter in structure.
 - 1) Starters NEMA Size 5 and larger and certain other components may be cable connected to the main bus with the approval of the Engineer.
 - e. Extend Vertical bus to spaces provided for future equipment.
 - 4. Ground bus:
 - a. Extend the full-length of the MCC with provisions for splicing additional sections to either end.
 - b. 300 A tin-plated copper.
 - c. Solidly grounded to each structure.
 - d. Locate near bottom of structure.
 - e. Provide for lug connection of equipment ground wires.
- D. Overcurrent and Short Circuit Protective Devices:
- 1. Main device:
 - a. Molded case circuit breaker.
 - b. Fusible switch.
 - 2. Feeder devices:
 - a. Molded case circuit breaker.
 - b. Fusible switch.
 - 3. Motor protection with full voltage starters:
 - a. Motor circuit protector.
 - b. Molded case circuit breaker.

- c. Class RK-1 fuse.
- 4. Motor protection with reduced voltage starters:
 - a. Molded case circuit breaker.
 - b. Motor circuit protector.
 - c. Class RK-1 fuse.
- 5. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
- 6. Factory installed.
- E. Motor Starters: See requirements within this Specification Section.
- F. Power Monitor Metering:
 - 1. Separate compartment.
- G. Miscellaneous:
 - 1. See Drawings for items provided by other but factory installed (e.g., submersible motor temperature/leak controller, control system gateways or switches).

2.3 SEPARATELY MOUNTED COMBINATION STARTERS

- A. Standards:
 - 1. NEMA 250, NEMA ICS 2.
 - 2. UL 508.
- B. Enclosure:
 - 1. NEMA 4 rated:
 - a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
 - b. No knockouts, external mounting flanges, hinged and gasketed door.
 - 2. NEMA 4X rated:
 - a. Body and cover: Type 304 or 316 stainless steel.
 - b. No knockouts, external mounting flanges, hinged and gasketed door.
 - 3. NEMA 7 and NEMA 9 rated:
 - a. Cast gray iron alloy or copper-free aluminum with manufacturer's standard finish.
 - b. Drilled and tapped openings or tapered threaded hub.
 - c. Gasketed cover bolted-down with stainless steel bolts.
 - d. External mounting flanges.
 - e. Front operating handle padlockable in the OFF position.
 - 4. NEMA 12 rated:
 - a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
 - b. No knockouts, external mounting flanges, hinged and gasketed door.
- C. Operating Handle:
 - 1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
 - 2. Circuit breaker and MCP operators includes a separate TRIPPED position.
 - 3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
 - 4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.

5. Padlockable in the OFF position.
 6. Exceptions: NEMA 7 and NEMA 9 enclosures.
- D. External mounted overload relay pushbutton.
- E. Control Devices:
1. Provide control devices as indicated on the Drawings per Specification Section 26 09 16.
 2. Devices will be accessible with the door closed.
- F. Control Power Transformer:
1. 120V secondary.
 2. Fused on primary and secondary side.
 3. Sized for 140% of required load.
- G. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.
- H. Motor Starters: See requirements within this Specification Section.
- I. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:
1. Motor circuit protector.
 2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
 3. Factory installed.

2.4 MOTOR STARTERS

- A. Standards:
1. NEMA ICS 2.
 2. UL 508.
- B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
1. NEMA full size rated contactor.
 - a. NEMA half sizes and IEC contactors are not permitted.
 2. Double-break silver alloy contacts.
 3. Overload relays:
 - a. Ambient compensated, bimetallic type with interchangeable heaters, 24% adjustability, single phase sensitivity, an isolated arm contact and manual reset.
 4. Interlock and auxiliary contacts, wired to terminal blocks:
 - a. Holding circuit contact, normally open.
 - b. Overload alarm contact, normally open.
 - c. Normally open auxiliary contact, for remote run status.
 - d. Additional field replaceable auxiliary contacts as required per the Sequence of Operation.
 - e. One additional normally open spare field replaceable auxiliary contacts.
- C. Full Voltage Reversing (FVR) Magnetic Starters:
1. Two FVNR starters with one overload relay assembled together.
 2. Mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously.
 3. See FVNR paragraph for additional requirements.
- D. Full Voltage Two-Speed (FV2S) Magnetic Starters:
1. Two FVNR starters with two overload relays assembled together.
 2. Configured for two winding or one winding consequent pole motors.

3. See FVNR paragraph for additional requirements.
- E. Reduced Voltage Autotransformer (RVAT) Starter:
 1. Closed transition design using three contactors and two or three autotransformers.
 2. Transformer taps: 50, 65 and 80%, factory set at 65%.
 3. NEMA full size rated contactor.
 - a. NEMA half sizes and IEC contactors are not permitted.
 4. Double-break silver alloy contacts.
 5. Overload relays:
 - a. Ambient compensated, bimetallic type with interchangeable heaters, 24% adjustability, single phase sensitivity, an isolated arm contact and manual reset.
 - b. Ambient insensitive, adjustable solid state type with phase loss protection, phase imbalance protection and manual reset.
 6. Interlock and auxiliary contacts, wired to terminal blocks:
 - a. Holding circuit contact, normally open.
 - b. Overload alarm contact, normally open.
 - c. Normally open auxiliary contact, for remote run status.
 - d. Additional field replaceable auxiliary contacts as required per the Sequence of Operation.
 - e. One additional normally open spare field replaceable auxiliary contacts.

2.5 MANUAL MOTOR STARTERS

- A. Standards:
 1. NEMA 250, NEMA ICS 2.
 2. UL 508.
- B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.
- C. Types:
 1. Horsepower rated, for ON/OFF control.
 2. Horsepower rated, for ON/OFF control and thermal overload protection.
 - a. Switch to clearly indicate ON, OFF, and TRIPPED position.
- D. Voltage and current ratings and number of poles as required for the connected motor.
- E. Enclosures:
 1. NEMA 1 rated:
 - a. Galvanized steel or steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
 - b. With or without concentric knockouts.
 2. NEMA 4 rated:
 - a. Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out or cast gray iron alloy or copper-free aluminum with manufacturer's standard finish.
 - b. No knockouts, external mounting flanges.
 3. NEMA 4X rated:
 - a. Type 304 or 316 stainless steel.
 - b. No knockouts, external mounting flanges.
 4. NEMA 7 and NEMA 9 rated:
 - a. Cast gray iron alloy or copper-free aluminum with manufacturer's standard finish.

- b. Drilled and tapped openings or tapered threaded hub, external mounting flanges.
- 5. NEMA 12 rated:
 - a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
 - b. No knockouts, external mounting flanges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.
- B. Mounting height for surface mounted equipment: See Specification Section 26 05 00.
- C. Mount MCC on 4 inches high concrete pad:
 - 1. Install two, 4 inches wide channel sills flush in pads to support and maintain alignment of the MCC.
 - 2. Align front of MCC with top edge of pad chamfer.
- D. Equipment Marking and Documentation:
 - 1. Provide labeling per NFPA 70 and other applicable codes.
 - 2. Service equipment:
 - a. Arc-flash hazard warning label. (Ref. NFPA 70 Article 110.16(A) and (B))
 - b. Available fault current label and documentation of the calculations made for compliance with marking requirements. (Ref. NFPA 70 Article 110.24)
 - 3. Other than service equipment:
 - a. Arc-flash hazard warning label. (Ref. NFPA 70 Article 110.16(A))
 - b. Available fault current label. (Ref. NFPA 70 Article 408.6)
 - 4. Identify (tag) all equipment and equipment components.
 - 5. Provide labels and tags in accordance with Section 10 14 00.
 - 6. Available fault current and other required label data from Coordinated Power System Study as required by the contract documents.
- E. Provide separately mounted combination starters with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - 1. Determine the SCCR rating by one of the following methods:
 - a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
 - b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
 - 2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
 - 3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.
- F. Overload Heaters:
 - 1. Size for actual motor full load current of the connected motor.
 - 2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.
- G. Combination and Manual Starter Enclosures:

1. Permitted uses of NEMA 1 enclosure:
 - a. Surface or flush mounted in architecturally finished areas.
 - b. Surface mounted above 10 feet in areas designated as dry in architecturally and non-architecturally finished areas.
2. Permitted uses of NEMA 4 enclosure:
 - a. Surface mounted in areas designated as wet.
3. Permitted uses of NEMA 4X enclosure:
 - a. Surface mounted in areas designated as wet and/or corrosive.
4. Permitted uses of NEMA 7 enclosure:
 - a. Surface mounted in areas designated as Class I hazardous.
 - b.
5. Permitted uses of NEMA 9 enclosure:
 - a. Surface mounted in areas designated as Class II hazardous.
6. Permitted uses of NEMA 12 enclosure:
 - a. Surface mounted in areas designated as dry.

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: See Specification Section 26 08 13.

END OF SECTION

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual transfer switches.
 - 2. Automatic transfer switches.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 2. Underwriters Laboratories, Inc. (UL):
 - a. 98, Standard for Safety Enclosed and Dead-Front Switches.
 - b. 1008, Standard for Safety Switch Equipment.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification:
 - b. See Section 26 05 00 for additional requirements.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the listed manufacturers are acceptable:
 - 1. Automatic transfer switches:
 - a. Automatic Switch Company.
 - b. Kohler.
 - c. Onan.
 - d. Russelectric.
 - e. ABB Zenith.
 - 2. Manual transfer switches:
 - a. Automatic Switch Company.

- b. Eaton.
- c. Russelectric.
- d. Square D Company.
- e. Siemens.
- f. ABB Zenith.

2.2 MANUAL TRANSFER SWITCH

- A. Double throw load break rated with:
 - 1. Quick-make/quick-break operating mechanism.
 - 2. Deionizing arc chutes.
 - 3. Double-break rotary action shaft and switchblade shall be manufactured as one common component.
 - 4. Clear line shields to prevent accidental contact with line terminals.
- B. Operating handle: Easily recognizable and padlockable in both positions.
- C. Wiring configuration to allow single load to be supplied by a normal or alternate source.
- D. Ratings:
 - 1. Voltage and amperage: As indicated on Drawings.
 - 2. Short circuit withstand: Equal to or greater than the upstream equipment.
- E. Enclosure:
 - 1. NEMA 1 rated:
 - a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - b. With or without knockouts, hinged and lockable door.
 - 2. NEMA 4X rated:
 - a. Body and cover: Type 304 or 316 stainless steel.
 - b. No knockouts, external mounting flanges, hinged, gasketed and lockable door.
- F. Standards: NEMA KS 1, UL 98.

2.3 AUTOMATIC TRANSFER SWITCH

- A. Construction:
 - 1. Electrically operated mechanically held, double throw, air-break type.
 - 2. Silver-surface main contacts and protect by arcing contacts.
 - 3. Switch shall have provisions for visual inspection of switch blades and contacts.
 - 4. Mechanical design will positively open all ungrounded conductors from normal source before connection is made to alternate source and will positively open alternate source before connection is made to normal source.
 - 5. Mechanical interlock to ensure the switch cannot be readily disabled, disconnected, improperly adjusted, removed or otherwise made inoperative.
 - 6. Make all contacts and coils readily accessible for replacement from front of panel without major disassembly.
 - 7. Ratings:
 - a. Continuous duty in both normal and emergency.
 - b. Three-phase, three-pole, four-wire.
 - c. Voltage and current ratings as indicated on the Drawings.
 - d. Short circuit withstand rating equal to or greater than the normal source electrical gear.
 - 8. Standards: UL 1008.

B. Operation:

1. Microprocessor based control module.
2. Open transition.
3. Red and green indicating lights with fuses, identification nameplates, and test switch on front to simulate normal power failure at switch.
4. Engine starting contacts and all other auxiliary contacts and accessory devices for functions to be performed.
5. Supervisory voltage relays on each phase of normal source and single phase supervisory voltage and frequency relay for emergency source.
 - a. Normal source voltage sensing.
 - 1) Adjustable pickup from 85-100% of rated voltage, factory set 90%.
 - 2) Adjustable dropout from 75-98% of pickup setting, factory set 85%.
 - b. Emergency source voltage and frequency sensing:
 - 1) Adjustable pickup from 85-100% of rated voltage, factory set 90%.
 - 2) Fixed voltage dropout at 85% of pickup setting.
 - 3) Adjustable pickup from 90-100% of rated frequency, factory set 95%.
 - 4) Fixed frequency dropout at 88% of pickup setting.
6. Time delays:
 - a. Engine start, adjustable from 0 to 10 seconds, factory set at 4 seconds, to avoid unnecessary starting caused by short time outages.
 - b. Transfer to generator, adjustable from 0 to 120 seconds, factory set at 10 seconds.
 - c. Retransfer to normal, adjustable from 2 to 30 minutes, factory set at 15 minutes to avoid erratic operation caused by short time reestablishment of normal source.
 - 1) Automatically bypassed when emergency source fails and normal source is available.
 - d. Generator cool down, adjustable from 0 to 60 minutes, factory set at 10 minutes.
7. Exerciser timer:
 - a. Enable and disable function.
 - b. Selectable to exercise with or without transferring load.
 - c. Adjustable exercise duration from 1 minute to 24 hours, factory set at 15 minutes.
 - d. Adjustable day of the week exercise setting, factory set for Monday.
8. Inphase monitor:
 - a. Compare the phase relationship and frequency difference between the normal and emergency sources and permit transfer the first time the sources are within 15 electrical degrees and only if transfer can be accomplished within 60 electrical degrees as determined by monitoring the frequency differences.
 - b. Inphase transfer accomplished if both sources are within 2 Hz of rated frequency and 70% or more of rated voltage.

C. Enclosure:

1. NEMA 1 rated.
2. Body and cover: Sheet steel finished with a rust inhibiting primer and manufacturers standard paint inside and out.
3. No knockouts, hinged and lockable door.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

- B. Connect as indicated in one-line diagram.
- C. Mounting of manual transfer switches: Wall-mounted.
- D. Mounting of automatic transfer switches:
 - 1. Wall-mounted or floor mounted on 4 inches high concrete pad.
- E. Manual Transfer Switch Enclosure:
 - 1. Permitted uses of NEMA 1 rated enclosure:
 - a. Surface mounted in areas designated as dry.
 - 2. Permitted uses of NEMA 4X rated enclosure:
 - a. Surface mounted in areas designated as wet and/or corrosive.

3.2 FIELD QUALITY CONTROL

- A. Automatic Transfer Switch Testing:
 - 1. Simulate power outage by opening normal source overcurrent device.
 - a. Verify engine generator starts and switch transfers in the specified time.
 - 2. Close normal source overcurrent device to simulate the return of normal power.
 - a. Verify the switch retransfers and engine generator shuts down in the specified time.
 - 3. Perform a manual transfer and retransfer.
 - 4. Verify the indicator lights function properly.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Site clearing Work, including:
 - a. General provisions for site clearing Work.
 - b. Preparation for site clearing Work.
 - c. Clearing and grubbing.
 - d. Tree protection, selective removals, and selective trimming.
 - e. Disposal and cleaning.
 - f. Stripping and stockpiling of topsoil.
- B. Related Requirements: Include but are not necessarily limited to:
1. Section 31 23 00 - Earthwork.

1.2 REFERENCES

- A. Terminology:
1. Terms indicated below are not defined terms indicated with initial capital letters but, when used in this Section, have the meanings indicated below:
 - a. "Arborist" means Subcontractor retained to perform Work requiring a specialist in trees, shrubs, brush, other vegetation of the types existing at the Site, and possessing not less than the required qualifications indicated in this Section.
 - b. "Clearing and grubbing" means removing and disposing of all: (1) trees, brush, and other vegetation, logs, and similar items ("clearing"); and (2) stumps, roots, logs, rubbish, and debris on or in the soil ("grubbing") after Clearing. Clearing and grubbing includes grinding and removing of stumps. When clearing and grubbing, topsoil stripping and stockpiling, and required demolition Work is complete, the Site will be ready for grading and other new construction.
 - c. "Demolition" means removal, whether in whole or in part, of existing human-made construction, such as removal of buildings, structures, and building systems; site work (such as pavement, curbs, sidewalks, gutters) and the like; Underground Facilities; and other existing construction.
 - d. "Selective removal" means removal of specific trees, shrubs, brush, and other vegetation, whether as shown or indicated in the Contract Documents or as directed at the Site by Engineer.
 - e. "Selective trimming" means removal of selected parts of trees, shrubs, brush, and other vegetation, performed by arborist, for the purpose of either: (1) allowing installation of new construction adjacent to or through the tree, shrub, brush, or vegetation, or)2) removing damaged or unhealthy growth, to allow balance of the subject tree, shrub, brush, or vegetation to continue normal, healthy growth.
 - f. "Site clearing" means all the Work required by this Section and related Drawings.
 - g. "Topsoil" means existing material at the Site, visible after clearing and grubbing, to be stripped, when such material is friable, clay loam, surface soil present in depth of not less than four inches. Topsoil shall be free of subsoil, clay lumps, stones, and other objects over two-inch diameter and other objectionable material. Topsoil required for planting and landscaping Work in the Specifications of Division 32 may differ from the meaning indicated in this Section.

B. Reference Standards:

1. ASTM International (ASTM):
 - a. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
 - b. D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
2. American National Standards Institute (ANSI):
 - a. A300, Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices.
3. International Society of Arboriculture (ISA):
 - a. Container Rootball Shaving.
 - b. Crown Correction.
 - c. Balled and Burlapped Root Correction.
 - d. Container Root Correction.
 - e. High Branched Crown Observation.
 - f. Low Branched Crown Observation.
 - g. Multiple Low Branches Crown Observation.
 - h. Balled and Burlapped Root Observation.
 - i. Container Root Observation - Tree.
 - j. Protection Maintenance.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Clearing Conference:

1. Prior to commencing site clearing Work, actively participate in conference regarding site clearing Work. Date and time of conference will be mutually established by Contractor and Engineer.
2. Location: Conference will be held at the Site.
3. Participants:
 - a. Required Participants: Contractor's project manager, Contractor's site superintendent, arborist, Engineer, Owner's Site Representative.
 - b. Potential Participants: Owner, facility manager (if applicable), and representative of properties (other than Owner) affected by site clearing Work,
4. Engineer will chair the conference, prepare and distribute an agenda, and prepare and distribute a record of the conference.
5. Participants shall be prepared to discuss:
 - a. Project requirements and the Contract requirements for site clearing Work.
 - b. Submittals required for site clearing Work.
 - c. Schedule for site clearing Work and availability of resources.
 - d. Locations and types of site clearing Work, with specific attention to areas of selective removals, selective trimming, and notable species. Limits of clearing and grubbing. Proposed locations for stockpiles and temporary storage of cuttings and debris.
 - e. Environmental and other conditions at the Site.
 - f. Growth, vegetation, and existing construction requiring protection.
 - g. Required observations and field quality control for site clearing Work.
6. If additional information affecting site clearing Work subsequently comes to light, reconvene the conference at earliest opportunity.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Arborist:
 - a. Where selective removal, selective trimming, or both are required or necessary, retain the services of, and employ in the Work, accredited arborist, possessing qualifications acceptable to Engineer.
 - b. Arborist shall be skilled, trained, and possess documented experience in successfully protecting, trimming, and restorative care of trees and shrubs of the types necessary for the Work.
 - c. Certification: Arborist shall be certified by either International Society of Arboriculture (ISA) or American Society of Consulting Arborists (ASCA).
 - d. Arborist shall use in selective removal and selective trimming Work only workers with specific skill and successful experience in this type of Work required. Such workers shall work under the direct, personal supervision of arborist.
 - e. Submit to Engineer names, employer(s), certifications, other relevant qualifications and record of relevant experience, as indicated below, for not less than [three] successful projects involving same species of trees, shrubs, and vegetation as involved in the site clearing Work:
 - 1) Names and telephone numbers of site owners, architects or engineers responsible for projects.
 - 2) Approximate contract price of the selective removal and selective trimming of trees, shrubs, and vegetation.
 - 3) Approximate time of year work was performed on each referenced project.
 - 4) Approximate quantity and types of selective removal and selective trimming of performed.
 - 5) General indication of species of trees, shrubs, and vegetation involved.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Limits of Site Clearing Work: When limits of site clearing Work are not expressly shown on the Drawings, or where Contractor proposes alternative limits of site clearing Work, submit drawings, developed from the Drawings, clearly indicating proposed limits of site clearing Work, with dimensions indicated where appropriate.
 - b. Where proposed limits of clearing and grubbing, selective removals, and topsoil stripping are not identical with each other, clearly and expressly indicate limits of each on the Shop Drawings.

B. Informational Submittals: Submit the following:

1. Permits and Approvals:
 - a. Submit copy of each permit required and obtained for site clearing Work, issued by authority having jurisdiction.
 - b. Where Owner's permission or approval is required for selected site clearing activities, submit copy of Owner's written permission or approval for such activity.
 - c. When approval of owner of property (other than Owner) is required for selected site clearing activity, submit to Engineer written copy of such approval.
2. Certificates:
 - a. Arborist's certification that trees and shrubs shown or indicated to remain were protected during the site clearing Work in accordance with the Contract Documents.
 - b. Where trees or shrubs (shown or indicated to remain) were damaged during site clearing Work, submit arborist's certification that such trees and shrubs were promptly and properly treated or, where successful treatment was not feasible, were replaced.
3. Qualifications Statements:

- a. Arborist qualifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Tree Wound Dressing:
 - 1. Provide tree wound dressing, waterproof, adhesive and elastic with an antiseptic, free from kerosene, coal tar, creosote, and other material injurious to life of tree or other plant.
- B. Drain Tile:
 - 1. Provide four-inch diameter, standard strength, perforated wall, bell-and- spigot clay pipe, in accordance with ASTM C700.
- C. Filter Fabric:
 - 1. In accordance with requirements for temporary erosion and sediment controls indicated in Section 01 57 05 - Temporary Controls.
- D. Drainage Fill:
 - 1. Selected crushed stone, or crushed or uncrushed gravel, washed.
 - 2. Size 24 (in accordance with ASTM D448), with 90 to 100 percent passing 2.5-inch sieve and not more than 10 percent passing 3/4-inch sieve.
- E. Burlap:
 - 1. Jute, not less than 7.2 ounces per square yard.
- F. For other materials needed for site clearing Work, such as stone, topsoil, or other, comply with requirements of the Contract Documents.

PART 3 - EXECUTION

3.1 SITE CLEARING – GENERAL

- A. Limits of Site Clearing Work:
 - 1. Limits of site clearing Work are shown and indicated on the Drawings.
- B. General Provisions for Site Clearing:
 - 1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals necessary and required to perform site clearing Work in accordance with the Contract Documents.
 - 2. Perform site clearing Work to avoid creating nuisances, pollution, and preventable adverse effects on the environment.
 - 3. Comply with this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".
 - 4. Excavation required for site clearing shall comply with Section 31 23 00 - Earthwork.
 - 5. Requirements of Authorities Having Jurisdiction:
 - a. Perform site clearing Work in accordance with Laws and Regulations.
 - b. Obtain, pay for, and comply with permits required for site clearing Work. Obtain from authorities having jurisdiction and furnish copy of each permit as a Submittal.
 - 6. Traffic Control:
 - a. Establish such controls prior to and maintain in place throughout site clearing Work that has potential to affect traffic.
 - 7. Site clearing Work shall comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article, unless the Contract Documents indicate more-stringent requirements.

8. Demolition Work is indicated in Section 02 41 00 - Demolition, including removal of site improvements and Underground Facilities.

3.2 PREPARATION

A. Permits and Approvals:

1. Do not commence site clearing Work until necessary permits and approvals are obtained and copies furnished to Engineer as Submittals.

B. Delineation of Limits of Site Clearing Work Areas:

1. Locate and clearly flag at the Site:
 - a. Limits of site clearing Work.
 - b. Trees, shrubs, vegetation, and other materials to remain within limits of site clearing Work.
 - c. Trees, shrubs, and other vegetation to be selectively trimmed.
 - d. Trees, shrubs, and vegetation to be selectively removed.
 - e. Salvageable trees, shrubs, and vegetation (to be relocated) within limits of site clearing Work.
2. Flagging:
 - a. Flagging shall be high-visibility type. Where necessary, provide lath or stakes driven into the ground, with flagging, to clearly delineate limits.
 - b. Provide different-colored flagging for each type of delineation required by this Article.
 - c. Promptly replace lost, moved, or destroyed flagging until Engineer concurs that flagging is no longer needed.
3. Review with Engineer:
 - a. Before starting site clearing Work, other than flagging, review at the Site with Engineer.
 - b. Make corrections as necessary.
 - c. Review all trees, 12-inch diameter (measured one foot above ground) and larger, to be removed or selectively trimmed.
 - d. Review with Engineer at the Site trees and shrubs to be selectively trimmed, to reach mutual agreement on extent of selective trimming required.

C. Protection: Establish protection of trees, shrubs, and vegetation to remain, in accordance with this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming", and other applicable provisions of the Contract Documents.

D. Temporary Erosion and Sediment Controls:

1. Provide applicable temporary erosion and sediment controls before commencing clearing and grubbing and topsoil stripping Work.
2. Comply with temporary erosion and sediment control requirements.
3. Continue providing temporary erosion and sediment controls as clearing and grubbing and topsoil stripping and stockpiling Work progresses into previously uncleared, ungrubbed areas of the Site.

3.3 CLEARING AND GRUBBING

A. Clearing and Grubbing – General:

1. Remove and dispose of all materials constituting clearing and grubbing Work within limits shown and indicated in the Contract Documents.
2. After grubbing Work is complete, properly fill holes resulting from grubbing before commencing site grading Work.

B. Trees and Shrubs Improperly Destroyed or Damaged:

1. Refer to this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".

C. Trees and Shrubs to Remain:

1. Trees and shrubs to remain shall be protected, and trimmed where necessary or required, in accordance with this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".

3.4 TREE PROTECTION, SELECTIVE REMOVALS, AND SELECTIVE TRIMMING

A. General Provisions for Tree Protection, Selective Removals, and Selective Trimming:

1. Provide temporary fencing, barricades, or guarding measures, as recommended by arborist, outside drip line of trees and shrubs to remain.
2. Protect root systems from damage caused by noxious materials, storm water runoff, site clearing, planting and landscaping, other Work, and storage of materials and equipment. Protect root systems from flooding, erosion, and excessive wetting resulting from dewatering of excavations, drainage of tanks, and other construction activities.
3. Fires are not allowed under or adjacent to trees, shrubs, and other vegetation to remain.
4. Do not store matter resulting from site clearing or demolition, topsoil, or other excavated material within drip line of trees and shrubs to remain. Vehicles are not allowed within drip line. Restrict foot, vehicle and equipment traffic to prevent compaction of soil over root systems. Where such activities are unavoidable, and only as acceptable to Engineer, provide temporary, continuous, heavy-duty wood planking effectively fastened together and capable of distributing loads from such activities. Temporary planking shall be underlaid by layer of filter fabric covered with two-inch layer of gravel.
5. Cut branches and roots, when necessary, with sharp pruning instruments; do not break or chop. Fully paint cuts 1/2-inch and larger in size with tree wound dressing.

B. Excavation and Protection of Trees and Shrubs:

1. Excavate within drip line of trees only where shown.
2. Where trenching for utilities is required within drip line, tunnel under or around main lateral feeder roots by drilling, auger boring, pipe jacking, or digging by hand under supervision of arborist. Do not cut main lateral roots or tap roots; cut smaller roots, which interfere with installation of the Work.
3. Where excavation for the Work is required within drip line of trees or shrubs, hand excavate to minimize damage to root systems. Perform excavation under supervision of arborist. Provide temporary shoring or other protective support systems at excavations, to minimize sloping and benching of excavations. Use narrow tine spading forks and comb excavated material to expose roots.
4. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of construction and relocation is not practical, cut roots approximately three inches back from construction.
5. Do not allow exposed roots to dry out before permanent backfill is provided; provide temporary earth cover. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.

C. Grade Adjustments and Tree Protection:

1. Maintain existing grade within drip line of trees, unless otherwise shown or indicated.
2. Lowering of Preconstruction Grade:
 - a. Where required finish grade is below preconstruction grade around trees and shrubs, grade beyond drip line. Maintain preconstruction grade within drip line of trees and shrubs.

- b. Prune tree and shrub roots exposed during grade lowering, or provide permanent protections as recommended by arborist. Do not cut main or lateral roots or tap-roots; cut only smaller roots.
 - c. Compensate for loss of roots and prune branches to stimulate root growth.
 - d. Provide extended service through completion of the Contract correction period as recommended by arborist.
3. Minor Fills:
- a. Where preconstruction grade is six inches or less below elevation of finish grade shown, fill with topsoil complying with quality requirements of Specifications for finish grading and landscaping.
 - b. Place in single layer and do not compact.
 - c. Hand-grade to required finish elevations.
4. Moderate Fills:
- a. Where preconstruction grade is more than six inches, but less than 16 inches, below finish grade elevation, provide layer of drainage fill and filter fabric on preconstruction grade prior to placing topsoil that complies with quality requirements of Specifications on finish grading and landscaping.
 - b. Carefully place drainage fill against trunk of tree or shrub approximately two inches above elevation of finish grade and extend not less than 1.5 feet from tree or shrub trunk on all sides.
 - c. Provide filter fabric with edges overlapping by 6 inches, minimum.
 - d. Place fill layer of topsoil to finish grade elevation.
 - e. Do not compact stone, gravel or topsoil layers. Hand-grade to required finish elevations.
5. Deep Fills:
- a. Provide an open dry circular well of durable, unmortared stone, located not less than two feet s from trunk of associated tree or shrub.
 - b. To facilitate proper drainage, provide eight to 10 continuous runs of four-inch drain tiles horizontally on the preconstruction ground surface under the complete spread of branches in radial pattern around the tree or shrub.
 - c. Slope drain tiles away from tree or shrub.
 - d. Provide drainage fill on preconstruction ground surface in depth of two inches under and six inches over drain tiles.
 - e. Provide filter fabric over entire top surface of drainage fill.
 - f. Provide eight to 10 drainage tiles, each four-inch diameter, vertically in radial pattern around tree or shrub, located five feet from trunk of tree or shrub. Extend vertical drainage tiles from the filter fabric layer above the horizontal drainage tiles to postconstruction finished grade
 - g. Hold drainage tiles in place with drainage fill.
 - h. Hand-grade to required finish grade elevation.
- D. Tree and Shrub Pruning (Selective Trimming):
- 1. Perform pruning and selective trimming under the supervision of arborist.
 - 2. Remove branches from trees and shrubs to remain only after Engineer's concurrence, only to extent necessary to clear location of permanent construction, using branch removal methods in accordance with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
 - 3. Extend pruning operation to restore natural shape of entire tree or shrub where pruning is approved by Engineer and as recommended by arborist.
 - 4. Prune branches to balance loss to root system caused by damage or cutting of root system.

5. Chip branches removed from trees and shrubs. Stockpile and spread chips as directed by Engineer, with arborist's recommendation.
- E. Selective Trimming:
1. In addition to pruning (as required above), perform other selective trimming under direction of arborist.
 2. Comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
 3. Where shown or indicated, and as directed by Engineer with arborist's recommendation, carefully remove larger branches, when necessary, using appropriate methods.
 4. Repair cut branches in accordance with this Section.
 5. During selective trimming, avoid damaging healthy (to remain) elements of trees and shrubs.
 6. Dispose of trimmings as indicated in this Section's "Disposal and Cleaning" Article.
- F. Selective Removals:
1. Perform selective removals under direction of arborist.
 2. Comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
 3. Fully remove trees and shrubs shown or indicated for selective removal.
 4. Remove stumps to not less than one foot below preconstruction ground surface.
 5. During selective removals, avoid damaging adjacent trees and shrubs to remain, and other property.
 6. Remove larger branches before cutting the trunk of tree or shrub being selectively removed.
 7. Dispose of trees and shrubs selectively removed as indicated in this Section's "Disposal and Cleaning" Article.
- G. Repair and Replacement of Trees and Shrubs:
1. Perform tree and shrub repair under direction of arborist.
 2. Cavity Repair:
 - a. Remove decayed areas to depth that exposes healthy tissue.
 - b. Shape cavities to provide drainage.
 - c. Paint inside of cavity with antiseptic tree wound dressing material.
 - d. Do not fill cavities.
 - e. When cavity's cross-section exceeds 60 percent of cross-section of tree or shrub branch, selectively trim subject branch. When cavity's cross-section exceeds 60 percent of cross-section of trunk of tree or shrub, remove tree or shrub upon Engineer's authorization. Engineer will consider arborist's recommendation. Comply with this Section's requirements for selective trimming and selective removals.
 3. Repair trees and shrubs damaged by construction operations, or selectively trimmed, within 24 hours of occurrence of such damage or selective trimming. Treat damaged trunks, branches, and roots according to written instructions of arborist, in accordance with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
 4. Remove and replace trees and shrubs that are (1) dead or destroyed due to construction operations, or (2) damaged beyond reasonable hope of recovery (as determined by arborist) following repairs, or (3) damaged and determined by arborist to be incapable of resuming normal growth pattern after repairs.,
 5. Obtain opinion from arborist regarding whether damaged trees, shrubs, and other vegetation is repairable with reasonable chance of success. Submit arborist's certification required in this Section's "Submittals" Article.
 6. For each tree or shrub to remain but is destroyed or damaged (beyond repair) by Contractor:

- a. For trees 8 inches or more in diameter (measured one foot above preconstruction ground surface), provide two replacements of the same species. Each replacement shall be four inches diameter (measured one foot above top of root ball).
- b. For trees smaller than [eight] inches diameter, and for shrubs, provide one replacement for each, of same species. Replacements shall be equal in size to original, up to maximum of four inches (measured one foot above root ball).
- c. Provide replacement at locations at the Site as directed by Engineer.
- d. Provide replacements in accordance with the Contract Documents, including Specifications on planting and landscaping.

3.5 DISPOSAL AND CLEANING

A. Disposal – General:

- 1. Dispose of matter resulting from clearing and grubbing, selective removals, and selective trimming, at appropriate offsite location, unless otherwise expressly allowed by the Contract Documents or mutual agreement of Owner and Contractor.
- 2. Do not use cleared, grubbed, or trimmed material as fill, backfill, or in embankments.
- 3. Dispose of cleared, grubbed, and trimmed material, and other materials, rubbish, and debris, in accordance with Laws and Regulations.
- 4. Pay all costs associated with transporting and disposing of materials and debris resulting from site clearing Work.
- 5. Cleared lumber and trimmings from trees are Contractor's property and, at Contractor's option, may be sold or salvaged offsite.

B. Cleaning:

- 1. Perform progress cleaning and other cleaning Work, and disposal of resulting materials and debris, in accordance with Section 01 74 00 - Cleaning.

C. Burning:

- 1. Burning will not be allowed on this project.

3.6 TOPSOIL STRIPPING AND STOCKPILING

A. Stripping:

- 1. Before commencing topsoil stripping:
 - a. Perform clearing and grubbing and selective removals.
 - b. Remove grass and other vegetation that may remain following clearing and grubbing.
 - c. Provide necessary and required temporary erosion and sediment controls.
- 2. Strip topsoil to depths encountered, in manner that prevents intermingling of topsoil with underlying subsoil and other objectionable material. Remove heavy growths of grass and vegetation and material below topsoil.
- 3. Before stockpiling, separate objectionable material from topsoil.
- 4. Do not strip topsoil from within drip line of trees and shrubs to remain as part of the completed Project.

B. Reuse of Stripped Topsoil:

- 1. Reuse in the finish grading and landscaping Work topsoil that complies with the Contract Documents for such Work.
- 2. Where topsoil stripped from the Site does not comply with the Contract Documents relative to quality required for use in finish grading and landscaping Work, provide appropriate soil amendment material, properly and fully mixed into topsoil stripped from the Site, so that amended material complies with quality requirements for topsoil required for finish grading and landscaping Work.

C. Disposal of Excess Topsoil:

1. Topsoil in excess of quantity required for finished Project becomes Contractor's property when Engineer indicates finish grading and landscaping Work is complete. Properly dispose of excess topsoil offsite. Contractor may sell excess topsoil at offsite location.

END OF SECTION

SECTION 31 22 00
SITE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork - site excavation, grading, compaction, disposal of waste and surplus materials, construction of berms, dewatering and other Earthwork related work.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 31 23 10 - Excavation and Backfill.
2. Section 32 15 40 - Crushed Stone Surfacing.

1.2 REFERENCES

A. Terminology:

1. Terms indicated in this provision are not defined terms indicated with initial capital letters, but when used in this Section have the meaning indicated in this provision.
2. "Excavation" consists of removal of materials encountered to subgrade or rough grade elevations required or indicated. Excavation includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.
3. "Geotechnical engineer" means the independent geotechnical specialist, licensed and registered as a professional engineer in the same jurisdiction as the Site, retained by Owner or Engineer, with responsibility for observing required field quality control activities and determining acceptability of results of required field quality control activities, in accordance with the Contract Documents. Where geotechnical engineer is not the same person who sealed and signed this Section and related Drawings, geotechnical engineer has not authority to approve or accept the Work or to modify the Contract Documents on behalf of Engineer.
4. "Non-structural fill" and "non-structural backfill" mean excavated materials placed and compacted to achieve finish grade elevations and do not support foundations, slabs, pavement, other flatwork, or carry imposed loads.
5. "Finish grade" means layer of soil or other acceptable material immediately below the Site's surfacing material (such as landscaping, pavement, and other surfaces).
6. "Rough grade" means layer of soil or other acceptable material immediately below the finish grade.
7. "Subgrade" means soil or other suitable material immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil.
8. "Unauthorized excavation" means removal of native material (a) beyond subgrade elevation or dimensions shown or indicated in the Contract Documents, and (b) outside of payment limits for Unit Price Work shown or indicated in the Contract Documents, without Engineer's authorization or an appropriate Contract modification. Unauthorized excavation and all Work necessary to remedy unauthorized excavation in accordance with the Contract Documents are ineligible for payment, and Contractor is ineligible for additional Contract Price or additional Contract Time therefor.
9. "Unsuitable material" and "unsuitable soil material" means materials, including soil encountered at the Site, at or below subgrade elevation, and of insufficient strength, stiffness, and bearing capacity to support the completed Work, as determined by Engineer.

B. Referenced Standards:

1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/CUFT).
 - c. D1241, Standard Specification for Material for Soil-Aggregate Subbase, Base, and Surface Courses.
 - d. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 feet-LBF/CUFT (2,700 kN-M/M)).
 - e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - f. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
 - g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - i. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
2. American Association of State Highway and Transportation Officials (AASHTO)
 - a. M 43, Standard Specification for Sizes of Aggregate for Road and Bridge Construction.
 - b. M 57, Standard Specification for Materials for Embankment and Subgrades.
 - c. M 147, Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.

1.3 SUBMITTALS

A. Acton Submittals: Submit the following:

1. Product Data:

- a. Written indication of each source of materials to be used for site grading Work. Where materials from the Site will be used, so indicate in the Submittal.
- b. Where materials not native to the Site will be used, indicate borrow source, location, and sufficient information to indicate to Engineer's satisfaction that proposed materials are appropriate and comply with the Contract Documents and are do not constitute a Hazardous Environmental Condition. Where borrow materials contain one or more Constituents of Concern, submit acceptable laboratory analysis results of representative samples sufficient to demonstrate such materials will not constitute a Hazardous Environmental Conditions when installed at the Site.
- c. Regardless of source, submit:
 - 1) Results and certification of gradation and material of aggregate fill.
 - 2) Results of representative sampling and testing of material for gradation (as applicable) and material content.
 - 3) Contractor's written certification that materials proposed comply with the Contract Documents, including applicable reference standards.

2. Samples:

- a. Coordinate with Engineer locations of Samples and testing of borrow materials.

B. Informational Submittals: Submit the following:

1. Supplier's Installation instructions: Written instructions on handling, storing, and installing materials from offsite sources.
2. Field Quality Control Results:
 - a. Results of required field quality control activities, including installed material density and moisture tests.

- b. One optimum moisture-maximum density curve for each type of material encountered.
- c. Report of actual unconfined compressive strength or results of bearing tests of each strata tested.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill:

1. Selected, suitable material from the Site excavation or from suitable offsite borrow approved by Engineer.
2. Structural Fill:
 - a. May be low volume change cohesive or granular soil at Contractor's option.
 - b. Free of organic matter, frozen material and debris.
 - c. Low volume change cohesive soil:
 - 1) ASTM D2487 classification: CL-ML or CL.
 - 2) Liquid limit: Less than 45.
 - 3) Maximum plasticity index: 20.
 - d. Granular soil:
 - 1) ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.
3. Non-Structural Fill:
 - a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
 - b. Liquid limit: Less than 45.
 - c. Maximum plasticity index: 20.

B. Aggregate Base:

1. Granular Fill Material:
 - a. Clean, Granular material.
 - b. Less than 5% fines passing the No. 200 sieve.
 - c. ASTM D1241/AASHTO M147 Grading "B" or other material acceptable to Engineer.
 - d. State of Missouri Department of Transportation (MoDOT):

C. Geotextile Filter Fabric:

1. Nonwoven type.
2. Equivalent opening size: 50 - 100 (U.S. Standard Sieve).
3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
4. Grab strength: 90 pounds minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
2. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain benchmarks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
4. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
5. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
6. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 SITE EXCAVATION AND GRADING

- A. The site excavation and grading work includes the offsite disposition of all material:
 1. That exceed quantities required for earthwork on the project.
 2. That the Geotechnical engineer classifies as unclassified excavation.
 3. That the Geotechnical engineer classifies as unacceptable.
 4. That the Geotechnical engineer classifies as potentially contaminated.
- B. Excavation and Grading:
 1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.
 2. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 6 inches in all proposed embankment and fill areas.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
 3. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
 1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 2. Include cost of all borrow material in original proposal.

3. Fill material to be approved by Engineer prior to placement.
- D. Construct embankments and fills as required by the Drawings:
 1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 inches.
 - a. Ensure stones larger than 4 inches are not placed in upper 6 inches of fill or embankment.
 - b. Do not place material in layers greater than 8 inches loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
 - a. In general, compact cohesive soils by sheepfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - b. Control moisture for each layer necessary to meet requirements of compaction.
- E. Grading Tolerances: ± 0.1 inches or As shown on Drawings.

3.3 USE OF EXPLOSIVES

- A. Blasting with any type of explosive is prohibited.
- B. Rock Excavation: Refer to Specification Section 31 23 17.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Engineer.
- C. Stabilize subgrade with well graded granular materials as directed by Engineer.
- D. Assure by results of testing that compaction densities comply with the following requirements:
 1. Sitework:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Subgrade:		
Cohesive soils	90% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	65% relative density per ASTM D4253 and ASTM D4254	
Rough Grade:		
Cohesive soils	95% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	
Finish Grade:		
Cohesive soils	95% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	

3.5 FIELD QUALITY CONTROL

- A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

END OF SECTION

SECTION 31 22 19
FINISH GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Topsoil quality and placing.
 2. Finish grading.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment:
1. Perform the Work of this Section for all areas within limits of grading and all areas outside limits of grading disturbed during construction.
 2. Perform the Work of this Section as part of the Lump Sum bid/pay item(s) indicated in the Contract.

1.3 REFERENCES

- A. Reference Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T194, Standard Method of Test for Determination of Organic Content of Soils by Loss on Ignition.
 2. ASTM International (ASTM):
 - a. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
 - b. D4221, Standard Test Method for Dispersive Characteristics of Clay Soil by Double Hydrometer.
 - c. D4972, Standard Test Methods for pH of Soils.
 - d. D5268, Standard Specification for Topsoil Used for Landscaping and Construction Purposes.
 - e. D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 - f. D7928, Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
 - g. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Contractor's Testing Laboratory:
 - a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of materials specified in this Section.
 - b. When Contractor is expressly required, by this Section's "Quality Assurance" Article, "Source Quality Control" Article or elsewhere in the Contract Documents, to retain testing laboratory for tests required under this Section's "Quality Assurance" Article or "Source Quality Control" Article, retain one testing laboratory for quality assurance testing and field quality control testing.
 - c. Testing laboratory shall comply with ASTM E329.
 - d. Testing laboratory shall be experienced in the types of testing required.

- e. Selection of testing laboratory is subject to Engineer's acceptance. Upon Engineer's request, submit qualifications statement for testing laboratory, including name of entity, location, copies of applicable certifications, summary of entity's experience, and names and qualifications of personnel who will perform the subject sampling and testing.
- B. Quality Assurance Testing:
- 1. Quality assurance testing, which may also be regarded as source quality control testing when topsoil to be installed will be topsoil originally stripped from the Site, is in addition to field quality control activities required by this Section's "Field Quality Control" Article.
 - 2. Allow free access to material stockpiles and borrow areas at all times. Tests shall be at Contractor's cost.
 - 3. Contractor's Testing Laboratory Scope:
 - a. Obtain samples and perform testing of proposed topsoil materials, whether obtained from offsite borrow sources or stockpiled topsoil originally stripped from the Site, to provide assurance that the Work will comply with the Contract Documents.
 - 4. Required Quality Assurance Material Testing by Contractor's Testing Laboratory:
 - a. Perform the following quality assurance tests for every 1,000 cubic yards of topsoil, or part thereof, to be incorporated into the Work. Submit results of such tests to Engineer and obtain Engineer's acceptance thereof prior to incorporating the subject topsoil into the Work.
 - 1) Gradation in accordance with ASTM D6913 and D7928.
 - 2) Clay content in accordance with ASTM D4221.
 - 3) pH in accordance with ASTM D4972.
 - 4) Organic content in accordance with ASTM D2974 or AASHTO T194.

1.5 SUBMITTALS

- A. Action Submittals: Submit the following:
- 1. Product Data:
 - a. Borrow Soil Materials: Name and address of Supplier of borrow soil materials, gradation, and Supplier's certification that materials are sufficiently free of Constituents of Concern so that a Hazardous Environmental Condition will not be created or exacerbated.
 - b. If no soil materials will be obtained from any borrow location, expressly so indicate to Engineer in writing.
 - 2. Samples:
 - a. Submit Sample of topsoil material required by this Section. Furnish Samples in durable, tightly-sealed containers; plastic bags are unacceptable. Samples shall be of sufficient quantity and material size to demonstrate the array of gradation and material types expected in the Work.
- B. Informational Submittals: Submit the following:
- 1. Quality Assurance Test Results Submittals:
 - a. Submit results of quality assurance testing performed in accordance with this Section's "Quality Assurance" Article, unless included as part of another submittal under this Section.
 - 1) Tests on materials from onsite and borrow sources.
 - 2. Qualifications Statements:
 - a. Quality assurance testing laboratory, when requested by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:

1. All soil accepted as topsoil, whether obtained from onsite or offsite sources, shall comply with requirements of this Section.
2. Topsoil Source: Reuse surface soil stockpiled on Site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Supplement acceptable onsite soil with manufactured topsoil from offsite sources, when quantities available on-Site are insufficient to complete the Work.
 - b. When existing soil material stripped from the Site and stockpiled does not comply with requirements of this Section, such soil may be provided as topsoil when addition of amendments and fertilizers will bring such soil material into compliance with this Section's topsoil requirements. Furnish to Engineer written advisory of Contractor's intent to amend existing soil materials to be compliant with topsoil requirements.
3. Provide fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than one inch diameter, or other extraneous material harmful to plant growth, in compliance with ASTM D 5268.
4. Provide topsoil of the following characteristics:
 - a. Required gradation:

Sieve Size	Percent Passing
3/4 inch mesh	100
No. 4-sieve	90 to 100
No. 200-sieve	0 to 10

- b. Clay content of material passing No. 200-sieve shall be not greater than 60 percent, as determined by hydrometer tests.
 - c. pH-adjusted with ferrous sulphate or ground limestone to provide pH 5.5 to 7.0 at time of installation of lawns and meadow areas, unless particular species of planting requires a different pH for optimal growth.
 - d. Electrical conductivity of a 1:2 soil-water suspension shall not exceed 1.0 milliohm per centimeter and with less than 200 parts per million of extractable aluminum.
 - e. Cation Exchange Capacity: 5, minimum.
 - f. Organic content not less than five percent, as determined by ignition loss of oven-dried samples passing No. 10-sieve (Muffle Furnace Temperature: 110 plus or minus five degrees C for eight hours).
 - g. Free of pests and pest larvae.
 - h. Relative to Constituents of Concern, topsoil shall be in accordance with Laws and Regulations. Constituents of Concern, if any, in topsoil furnished shall not constitute or result in a Hazardous Environmental Condition.

B. Topsoil Amendments and Fertilizer

1. Provide planting soil by adding amendments, fertilizer, and other materials to topsoil and other suitable soil materials as necessary to support vigorous growth of required plantings.

2.2 SOURCE QUALITY CONTROL

A. Tests and Inspections at Source of Supply:

1. Perform quality assurance testing, and submit results to Engineer, in accordance with the "Quality Assurance" Article in Part 1 of this Section.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-place Conditions:

1. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing plants from damage caused by finish grading.

B. Preparation – General:

1. Provide temporary measures for controlling erosion and sedimentation, airborne dust, and fugitive dust emissions from the Site.
2. Topsoil stripping and stockpiling requirements are indicated in Section 31 10 00 - Site Clearing.
3. Adjust rough grading to within 0.1 foot of required elevations. Properly compact subgrades. Rough grading shall provide for appropriate drainage in accordance with the Contract Documents.
4. Before applying topsoil:
 - a. Remove from exposed subgrade all stones and debris over one inches in any dimension and properly dispose of such items at an appropriate, offsite location.
 - b. Apply superphosphate fertilizer directly to subgrade before loosening.
 - c. Loosen sub-grade surface to depth of not less than two inches.

3.2 INSTALLATION

A. Installation Requirements:

1. Required Depth of Topsoil:
 - a. For areas of gardens, shrubs and similar plantings, provide finished, lightly compacted, topsoil depth of not less than 6 inches.
 - b. For all other areas requiring topsoil, including lawns and meadows, provide finished, lightly compacted, topsoil depth of not less than 4 inches.
2. Do not place topsoil when subgrade is muddy, wet or frozen enough to cause clodding.
3. Provide finished surface smooth and true to required grades, in accordance with this Article's "Installation Tolerances" provision. Provide finished surface of topsoil equal to required finished elevations after light rolling and natural settlement.
4. Grade topsoil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to provide required finish grades.
5. Restore topsoil if eroded or otherwise disturbed after finish grading and before planting.
6. Topsoil Quantity Differentials:
 - a. If quantity of required topsoil exceeds the quantity, if any, of topsoil stockpiled at the Site and available for use by Contractor, provide the additional required quantity from appropriate offsite borrow sources at no additional cost to Owner.
 - b. When quantity of topsoil obtained from offsite borrow sources exceeds the required quantity of topsoil, remove excess from the Site, unless Owner allows such excess to be stockpiled at an appropriate location at the Site.
 - c. When quantity of required topsoil is less than quantity of onsite stockpiles, following installation of topsoil, properly grade remaining stockpile for appropriate drainage without undue erosion and seed stockpile as required for other areas of lawn restoration in accordance with the Contract Documents.

B. Installation Tolerances:

1. Finish Grading Tolerance: ± 0.1 foot from finish elevation required by the Contract Documents. Ensure adequate drainage.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Upon completion of topsoil installation, obtain Engineer's concurrence regarding grades and drainage.
2. Where directed by Engineer, provide test holes to demonstrate that required depth of topsoil was provided. After observation and measurement by Engineer, properly refill test holes.
3. Where insufficient depth of topsoil is revealed, remedy by providing required depth and quantity in accordance with the Contract Documents. When additional topsoil is added after initial establishment of plant growth, re-establish required plantings to provide compliance with the Contract Documents.

3.4 PROTECTION

- #### **A. Commencing immediately after topsoil installation, protect installed topsoil from erosion and damage from other causes, including personnel, vehicles, and equipment. Promptly perform seeding, sodding (as applicable), mulching, and other measures to permanently stabilize soils and prevent erosion.**

END OF SECTION

SECTION 31 23 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork - excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, sheeting, bracing, dewatering and other Earthwork related work.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C33/C33M, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/FT³).
 - c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 feet-LBF/FT³(2,700 kN-M/M³)).
 - d. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - e. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
 - f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
2. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR Part 1926.650, Safety and Health Regulations for Construction - Excavations, referred to herein as OSHA Standards.

1.3 DEFINITIONS

A. Excavation:

1. Consists of removal of material encountered to subgrade elevations required or indicated.
2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.

B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

C. Geotechnical Engineer: Independent geotechnical specialist providing field quality control for the project.

D. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.

G. Unauthorized Excavation:

1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.
 - a. Unauthorized excavation, as well as associated remedial work as directed by Engineer or Geotechnical Engineer, shall be at Contractor's expense.
2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the Geotechnical Engineer.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
2. Certifications.

B. Samples:

1. Coordinate samples and testing for approval of off-site materials with the Geotechnical Engineer.
2. Test reports.

1.5 PROJECT CONDITIONS

- A. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- B. Dispose of waste materials, legally, off site.
 1. Burning, as a means of waste disposal, is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill:

1. Selected material approved by Geotechnical Engineer from site excavation or from off site borrow.
2. Structural Fill:
 - a. May be low volume change cohesive or granular soil at Contractor's option.
 - b. Free of organic matter, frozen material and debris.
 - c. Low volume change cohesive soil:
 - 1) ASTM D2487 classification: CL-ML or CL.
 - 2) Liquid limit: Less than 45.
 - 3) Maximum plasticity index: 20.
 - d. Granular soil:
 - 1) ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.
3. Non-Structural Fill:
 - a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
 - b. Liquid limit: Less than 45.
 - c. Maximum plasticity index: 20.

B. Granular Fill Under Building Floor Slabs-On-Grade, Electrical Equipment Pads, Manholes and Handholes:

1. Clean, granular material.
 2. Less than 5% fines passing the No. 200 sieve.
 3. ASTM C33/C33M gradation size No. 67, 3/4 inches to No. 4 or other material acceptable to Geotechnical Engineer.
- C. Granular Fill Under Base Slabs with Pressure Relief Valves:
1. Drainage material: Conform to ASTM C33/C33M, Size No. 67.
 2. Filter material: Conform to ASTM C33/C33M requirements for fine aggregate.
- D. Granular Fill Under Electrical Equipment Pads, Manholes and Handholes: Clean, crushed, nonporous rock, crushed or uncrushed gravel complying with ASTM C33/C33M gradation size No. 67, 3/4 inches to No. 4.
- E. Geotextile Filter Fabric:
1. Nonwoven type.
 2. Equivalent opening size: 50 - 100 (U.S. Standard Sieve).
 3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
 4. Grab strength: 90 pounds minimum in either direction in accordance with ASTM D4632 requirements.
 5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Erosion Control:
1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
 2. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.
- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 2. Protect and maintain benchmarks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 3. Verify location of utilities.
 - a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
 - b. Secure and examine local utility records for location data.
 - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
 - 1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
 - 3) Obtain Owner's approval prior to disconnecting any utility service.
 - d. Repair damages to utility items at own expense.

- e. In case of damage, notify Engineer at once so required protective measures may be taken.
- 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
- 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
- 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 SITE EXCAVATION AND GRADING

- A. The site excavation and grading work includes the offsite disposition of all material:
 - 1. That exceed quantities required for earthwork on the project.
 - 2. That the Geotechnical engineer classifies as unclassified excavation.
 - 3. That the Geotechnical engineer classifies as unacceptable.
 - 4. That the Geotechnical engineer classifies as potentially contaminated.
- B. Excavation and Grading:
 - 1. Perform as required by the Contract Drawings.
 - 2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.
 - 3. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 6 inches in all proposed embankment and fill areas.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
 - 4. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
 - 1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 - 2. Include cost of all borrow material in original proposal.
 - 3. Fill material to be approved by Geotechnical Engineer prior to placement.
- D. Construct embankments and fills as required by the Contract Drawings:

1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 inches.
 - a. Ensure that stones larger than 4 inches are not placed in upper 6 inches of fill or embankment.
 - b. Do not place material in layers greater than 8 inches loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
 - a. In general, compact cohesive soils by sheepsfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - b. Control moisture for each layer necessary to meet requirements of compaction.

E. Grading Tolerances: As shown on Drawings.

3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Geotechnical Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Geotechnical Engineer.
- D. Stabilize subgrade with well graded granular materials as directed by Geotechnical Engineer.
- E. Assure by results of testing that compaction densities comply with the following requirements:
 1. Sitework:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Under Paved Areas, Sidewalks and Piping:		
Cohesive soils	95% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	
Unpaved Areas:		
Cohesive soils	90% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	65% relative density per ASTM D4253 and ASTM D4254	

2. Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	98% per ASTM D698	-2 to +3% of optimum
Outside structures next to walls, piers, columns and any other structure exterior member	92% per ASTM D698	-2 to +3% of optimum

3. Specific areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Outside structures under equipment support foundations	98% per ASTM D698	-2 to +3% of optimum
Under void	85% per ASTM D1557	-2 to +3% of optimum
Granular fill under base slabs with pressure relief valves	75% relative density per ASTM D4253 and ASTM D4254 or 98% of ASTM D698	
Granular fill under building floor slabs-on-grade	60% relative density per ASTM D4253 and ASTM D4254	

3.5 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
 - a. Materials and source to be approved by Geotechnical Engineer.
 - b. Excavated material approved by Geotechnical Engineer may also be used for fill and backfill.
3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:

- a. Do not commence excavation for foundations for structures until Geotechnical Engineer approves:
 - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
 - 2) Density and moisture content of site area compacted fill material meets requirements of specifications.
 - 3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
 - 4) Surcharge or mass fill material has been removed from construction area or portions thereof.
- b. Engineer grants approval to begin excavations.

2. Dimensions:

- a. Excavate to elevations and dimensions indicated or specified.

- b. Allow additional space as required for construction operations and inspection of foundations.
 - c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
 - d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
 - a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Geotechnical Engineer.
 - b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:
 - 1) Distance equal to depth of overexcavation below bottom of foundations.
 - 2) [5] feet.
 - 3) As directed by Geotechnical Engineer.
 - c. When excavation has reached required subgrade elevations, notify Geotechnical Engineer, who will make an inspection of conditions.
 - 1) If Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.
 4. Install working surface over approved subgrade.
 - a. Minimum thickness: 6 inches.
 5. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
 - a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
 - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 inches and then compact to density stated in this Specification Section before fill material can be placed thereon.
 - c. Do not carry excavations lower than shown for foundations except as directed by Geotechnical Engineer or Engineer.
 - d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:
 - 1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a) Concrete fill may be used to bring elevations to proper position.
 - 2) In locations other than those above, including slabs on grade and pile supported foundations, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Geotechnical Engineer.
 - 3) No extra compensation will be made to Contractor for correcting unauthorized excavations.
 6. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
 7. Notify Geotechnical Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.

- a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Geotechnical Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
 - b. Geotechnical Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
 - c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
 - d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
8. Dewatering:
- a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
 - b. Groundwater shall be maintained at least 3 feet below the bottom of any excavation.
 - c. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
 - d. Employ dewatering specialist for selecting and operating dewatering system.
 - e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
 - f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1) Install groundwater monitoring wells as necessary.
 - g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
9. Subgrade stabilization:
- a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Geotechnical Engineer.
 - b. Provide compaction density of replacement material as stated in this Specification Section.
 - c. Loose, wet, or soft materials, when approved by Geotechnical Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
 - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
 - e. Remove and replace frozen materials as directed by Geotechnical Engineer.
 - f. Method of stabilization shall be performed as directed by Geotechnical Engineer.
 - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Geotechnical Engineer.
10. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
- a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40

degrees F before structure is completed and heated to a temperature of at least 50 degrees F.

11. Protection of structures:

- a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
- b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

12. Shoring:

- a. Shore, slope, or brace excavations as required to prevent them from collapsing.
- b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
- c. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.

13. Drainage:

- a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
- b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
- c. Provide pumping required to keep excavated spaces clear of water during construction.
- d. Should any water be encountered in the excavation, notify Engineer and Geotechnical Engineer.
- e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

14. Frost protection:

- a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
- b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
- c. Protect excavation from frost if placing of concrete or fill is delayed.
- d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
- e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 degrees F.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:

1. General:

- a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Geotechnical Engineer and scarified to a depth of 6 inches and compacted to density specified herein.
- b. Surface may be stepped by at not more than 12 inches per step or may be sloped at not more than 2%.
- c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Geotechnical Engineer as being free of undesirable material and compacted to specified density.

2. Obtain approval of fill and backfill material and source from Geotechnical Engineer prior to placing the material.

3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07 26 00 and shown on Contract Drawings.
5. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Geotechnical Engineer.
 - b. Place fill and backfill material in 8 inches lifts.
 - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
 - d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
 - 1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use hand operated equipment for filling and backfilling next to walls.
 - f. Do not place fill and backfill when the temperature is less than 40 degrees F and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment to compact granular material; do not use water.
6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content as required to fill the specified overexcavation to bottom of foundation.

D. Filling and Backfilling Outside of Structures:

1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Geotechnical Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Geotechnical Engineer.
 - b. Place fill and backfill material to maximum allowable lift thickness indicated in Paragraph 3.5, C, 5, b of this Section.
 - c. Compact material with equipment of proper type and size to obtain density specified.
 - d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
 - 1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - f. Do not place fill or backfill material when temperature is less than 40 degrees F and when subgrade to receive material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:
 - a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
 - b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.

- c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
 - 1) See Contract Drawings for specific exceptions.
 - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures Under Piping or Paving:
- 1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
 - 2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
 - 3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.6 FIELD QUALITY CONTROL

- A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA Standards, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

END OF SECTION

SECTION 31 23 10
EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork - excavation, backfilling, compaction, disposal of waste and surplus materials, placing structural fill, placing crushed stone, sheeting, bracing, dewatering and other Earthwork related work.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/CUFT).
 - c. D1241, Standard Specification for Material for Soil-Aggregate Subbase, Base, and Surface Courses.
 - d. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 feet-LBF/CUFT(2,700 kN-M/M)).
 - e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - f. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
 - g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - i. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
2. American Association of State Highway and Transportation Officials (AASHTO)
 - a. M 43, Standard Specification for Sizes of Aggregate for Road and Bridge Construction.
 - b. M 57, Standard Specification for Materials for Embankment and Subgrades.
 - c. M 147, Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.

B. Federal Regulations:

1. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR Part 1926.650, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

1.3 DEFINITIONS

A. Excavation:

1. Consists of removal of material encountered to subgrade elevations required or indicated.
2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.

- B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

- C. Geotechnical Engineer: Independent geotechnical specialist providing field quality control for the project.
- D. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.
- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.
- F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.
- G. Unauthorized Excavation:
 - 1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.
 - a. Unauthorized excavation, as well as associated remedial work as directed by Engineer or Geotechnical Engineer, shall be at Contractor's expense.
 - 2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the Geotechnical Engineer.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Acknowledgement that products submitted meet requirements of standards referenced.
 - 2. Manufacturer's installation instructions.
 - 3. Certifications.
- B. Samples:
 - 1. Coordinate samples and testing for approval of off-site materials with the Geotechnical Engineer.

1.5 PROJECT CONDITIONS

- A. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- B. Dispose of waste materials, legally, off site.
 - 1. Burning, as a means of waste disposal, is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill and Backfill:
 - 1. Selected material approved by Geotechnical Engineer from site excavation or from off site borrow.
 - 2. Structural Fill:
 - a. May be low volume change cohesive or granular soil at Contractor's option.
 - b. Free of organic matter, frozen material and debris.
 - c. Low volume change cohesive soil:
 - 1) ASTM D2487 classification: CL-ML or CL.
 - 2) Liquid limit: Less than 45.
 - 3) Maximum plasticity index: 20.
 - d. Granular soil:
 - 1) ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.

3. Non-Structural Fill:
 - a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
 - b. Liquid limit: Less than 45.
 - c. Maximum plasticity index: 20.
- B. Granular Fill Under Building Floor Slabs-On-Grade, Electrical Equipment Pads, Manholes and Handholes:
 1. Clean, granular material.
 2. Less than 5% fines passing the No. 200 sieve.
 3. ASTM C33/AASHTO M43 gradation size No. 89, 3/8 inches to No. 4 or other material acceptable to Geotechnical Engineer.
- C. Granular Fill Under Spread Footing Foundations, Mat Foundations, Electrical Equipment Pads, Manholes and Handholes:
 1. Clean, Granular material.
 2. Less than 5% fines passing the No. 200 sieve.
 3. ASTM D1241/AASHTO M147 Grading "B" or other material acceptable to Geotechnical Engineer.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Erosion Control:
 1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
 2. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.
- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
 4. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
 5. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
 6. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

- A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
 2. Obtain fill and backfill material necessary to produce grades required.
 - a. Materials and source to be approved by Geotechnical Engineer.
 - b. Excavated material approved by Geotechnical Engineer may also be used for fill and backfill.
 3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.
- B. Excavation Requirements for Structures:
1. General:
 - a. Do not commence excavation for foundations for structures until Geotechnical Engineer approves:
 - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
 - 2) Density and moisture content of site area compacted fill material meets requirements of specifications.
 - 3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
 - 4) Surcharge or mass fill material has been removed from construction area or portions thereof.
 - b. Engineer grants approval to begin excavations.
 2. Dimensions:
 - a. Excavate to elevations and dimensions indicated or specified.
 - b. Allow additional space as required for construction operations and inspection of foundations.
 - c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
 - d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
 3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
 - a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Geotechnical Engineer.
 - b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:
 - 1) Distance equal to depth of overexcavation below bottom of foundations.
 - 2) [5] feet.
 - 3) As directed by Geotechnical Engineer.
 - c. When excavation has reached required subgrade elevations, notify Geotechnical Engineer, who will make an inspection of conditions.
 - 1) If Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.
 4. Install working surface over approved subgrade.
 - a. Minimum thickness: 12 inches.

5. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
 - a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
 - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 inches and then compact to density stated in this Specification Section before fill material can be placed thereon.
 - c. Do not carry excavations lower than shown for foundations except as directed by Geotechnical Engineer or Engineer.
 - d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:
 - 1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a) Concrete fill may be used to bring elevations to proper position.
 - 2) In locations other than those above, including slabs on grade and pile supported foundations, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Geotechnical Engineer.
 - 3) No extra compensation will be made to Contractor for correcting unauthorized excavations.
6. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
7. Notify Geotechnical Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.
 - a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Geotechnical Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
 - b. Geotechnical Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
 - c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
 - d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
8. Subgrade stabilization:
 - a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Geotechnical Engineer.
 - b. Provide compaction density of replacement material as stated in this Specification Section.
 - c. Loose, wet, or soft materials, when approved by Geotechnical Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
 - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.

- e. Remove and replace frozen materials as directed by Geotechnical Engineer.
 - f. Method of stabilization shall be performed as directed by Geotechnical Engineer.
 - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Geotechnical Engineer.
9. Protection of structures:
- a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
 - b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
10. Shoring:
- a. Shore, slope, or brace excavations as required to prevent them from collapsing.
 - b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
 - c. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.
11. Drainage:
- a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
 - b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
 - c. Provide pumping required to keep excavated spaces clear of water during construction.
 - d. Should any water be encountered in the excavation, notify Engineer and Geotechnical Engineer.
 - e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
12. Frost protection:
- a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
 - b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
 - c. Protect excavation from frost if placing of concrete or fill is delayed.
 - d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
 - e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 degrees F.
- C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
1. General:
- a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Geotechnical Engineer and scarified to a depth of 6 inches and compacted to density specified herein.
 - b. Surface may be stepped by at not more than 12 inches per step or may be sloped at not more than 2%.
 - c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Geotechnical Engineer as being free of undesirable material and compacted to specified density.

2. Obtain approval of fill and backfill material and source from Geotechnical Engineer prior to placing the material.
3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07 26 00 and shown on Contract Drawings.
5. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Geotechnical Engineer.
 - b. Place fill and backfill material in 8 inches lifts.
 - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
 - d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
 - 1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum.
 - 2) Contractor is responsible for method of compaction so as not to damage walls or buried commodities.
 - e. Use hand operated equipment for filling and backfilling next to walls.
 - f. Do not place fill and backfill when the temperature is less than 40 degrees F and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment to compact granular material; do not use water.
6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content as required to fill the specified overexcavation to bottom of foundation.

D. Filling and Backfilling Outside of Structures.

1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Geotechnical Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Geotechnical Engineer.
 - b. Place fill and backfill material to maximum allowable lift thickness indicated in Paragraph 3.2, C, 5, b of this Section.
 - c. Compact material with equipment of proper type and size to obtain density specified.
 - d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
 - 1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum.
 - 2) Contractor is responsible for method of compaction so as not to damage walls or buried commodities.
 - e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - f. Do not place fill or backfill material when temperature is less than 40 degrees F and when subgrade to receive material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:

- a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
 - b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
 - c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
 - 1) See Contract Drawings for specific exceptions.
 - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures Under Piping or Paving:
- 1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
 - 2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
 - 3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.3 USE OF EXPLOSIVES

- A. Blasting with any type of explosive is prohibited unless specified otherwise on the drawings or written approval is obtained from the Owner.
- B. Rock Excavation: Refer to Specification Section 31 23 17.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Geotechnical Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Geotechnical Engineer.
- D. Stabilize subgrade with well graded granular materials as directed by Geotechnical Engineer.
- E. Assure by results of testing that compaction densities comply with the following requirements:
 - 1. Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	95% per ASTM D698	-2 to +3% of optimum
Outside structures next to walls, piers, columns and any other structure exterior member	92% per ASTM D698	-2 to +3% of optimum

- 2. Specific areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Outside structures under equipment support foundations	95% per ASTM D698	-2 to +3% of optimum
Under void	85% per ASTM D1557	-2 to +3% of optimum

3.5 FIELD QUALITY CONTROL

- A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.
- B. Responsibilities of Special Inspector:
1. Review proposed materials for fill and backfill around structures.
 2. All testing, observation and work indicated as being performed by the Geotechnical Engineer in this Specification Section.
 3. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
 4. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
 5. Extent of compaction testing will be as necessary to assure compliance with specifications.
 6. Prepare and submit inspection and test reports to Engineer.
 - a. Coordinate such work with other Special Inspectors.
 7. Test reports to include the following:
 - a. Report and certification of aggregate fill and drainage fill.
 - b. Test reports on borrow material.
 - c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
 - d. Field reports; in-place soil density and moisture tests.
 - e. One optimum moisture-maximum density curve for each type of soil encountered.
 - f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
 - g. Other documentation necessary for Geotechnical Engineer to approve earthwork.
 - h. Assist Engineer to determine corrective measures necessary for defective work.
- C. Responsibilities of Testing Agency for Excavation and Backfilling:
1. All testing, observation and work indicated as being performed by the Geotechnical Engineer in other than Article 3.5 of this Specification Section.
 2. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
 3. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
 4. Extent of compaction testing will be as necessary to assure compliance with specifications.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Dewatering system.
 2. Surface water control system.
 3. Monitoring wells.
 4. System operation and maintenance.
 5. Water disposal.

1.2 QUALITY ASSURANCE

1.3 DEFINITIONS

- A. Dewatering:
1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering excavations, trenches and shafts.
 2. Disposing of removed water.
- B. Surface Water Control:
1. Removal of surface water within open excavations.
- C. Foundations:
1. Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

1.4 SUBMITTALS

- A. Shop Drawings:
1. Dewatering plan design data and Drawings including the following:
 - a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.
 - b. Arrangement, locations, and depths of system components.
 - c. Pipe sizes and capacities.
 - d. Filter types and sizes.
 - e. Water disposal method and location.
 - f. Surface water control devices.
 - g. System operation, monitoring, and maintenance procedures.
 - h. Method of monitoring water quality.
 - i. Signed and sealed by professional engineer.
 2. Product technical data including:
 - a. Dewatering pump data including the following:
 - 1) Size, capacity, and means of operation of engine and motor.
 - b. Pumping equipment for control of surface water within excavation.

1.5 PROJECT CONDITIONS

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

- A. Select dewatering equipment to meet specified performance requirements.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Erosion Control:
 - 1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
 - 2. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.
- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
 - 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 - 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 - 3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
 - 4. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

3.2 DEWATERING

- A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
- B. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
 - 1. Employ dewatering specialist for selecting and operating dewatering system.
 - 2. Groundwater shall be maintained at least 3 feet below the bottom of any excavation.
 - 3. Install groundwater monitoring wells as necessary.
 - 4. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
- C. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

2. Discharge water into [existing storm sewer system, drainage channels and settling basins].

3.3 SURFACE WATER CONTROL SYSTEMS

- A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area.
- B. Divert surface water and seepage water within excavation areas into sumps and pump water into [drainage channels, storm drains and settling basins] in accordance with requirements of the agencies having jurisdiction.
- C. Control and remove unanticipated water seepage into excavation.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation, trenching, backfilling and compacting for all underground utilities.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 26 - Electrical.
 - 2. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/FT³ (600 kN-M/M³)).
 - b. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - c. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

- A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 2. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
 - 3. Submit sieve analysis reports on all granular materials.
- B. Informational Submittals:
 - 1. Trench shield (trench box) certification if employed:
 - a. Specific to Project conditions.
 - b. Re-certified if members become distressed.
 - c. Certification by registered professional structural engineer, registered in the state where the Project is located.
 - d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.

1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:

1. As approved by Engineer.
 - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - b. Moisture content at time of placement: $\pm 3\%$ of optimum moisture content as specified in accordance with ASTM D698.
2. Gravel trench backfill materials:
 - a. Uniformly graded pea gravel defined below:

Sieve Size	1 inches	3/4 inches	1/2 inches	No. 4	No. 8
Percent Passing by Weight	100	100	30-55	0-15	0-5

B. Bedding Materials:

1. As approved by the Geotechnical Engineer.
2. Granular bedding materials:
 - a. ASTM D2321 Class 1B.
 - 1) Well-graded crushed stone.
3. Flowable fill:
 - a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
 - b. Material characteristics:
 - 1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
 - a) Cement (Type I or II): 50 pounds.
 - b) Fly ash: 200 pounds.
 - c) Fine sand: 2,700 pounds.
 - d) Water: 420 pounds.
 - e) Air content: 10%.
 - 2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
 - 3) Approximate compressive strength should be 85 to 175 psi.
 - 4) Fine sand shall be an evenly graded material having not less than 95% passing the No. 4 sieve and not more than 5% passing the No. 200 sieve.
 - 5) Mixing and handling of the material shall be in accordance with Specification Section 03 31 31.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer to site provided by Contractor.

3.2 EXCAVATION

- A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Geotechnical Engineer.
- B. Excavation for Appurtenances:
 - 1. 12 inches (minimum) clear distance between outer surface and embankment.
 - 2. See Specification Section 31 23 00 for applicable requirements.
 - 3. See Specification Section 33 05 16 for applicable requirements.
- C. Groundwater Dewatering:
 - 1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow [subgrade stabilization,] pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
 - 2. Groundwater shall be drawn down and maintained at least 3 feet below the bottom of any trench or manhole excavation prior to excavation.
 - 3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
 - a. Employ dewatering specialist for selecting and operating dewatering system.
 - 4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
 - 5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 6. Install groundwater monitoring wells as necessary.
 - 7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
 - 8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation.
- D. Trench Excavation:
 - 1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility.
 - 2. Open trench outside buildings, units, and structures:
 - a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
 - b. Field adjust limitations as weather conditions dictate.
 - 3. Trenching within buildings, units, or structures:
 - a. No more than 100 LF at any one time.
 - 4. Any trench or portion of trench, which is opened and remains idle for seven calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
 - a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.

5. Observe following trenching criteria:

a. Trench size:

- 1) Excavate width to accommodate free working space.
- 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 inches and less	18 inches
more than 33 inches	24 inches

- 3) Cut trench walls vertically from bottom of trench to 1 foot above top of pipe, conduit, or utility service.
- 4) Keep trenches free of surface water runoff.
 - a) Include cost in Bid.
 - b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
2. Modify for electrical installations as follows:
 - a. Open no more than 600 linear foot of trench in exterior locations for trenches more than 12 inches but not more than 30 inches wide.
 - b. Any length of trench may be opened in exterior locations for trenches which are 12 inches wide or less.
 - c. Do not over excavate trench.
 - d. Cut trenches for electrical runs with minimum 30 inches cover, unless otherwise specified or shown on Drawings.
 - e. See Division 26 for additional requirements.

F. Flowable Fill:

1. Flowable fill shall be:
 - a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
 - b. Placed in 4 feet maximum lifts to the elevations indicated.
 - 1) Allow 12 hour set-up time before placing next lift or as approved by the Engineer.
 - 2) Place flowable fill lifts in such a manner as to prevent flotation of the pipe.
2. Flowable fill shall not be placed on frozen ground.
3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
4. Conform to appropriate requirements of Specification Section 31 23 00.
5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 degrees F and rising.
6. At the time of placement, flowable fill must have a temperature of at least 40 degrees F.
7. Mixing and placing shall stop when the air temperature is 38 degrees F or less and falling.
8. Each filling stage shall be as continuous an operation as is practicable.
9. Prevent traffic contact with flowable fill for at least 24 hours after placement or until flowable fill is hard enough to prevent rutting by construction equipment.

10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

- A. Over-Excavation:
 1. Backfill and compact to 90% of maximum dry density per ASTM D698.
 2. Backfill with granular bedding material as option.
- B. Rock Excavation:
 1. Excavate minimum of 6 inches below bottom exterior surface of the pipe or conduit.
 2. Backfill to grade with suitable earth or granular material.
 3. Form bell holes in trench bottom.
- C. Subgrade Stabilization:
 1. Stabilize the subgrade when directed by the Owner.
 2. Observe the following requirements when unstable trench bottom materials are encountered.
 - a. Notify Owner when unstable materials are encountered.
 - 1) Define by drawing station locations and limits.
 - b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
 - 1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

- A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.
- B. Carefully Compacted Backfill:
 1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 inches above top of pipe or conduit.
 2. Comply with the following:
 - a. Place backfill in lifts not exceeding 8 inches (loose thickness).
 - b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
 - c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - d. Compact each lift to specified requirements.
- C. Common Trench Backfill:
 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
- D. Water flushing for consolidation is not permitted.
- E. Backfilling for Electrical Installations:
 1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
 2. Modify for electrical installation as follows:

- a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

A. General:

- 1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
- 2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:

- 1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.

a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75% relative density by ASTM D4253 and ASTM D4254

b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95% of maximum dry density by ASTM D698
	Cohesionless soils	75% relative density by ASTM D4253 and ASTM D4254

c. Toe drain bedding and backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	60% relative density by ASTM D4253 and ASTM D4254

d. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95% of maximum dry density by ASTM D698
	Cohesionless soils	60% of relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	85% of maximum dry density by ATM D698
	Cohesionless soils	40% of relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:

- 1. Perform in-place moisture-density tests as directed by the Owner.
- 2. Perform tests through recognized testing laboratory approved by Owner.
- 3. Costs of "Passing" tests paid by Owner.

4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 32 15 40
CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Crushed Stone surfacing.
 - a. Drainage outflow area.
 - b. Slope rip rap.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 22 00 - Site Grading.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T2, Sampling Stone, Slag, Gravel, Sand and Stone Block for Use as Highway materials.
 - 2. ASTM International (ASTM):
 - a. C29, Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate.
 - b. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - c. D75, Standard Practice for Sampling Aggregates.
 - d. D5821, Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Acknowledgement that products submitted meet requirements of standards referenced.
 - 2. Sieve analysis reports on all granular materials.
 - 3. Resistance/resistivity data, see Specification Section 02 31 26.
 - 4. Source tests: submit certified test reports and service records to determine acceptability and application of stone materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crushed Stone Surfacing:
 - 1. Fractured Faces: ASTM D5821 - 85% of the rock shall be fractured on all faces.
 - 2. Electrical Resistivity: Minimum 3,000 ohm-meters.
 - 3. DSMO Loss: ASTM DMSO - Maximun 12%.
 - 4. Bulk Density: ASTM C29 - Minimun 80 pcf.
 - 5. Gradation: ASTM C136 as defined below:

Sieve Size	1 inches	3/4 inches	3/8 inches	No. 4	No. 8
Percent Passing by Weight	100	50	5 to 10	4 to 9	0 to 2

2.2 SOURCE QUALITY CONTROL

- A. Furnish material from a single source.
- B. Obtain samples per ASTM D75 from a local quarry that typically provides material to meet the specification requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Trim and dress all areas to required cross sections.
- B. Bring areas that are below allowable minus tolerance limit to grade by filling with material similar to adjacent material.
- C. Compact to density specified for backfill in accordance with Specification Section 31 23 00.
- D. Do not place any stone on soft, muddy, or frozen material.
- E. Prevent contamination of existing surfacing stone during excavation activities.
- F. Do not place any stone material on prepared base prior to approval by Engineer.

3.2 PLACING

- A. Place to required thickness and grades:
 - 1. Depth: -0 inches, +2 inches.
- B. Place to full thickness in a single operation to avoid displacing the underlying material.
- C. Compact material to a firm uniform layer.
- D. Maintain a neat and dust-free finish surface.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fencing and gates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 00 05 - Concrete.
 - 2. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - c. A824, Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain-Link Fence.
 - d. F552, Standard Terminology Relating to Chain Link Fencing.
 - e. F567, Standard Practice for Installation of Chain-Link Fence.
 - f. F626, Standard Specification for Fence Fittings.
 - g. F900, Standard Specification for Industrial and Commercial Steel Swing Gates.
 - h. F1043, Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
 - i. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
 - 2. American Welding Society (AWS).
 - 3. National Fire Protection Association (NFPA):
 - a. NFPA 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL).
- B. Qualifications:
 - 1. Installer bonded and licensed in the Project state.
 - 2. Installer shall have a minimum two years experience installing similar fencing.
 - 3. Utilize only AWS certified welders.
 - 4. Electric gate operators to be UL listed.
 - 5. Grounding by an electrician licensed in Project state.

1.3 DEFINITIONS

- A. See ASTM F552.
- B. NPS: Nominal pipe size, in inches.
- C. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 2. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
 - 3. Mill certificates.
 - 4. Source quality control test results.
 - 5. Automatic gate system:
 - a. Electrical circuitry and control wiring.
 - b. Intercom system.
 - c. Detector loop layout.
 - d. Locking plan.
 - e. Method of installation of detector loop.
 - f. Sealant material for detector loops.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Chain Link Fabric:
 - 1. Fabric type:
 - a. ASTM A392 zinc-coated steel:
 - 1) Coated before weaving, 2.0 oz/SQFT.
 - 2. Wire gage: 9.
 - 3. Mesh size: 2 inches.
 - 4. Selvage treatment:
 - a. Top: Twisted and barbed.
 - b. Bottom: Knuckled.
- B. Concrete: See Specification Section 03 00 05 - Concrete.
- C. Line Post:
 - 1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 2.
- D. Corner or Terminal Posts:
 - 1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 2-1/2.
- E. Brace and Rails:
 - 1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 1-1/4.
- F. Tension Wire:
 - 1. Top of fabric:
 - a. ASTM A824, galvanized steel, Class 3.
- G. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods):

1. ASTM F626.
- H. Swing Gate:
1. ASTM F900.
 2. Materials as specified for fence framework and fabric.
 3. Hardware:
 - a. Galvanized per ASTM A153/A153M.
 - b. Hinges to permit 180 degrees outward gate opening.

2.2 SOURCE QUALITY CONTROL

- A. Test related fence construction materials to meet the following standards:
1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with:
1. Manufacturer's instructions.
 2. Lines and grades shown on Drawings.
 3. ASTM F567.
- B. Do not start fence installation before final grading is complete and finish elevations are established.
- C. Drill holes in firm, undisturbed or compacted soil.
- D. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.
1. Correct minor irregularities in earth to maintain maximum clearance.
- E. Space line posts at equal intervals not exceeding 10 feet on-center.
- F. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.
- G. Install tension bars full height of fabric.
- H. Rails:
1. Fit rails with expansion couplings of outside sleeve type.
 2. Rails continuous for outside sleeve type for full length of fence.
- I. Provide expansion couplings in top rails at not more than 20 feet intervals.
- J. Anchor top rails to main posts with appropriate wrought or malleable fittings.
- K. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts.
1. Locate compression members at mid-height of fabric.
 2. Extend diagonal tension members from compression members to bases of posts.
 3. Install so that posts are plumb when under correct tension.
- L. Pull fabric taut and secure to posts and rails.
1. Secure so that fabric remains in tension after pulling force is released.
 2. Secure to posts at not over 15 inches on-center, and to rails at not over 24 inches on-center, and to tension wire at not over 24 inches on-center.
 3. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
 4. Bend ends of wire to minimize hazards to persons or clothing.

- M. Install post top at each post.
- N. Gates:
 - 1. Construct with fittings or by welding.
 - 2. Provide rigid, weatherproof joints.
 - 3. Assure right, non-sagging, non-twisting gate.
 - 4. Coat welds with rust preventive paint, color to match pipe.
- O. Install electric gate operator in accordance with NFPA 70.

END OF SECTION

SECTION 32 92 00
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding, sodding and landscape planting:
 - a. Soil preparation.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 22 19 - Finish Grading.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):
 - a. Z60.1, American Standard for Nursery Stock.
 - 2. AOAC International (AOAC).
 - 3. ASTM International (ASTM):
 - a. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
 - b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.
- B. Quality Control:
 - 1. Fertilizer:
 - a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
 - b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
 - c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout drawings:
 - a. Scaled site plan (scale 1 inch = 20 feet or equal to scale of Project site plan Drawing) on reproducible Drawing to show:
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
 - d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
 - e. Source and location of sod, plants, and plant material.
 - 3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.
- B. Informational Submittals:

1. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

A. Installation Schedule:

1. Provide schedule showing when trees, shrubs, groundcovers and other plant materials are anticipated to be planted.
2. Show schedule of when lawn type and other grass areas are anticipated to be planted.
3. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.
4. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:

1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND SUPPLIERS

- A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

- A. Native Grass Seeding: Certified seed of locally adapted strains.
- B. Soil Amendments:
- C. Asphalt Binder: Emulsified asphalt per State specifications.
- D. Water:
 1. Water free from substances harmful to grass or sod growth.
 2. Provide water from source approved prior to use.
- E. Plants:
 1. See plant list on Drawings.
 2. Sound, healthy, vigorous, with normal top and root systems, free from disease, insect pests or their eggs, grown in same or colder climatic zone as project.
 - a. Nursery grown stock, freshly dug.
 - 1) No heeled-in, cold storage or collected stock.
 - b. Species and size as indicated on Drawings.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:

1. Limit preparation to areas which will be planted soon after.
2. Provide facilities to protect and safeguard all persons on or about premises.
3. Protect existing trees designated to remain.
4. Verify location and existence of all underground utilities.
 - a. Take necessary precaution to protect existing utilities from damage due to construction activity.
 - b. Repair all damages to utility items at sole expense.

5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
 - a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.
- B. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:
1. Loosen surface to minimum depth of 4 inches.
 2. Remove stones over 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter.
 3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
 4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
 5. Distribute fertilizer uniformly over areas to be seeded:
 - a. For lawn-type seeding: 30 pounds per 1000 square feet.
 - b. For pasture seeding: 200 pounds per acre.
 6. Incorporate fertilizer into soil to a depth of at least 2 inches by disking, harrowing, or other approved methods.
 7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
 8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
 - a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - b. Limit fine grading to areas which can be planted soon after preparation.
 9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

- A. Lawn-Type and Pasture Seeding:
1. Do not use seed which is wet, moldy, or otherwise damaged.
 2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
 3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
 4. Distribute seed evenly over entire area at rate of application not less than 4 pounds (PLS) of seed per 1000 square feet, 50% sown in one direction, remainder at right angles to first sowing.
 5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
 - a. Resume work only when favorable conditions develop.
 6. Lightly rake seed into soil followed by light rolling or cultipacking.
 7. Immediately protect seeded areas against erosion by mulching.
 - a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
 8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
 - a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
 9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 square feet.

- a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
- b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
- c. Use appropriate shields to protect adjacent site improvements.

3.3 PLANTING TREES, SHRUBS, AND GROUND COVERS

A. Notification:

1. Notify Engineer of source of plants and plant materials at least 30 days prior to planting to permit Engineer's inspection of source qualifications.

B. Preparation:

1. Handle plants so that roots or balls are adequately protected from breakage of balls, from sun or drying winds.
 - a. Ensure tops or roots of plants are not permitted to dry out.
2. During transportation, protect materials from wind and sun to prevent tops and roots from drying out.
3. Protect tops of plants from damage.
 - a. Plants with damaged tops will be rejected.
4. For purpose of inspection and planting identification, attach durable, legible labels to bundle or container of plant material delivered at the planting site.
 - a. State correct plant name and size of each plant in weather-resistant ink on labels.
5. Do not prune trees and shrubs at nursery.

C. Planting Season:

1. Plant deciduous shade trees and shrubs any time the ground is suitable between October 15 and June 1.
2. Plant evergreen material between September 1 and June 1.
3. Plant ground covers between March 15 to June 1.

D. Planting Procedure:

1. Indicate locations of plants for approval by Engineer before excavating plant locations.
2. In event underground construction, utilities, obstructions, or rock are encountered in excavation of plantings, secure alternate locations from Engineer.
 - a. Make said changes without additional compensation.
 - b. Where tree locations fall under existing overhead wires, or crowd existing trees, adjust locations as directed by Engineer.
3. Excavate pits and beds as necessary and in accordance with ANLA/ANSI Z60.1.
 - a. Loosen bottom of pits prior to planting.
 - b. Excavation is unclassified, excavate all materials without additional cost.
4. Tree and shrub pits to be circular in shape with vertical sides at least 1 foot greater in diameter than ball diameter.
 - a. Pit to be of sufficient depth to provide 6 inches of planting soil under ball when set to natural grade.
5. Shrub and ground cover beds:
 - a. Plant shrubs used in mass plantings in individual holes of required size.
 - b. Strip all sod from among mass planting.
 - c. For ground cover beds, remove sod from within limits of bed.
 - d. Add soil amendments as specified and mix or rototill with existing topsoil to a depth of 6 inches.

6. Set plants straight or plumb, in locations when indicated and at such level that after settlement they bear same relationship to finished grade as they did in their former setting.
 - a. Carefully tamp planting soil under and around base of balls to prevent voids.
 - b. Remove burlap, rope and wires from top of balls.
 - c. Do not remove burlap from sides and bottom of balls.
7. Backfill plants with planting soil.
 - a. Tamp to 1/2 depth of pit and thoroughly water and puddle before bringing backfill to proper grade.
 - b. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.
8. After planting is complete, form a level saucer 3 inches high around each tree extending to limit of plant pit for watering purposes.
9. Mulch plant pit after saucer has been shaped.
 - a. Mulch to limits of pit and uniformly over ground cover beds to a depth of 3 inches.
 - b. In mass plantings of shrubs, mulch entire area uniformly among shrubs to a depth of 3 inches.
 - c. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.
10. Staking: Stake trees immediately after planting as detailed on Drawings or in accordance with Nursery Standards.
11. Wrap deciduous trees 2 inches or more in caliper by neatly overlapping wrapping material between ground line and second branch.
 - a. Place ties at top and bottom of wrapping material and not more than 12 inches apart between top and bottom ties.
12. Remove dead or damaged branches.
 - a. Thin deciduous material to about two-thirds of initial branching.
 - b. Remove only dead or damaged branches from evergreens.
13. Water plants during planting operations.
 - a. Water each plant a minimum of once each week until final acceptance.
 - b. Apply sufficient water to moisten backfill about each plant so that moisture will extend into the surrounding soil.

3.4 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
 - a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
 - b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded or Sodded Lawns:

1. Maintain seeded lawns: 90 days, minimum, after installation and review of entire project area to be planted.

2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
3. Engineer will review seeded or sodded lawn area after installation for initial acceptance.
4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
 - a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
 - a. Repeat mowing as required to maintain height.
 - b. Do not delay mowing until grass blades bend over and become matted.
 - c. Do not mow when grass is wet.
 - d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 inches.
 - e. Do not mow lower than 1-1/2 inches.
7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
 - a. Anchor as required to prevent displacement.
8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
9. Replant bare areas using same materials specified.
10. Engineer will review final acceptability of installed areas at end of maintenance period.
11. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION

SECTION 33 05 11
CEMENTITIOUS MANHOLE LINER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section shall govern all Work, materials, and equipment required for substrate rehabilitation for the purpose of eliminating infiltration, repair of voids, and restoration of the structural integrity of the specified manholes as a result of applying a monolithic cementitious liner to the wall and bench surfaces of brick, concrete, or any other masonry construction material.
- B. Described are procedures for cleaning, preparation, application, and testing:
 - 1. The applicator shall furnish all labor, equipment and materials for applying a cementitious mix to form a monolithic liner of a minimum of 1 IN thickness, with machinery specially designed for the application.
 - 2. All aspects of the installation shall be in accordance with the manufacturer's recommendation and per the following Specifications which include:
 - a. The removal of any loose and unsound material.
 - b. Cleaning of the area to be sprayed with high pressure water.
 - c. The repair and filling of voids.
 - d. The repair and sealing of the pipe entry points and benches.
 - e. The elimination of active infiltration prior to making the application.
 - f. The spray application of a cementitious mix to form a structural/structurally enhanced monolithic liner.
- C. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C78, Flexural Strength of Concrete.
 - 2. ASTM C94, Ready Mixed Concrete.
 - 3. ASTM C109, Compressive Strength of Hydraulic Cement Mortars [Using 2-IN. or (50-MM) Cube Specimens].
 - 4. ASTM C234, Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel.
 - 5. ASTM C267, Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing.
 - 6. ASTM C321, Bond Strength of Chemical Resistant Mortars.
 - 7. ASTM C496, Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - 8. ASTM C596, Drying Shrinkage of Mortar Containing Portland Cement.
 - 9. ASTM C666, Resistance of Concrete to Rapid Freezing and Thawing.
 - 10. ASTM C827, Standard Test Method for. Change in Height at Early Ages of Cylindrical. Specimens of Cementitious Mixtures.
 - 11. ASTM C952, Bond Strength of Mortar to Masonry Units.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product Technical Data including:
 - a. Submit manufacturer's product data, including physical properties, surface preparation, repair, application, curing, and field quality control.
 - b. Acknowledgement that products submitted meet requirements of standards referenced.
- B. Manufacturer Qualifications: Submit list of minimum of 10 manhole rehabilitation projects completed during past 3 YRS.
- C. Applicator Qualifications: Submit certification stating applicator is factory trained and approved by manufacturer in application of the specified products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to Site in manufacturer's original, unopened containers and packaging, with labels clearly identifying produce name and manufacturer.
- B. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Keep containers sealed until ready to use.
 - 3. Store materials in a cool, dry environment.

1.5 PROJECT/SITE CONDITIONS

- A. Do not apply materials if ambient temperature is below 40 DEGF.
- B. Do not apply materials to frozen surfaces or if freezing is expected within substrate within 24 HRS after application.
- C. Keep mix temperature at time of application below 90 DEGF.
- D. Do not exceed water temperature of 80 DEGF.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cementitious manhole liner product shall be one of the following:
 - 1. Quadex-Aluminaliner.
 - 2. StrongSeal - MS-2C.
 - 3. Permacast CR-9000.
 - 4. Or approved equal.

2.2 MANHOLE REHABILITATION CONSTRUCTION MATERIALS

- A. Unless otherwise specified, all materials used for manhole rehabilitation shall conform to these requirements:
 - 1. Concrete Bonding Agent: Concrete bonding agents shall be used to improve adhesion between mortar, existing brick and concrete surfaces and shall be made up of a special formulation of acrylic polymers and modifiers, designed for use as an additive to concrete mixes to improve adhesion and mechanical properties.
 - 2. Cement Patch:

- a. Materials used for sealing holes and cracks that are not actively leaking shall be a rapid set, hand mixed and hand applied Calcium Aluminate cementitious product with set modifiers.
 - b. The patching material is to be mixed and applied according to manufacturer's recommendations, and shall meet or exceed the following physical property requirements:
 - 1) Compressive Strength (ASTM C-109): 1,400 PSI at 6 HRS.
 - 2) Shrinkage (ASTM C-596): 0 PCT at 90 PCT relative humidity.
 - 3) Bond Strength (ASTM C-321): 145 PSI at 28 days.
 - 4) Mix Ratio (by Volume): One part water to three parts patching mix.
 - 5) Mix Time: Hand mix only – maximum, one to two min.
 - 6) Applied Density: 105 LBS, ±5 LBS PCF.
 - 7) Placement Time: Five to 10 min.
 - 8) Flow Release: 15 to 30 min. after placement.
3. Cement Plug:
- a. The grout used to plug active infiltration shall be a rapid set hand mixed and hand applied cementitious products with set modifiers and other additives. Material shall not contain chlorides, gypsum, or metallic particles.
 - b. The plugging mix is to be mixed and applied according to manufacturer's recommendations, and shall meet or exceed the following physical property requirements:
 - 1) Compressive Strength (ASTM C-109):
 - a) 1 HR > 400 PSI.
 - b) 24 HRS > 1,800 PSI.
 - c) 28 day > 5,500 PSI.
 - 2) Bond Strength (ASTM C321):
 - a) 30 min: 50 PSI.
 - b) One day: 85 PSI.
 - 3) Expansion (ASTM C827): 0.1 PCT.
 - 4) Pull Out Strength (ASTM C234): 14,000 LBS.
 - 5) Sulfate Resistance (ASTM C267): No weight loss after 15 cycles, 2,000 PPM sulfuric acid, test continuing.
 - 6) Freeze/Thaw Resistance (ASTM C666 Method "A"): 100 cycles, no weight loss.
 - 7) Set Time (ASTM C191): 60 to 90 sec.
4. Invert Repair and Patching:
- a. All material furnished shall be designed to fill large voids in manhole walls and to repair or reconstruct inverts where no hydrostatic pressure exists.
 - b. Material shall consist of rapid setting cements, NSG aggregates, and various accelerating agents.
 - c. Material shall not contain chlorides, gypsum, or metallic particles:
 - 1) Compression Strength (ASTM C109):
 - a) 1 HR: 4,170 PSI.
 - b) 3 HRS: 5,840 PSI.
 - c) 24 HRS: 7,660 PSI

- 2) Flexural Strength (ASTM C348):
 - a) 1 HR: 450 PSI.
 - b) 3 HRS: 625 PSI.
 - c) 24 HRS: 820 PSI.
- 3) Freeze-Thaw (ASTM C666): 300 cycles with no damage
- 4) Setting Time (Gilmore ASTM C266):
 - a) Initial: 15 to 18 minutes.
 - b) Final: 22 to 25 minutes.
5. Cement Pressure Grout:
 - a. The grout used for stopping very active infiltration and filling voids shall be a pre-blended mixture of cementitious binders, lightweight aggregate, mineral filler, and additives specifically selected to prevent segregation, to promote volume stability, and to reduce attack by aggressive groundwater.
 - b. The grouting mix shall be mixed and applied according to manufacturer's recommendations and shall meet or exceed the following physical property requirements:
 - 1) Compressive Strength (ASTM C-109): 250 PSI (minimum) at 28 days.
 - 2) Shrinkage (ASTM C-596): 0 PCT when cured at 90 PCT relative humidity.
 - 3) Loose Bulk Density: 30 to 35 LBS PCF.
 - 4) Wet Density: 30 to 35 LBS PCF.
6. Chemical Grout Gel: The Contractor may utilize acrylamide or urethane chemical grout gel to seal external voids and internal defects in the pipe entry point. The chemical grout material shall meet the following requirements:
 - a. Acrylamide Base Gel:
 - 1) Acrylamide base gel for grouting manhole pipe seals shall meet the following requirements:
 - a) A minimum of ten percent (10 PCT) acrylamide base material by weight in the total sealant mix. A higher concentration (percent) of acrylamide base material may be used to increase the strength or offset dilution during injection.
 - b) The ability to tolerate some dilution and react in moving water during injection.
 - c) A viscosity of approximately two centipoise which can be increased with additives.
 - d) A constant viscosity during the reaction period.
 - e) A controllable reaction time from two seconds to 1 HR.
 - f) A reaction (curing) which produces a homogeneous, chemically stable and non-biodegradable, firm, flexible gel.
 - g) The ability to increase mix viscosity, density, gel strength by the use of additives.
 - 2) Any additives for reinforcing the gel, catalyzing the gel reaction, inhibiting the gel reaction, buffering the solution, lowering the freezing temperature of the solution, or for inhibition of root growth shall be utilized in accordance with manufacturers' recommendations:
 - a) If pressure grouting of manholes is to be done in temperatures less than 40 DEGF, it must be done in accordance with manufacturers' recommendations.

- b) The Acrylamide Base Gel shall be "AV 100" as manufactured by Avanti International or approved equal.
- b. Urethane Base Gel:
- 1) Urethane base gel for grouting manhole pipe entry point shall meet the following requirements:
 - a) One part urethane prepolymer thoroughly mixed with between five and 10 parts of water by weight.
 - b) A liquid prepolymer having a solids content of 77 to 83 PCT, specific gravity of 1.04, and a flash point of 20 DEGF.
 - c) A liquid prepolymer having a viscosity of 600 to 1,200 centipoise at 70 DEGF that can be pumped through 500 FT of 1/2 IN hose with a 1,000 PSI head at a flow rate of 1 OZ per second.
 - d) The water used to react the prepolymer should have a pH of 5 to 9.
 - e) A cure time of 80 seconds at 40 DEGF, 55 seconds at 60 DEGF, and 30 seconds at 80 DEGF when one part prepolymer is reacted with eight parts of water only.
 - f) A cure time that can be reduced to 10 seconds for water temperatures of 40 DEGF to 80 DEGF when one part prepolymer is reacted with eight parts of water containing a sufficient amount of gel control agent additive.
 - g) A relatively rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoise in the first minute for one to eight prepolymer/water ratio at 50 DEGF.
 - h) A reaction which produces a chemically stable and non-biodegradable, tough, flexible gel.
 - i) The ability to increase mix viscosity, density, gel strength and resistance to shrinkage by the use of additives to the water.
 - 2) Any additives for reinforcing the gel, catalyzing the gel reaction, inhibiting the gel reaction, buffering the solution, lowering the freezing temperature of the solution, or for inhibition of root growth shall be utilized in accordance with manufacturers' recommendations:
 - a) If pressure grouting of manholes is to be done in temperatures less than 40 DEGF, it must be done in accordance with manufacturers' recommendations.
 - b) The Urethane Base Gel shall be "Scotch-Seal 5610" as manufactured by 3M or approved equal.

2.3 CEMENTITIOUS MANHOLE LINER

- A. The lining material used for interior manhole wall and benches repair shall be specifically designed for the rehabilitation of manholes and other related wastewater structures:
 - 1. Liner materials shall be cement based, poly-fiber reinforced, shrinkage compensated, and enhanced with chemical admixtures and siliceous aggregates.
 - 2. Liner materials shall be mixed with water per manufacturer's written specifications and applied using equipment specifically designed for low-pressure spray application of cement mortars.
 - 3. All cement liner materials must be capable of a placement thickness of 1/2 IN to 4 IN in a one-pass monolithic application.

4. Material shall be sprayed from bottom of CI frame and cover to bottom of MH walls and may be sprayed on bench from wall to invert.
5. The liner shall be impervious to the flow of water and shall restore structural integrity to existing substrates, and shall meet the following requirements:
 - a. Cementitious liner shall be a factory blended, package mix composed of the following components:
 - 1) Cement shall be Calcium Aluminate Cement, fiber reinforced.
 - 2) Aggregate shall be Nepheline Synite Granite.
 - 3) Water addition as recommended by manufacturer.
 - b. Cementitious Liner shall meet or exceed the following 28-day physical property requirements:
 - 1) Compressive Strength (ASTM C-109): 28 day; 9,000 PSI.
 - 2) Tensile Strength (ASTM C-496): 28 day; 580 PSI.
 - 3) Flexural Strength (ASTM C-78): 28 day; 1,400 PSI.
 - 4) Shrinkage (ASTM C-596): 0 PCT at 28 days, 90 PCT relative humidity.
 - 5) Freeze-Thaw (ASTM C-666 - Method "A"): No visual damage after 300 cycles.
 - 6) Water / Cement Ratio: 0.40.
 - 7) Bond Strength (ASTM C-952): 2,000 PSI at 28 days.
 - 8) Dry Bulk Density: 65 to 67 LBS per CUFT.
 - 9) Applied Density: 115 ±5 LBS per CUFT.
 - 10) Fiber Reinforcement: 1/2 IN to 5/8 IN Alkaline-Resistant Fiberglass Rods.

PART 3 - EXECUTION

3.1 CEMENTITIOUS MANHOLE LINER

A. Repair Manhole Interior:

1. Repair of existing manholes by lining shall consist of cleaning the entire manhole interior surface and removal of any existing steps; preparation (plugging and/or patching) of the manhole interior surface for lining including grade adjustment, cone, wall, pipe seals, and bench; and lining the entire manhole interior surface down to the point where the bench meets the invert with a structurally enhancing monolithic liner that is suitable for top coating with an epoxy liner.
2. Application, cure time and surface preparation of cementitious liners shall follow procedures recommended by the manufacturer of the epoxy liner, to permit optimum bond strength with the epoxy coating:
 - a. Cleaning:
 - 1) Prior to cleaning, covers shall be placed over the flow channels to prevent extraneous material from entering the sewer lines.
 - 2) Cleaning shall consist of completely removing loose bricks and mortar, unsound concrete, grease, roots, mud and debris from the interior surface of the manhole to a depth necessary to expose a sound subbase.
 - 3) All roots shall be cut flush with the manhole wall.
 - 4) The entire interior surface of the manhole shall be cleaned using a high pressure (minimum of 3,500 PSI) water (potable) spray.

- 5) When grease and/or oil are present within the manhole, an approved detergent or muriatic acid shall be used intergrally with the high pressure cleaning water.
- b. Preparation for Manhole Lining:
 - 1) After cleaning, the manhole interior surface shall be prepared for lining.
 - 2) Loose or missing brick or block shall be removed and replaced, actively leaking areas plugged, and voids patched.
 - 3) Any patching and/or plugging materials shall be deemed compatible with the lining material used for lining the manhole as determined by the manufacturers.
 - 4) All existing manhole steps shall be removed from the manhole walls and the void shall be plugged with grout conforming to the requirements of "Cement Patch," as provided herein.
- c. Actively leaking areas shall be plugged with grout conforming to the requirements of "Cement Plug," as provided herein, for plugging infiltrating water:
 - 1) Holes, voids, and cracks shall be patched with grout conforming to the requirements of "Cement Patch," as provided herein, for filling voids.
 - 2) Pressure grouting using a cement pressure grout shall be performed when initial application of cement plug material fails to eliminate infiltration.
- d. Invert Repair shall consist of hand mixing and applying material conforming to the requirements of "Invert Repair and Patching", as provided herein:
 - 1) This Work shall be completed prior to spray lining of the manhole.
 - 2) For invert repairs, flow must be temporarily restricted by inflatable or mechanical plugs prior to cleaning.
 - 3) The materials shall be applied to the invert or void areas by hand trowel.
 - 4) In invert applications, care should be taken to not apply excessive material in the channel, which could restrict flow.
 - 5) Once applied, materials should be smoothed by trowel in order to facilitate flow.

B. Cementitious Manhole Liner:

1. Application of the cementitious lining material shall be done in accordance with the manufacturer's recommendations.
2. The entire manhole interior surface shall be clean and free of foreign material.
3. The material shall be applied from the bottom to the top of the manhole to form a coating of uniform thickness sufficient to insure that all cracks, crevices, and voids are filled and a relatively smooth surface remains.
4. The thickness of the lining material shall not be less than 1 IN thick at any point from the wall/bench joint to the bottom of the frame:
 - a. Equipment: Equipment used to mix and apply the lining material shall meet the requirements and specifications of the manufacturer.
 - b. Mixing: Mixing of the lining material shall be done in accordance with requirements and specifications of the manufacturer.
 - c. Troweling of materials shall begin immediately following the spray application:
 - 1) Initial troweling shall be in an upward motion, to compress the material into voids and solidify manhole wall.
 - 2) Precautions should be taken to not over trowel.

- d. Curing:
 - 1) Curing of the applied lining material shall be done in accordance with the manufacturer's recommendations.
 - 2) It is important that the manhole cover is replaced no more than 10 to 20 minutes after troweling is complete to avoid moisture loss in the material due to sunlight and winds.
- e. Material shall not be applied during freezing weather conditions. Material shall not be placed when the ambient temperature is 37 DEGF and falling or when the temperature is anticipated to fall below 32 DEGF during 24 HRS.

3.2 QUALITY CONTROL

- A. The quality and performance of the Cementitious Manhole Liner material shall be maintained by the following measures:
 - 1. Performance Testing:
 - a. Vacuum Testing as detailed in City of Osage Beach Standards.
 - b. Visual Inspection.
 - 2. Material Testing: One 2 IN by 2 IN Sample cube shall be taken for every 50 bags of material used. Samples shall be sprayed from nozzle, identified and sent to an independent test laboratory for compression strength testing as described in ASTM C-109.

3.3 WARRANTY

- A. Product manufacturers shall warrant all materials to be free of defects product design and workmanship for a period of 1 YR from date of purchase:
 - 1. Manufacturer will provide replacement materials for any product proven to be defective when applied in accordance with manufacturer's recommendations.
 - 2. Manufacturer's obligation shall be limited solely to product replacement.

END OF SECTION

SECTION 33 05 16
PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast concrete round manhole structures and appurtenant items.
 - a. Sanitary sewer manholes and appurtenances.
 - b. Drain manholes and appurtenances.
 - c. Storm sewer manholes and appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A48/A48M, Standard Specification for Gray Iron Castings.
 - b. C150/C150M, Standard Specification for Portland Cement.
 - c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
 - f. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 2. Fabrication and/or layout drawings:
 - a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
 - b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
 - c. Indicate knockout elevations for all piping entering each manhole.
 - 3. Buoyancy uplift and structural calculations.
 - 4. Drawings shall be signed and sealed by a Professional Engineer registered in state corresponding to the project location.
- B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Manhole rings, covers and frames:
 - a. Neenah Foundry and Neenah Enterprises, Inc.
 - b. Deeter Foundry.
2. Black mastic joint compound:
 - a. Kalktite 340.
 - b. Tufflex.
 - c. Plastico.
3. Premolded joint compound:
 - a. RAM-NEK.
 - b. Kent Seal.
4. Emulsified fibrated asphalt compound:
 - a. Sonneborn Hydrocide 700B.

2.2 SANITARY SEWER, STORM AND DRAIN MANHOLE STRUCTURE COMPONENTS

A. Manhole Components:

1. Reinforcement: ASTM C478.
2. Minimum wall thickness: 5 inches.
3. Minimum base thickness: 12 inches.
4. Provide the following components for each manhole structure:
 - a. Base (precast) with integral bottom section or (cast-in-place).
 - b. Precast bottom section(s).
 - c. Precast barrel section(s).
 - d. Precast eccentric transition section.
 - e. Precast adjuster ring(s).
 - f. Precast concrete transition section.
 - g. Precast flat top.
5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 inches inside dimensions.

B. Nonpressure Type Frames and Cover:

1. Cast iron frame and covers: ASTM A48/A48M, Class 35 (minimum).
2. Use only cast iron of best quality, free from imperfections and blow holes.
3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 pounds.
4. Machine all horizontal surfaces.
5. Furnish unit with solid nonventilated lid with concealed pickholes.
 - a. Letter covers "SEWER" for all collection system manholes, "DRAIN" for all gravity unit drains returning flow to the headworks, and "STORM" for storm sewer systems.
6. Ensure minimum clear opening of 24 inches diameter.

C. Pressure Type Frame and Cover:

1. Provide covers meeting the requirements of the Nonpressure Type Frames and Cover paragraph above and as modified below.
2. Furnish frame and bolted cover of heavy-duty construction.
 - a. Equip unit with six stainless steel countersunk 3/8 inches diameter by 1-1/2 inches long bolts with stainless steel washers.
3. Provide solid lid and minimum 1/8 inches thick x 1/2 inches wide continuous strip neoprene gasket.

4. Furnish unit with a minimum of six anchorage holes and six, 6 inches long x 3/4 inches diameter stainless steel anchor bolts.
- D. Special Coatings and Joint Treatment:
1. Joints of precast sections:
 - a. Black mastic compound: ASTM D4586.
 2. Vertical wall surfaces:
 - a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type II for all exterior [and interior] vertical wall surfaces.
- E. Sanitary Sewer Manhole Concrete:
1. Provide all sanitary manholes constructed with Portland ASTM C150/C150M, Type I or II cement with a tricalcium aluminate content not to exceed 8%.
 2. Mix aggregate shall be a minimum of 50% crushed limestone.
 3. Provide 3000 psi nonshrink grout.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

- A. General:
1. Construct cast-in-place concrete base slabs.
 2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
 3. On all straight runs, lay pipe through manhole and cut out top half of pipe.
 - a. See detail on Drawings.
 - b. If pipes deflect at manhole, shape as specified in Paragraphs 2 and 4 inches this General Paragraph.
 4. Shape inverts accurately and steel trowel finish.
 - a. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert using as large a radius as manhole inside diameter will permit.
 - b. Pour base slab integral with bottom barrel section.
- B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.
- C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 inches immediately prior to mating the surfaces.
- D. For horizontal joints that fall below established high groundwater elevation shown, install a resilient O-ring type gasket or pre-molded joint compound.
- E. Seal all pipe penetrations in manhole.
1. Form pipe openings smooth and well shaped.
 2. After installation, seal cracks with, non shrink grout.
 3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 inches to ensure complete seal.
- F. Set and adjust frame and cover final 6 inches (minimum) to 18 inches (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

SECTION 33 05 19
DUCTILE-IRON UTILITY PIPE (1)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductile iron piping, fittings, specials, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
 - 2. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 REFERENCES

- A. Definitions:
 - 1. CLSM: Controlled Low Strength Material.
 - 2. Mechanical Couplings: Fittings intended to join grooved and/or shouldered pipe.
 - 3. Pipe Diameter: Pipe diameter specified or shown on the Drawings is the nominal pipe diameter for ductile iron pipe.
- B. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - c. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
 - 2. ASTM International (ASTM):
 - a. A47, Standard Specification for Ferritic Malleable Iron Castings.
 - b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - d. A536, Standard Specification for Ductile Iron Castings.
 - e. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - 3. American Water Works Association (AWWA):
 - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - b. C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe.
 - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C104/A21.4, Standard for Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.
 - b. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - c. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - d. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - e. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - f. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.

- g. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
- h. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
- i. C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.
- j. C219, Bolted Sleeve-Type Couplings for Plain-End Pipe.
- k. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Action Submittals:

- 1. Submit shop drawings for ductile iron pipe, fittings and appurtenances as one package.
- 2. Submit the class and wall thickness for all pipe and pressure rating and wall thickness of all fittings.
- 3. Submit standard and restrained joints details indicating all pertinent dimensions and manufacturing tolerances.
- 4. Submit a materials list indicating the anticipated number of straight lengths of pipe to be used and all fittings and specials
- 5. Submit separate shop drawing for fittings only if manufactured by a separate supplier.
- 6. Material list.
- 7. Manufacturing Information.
 - a. Pipe and fitting details for temporary and permanent facilities indicating:
 - 1) Manufacturing tolerances.
 - 2) Maximum angular deflection limitations of field joints.
 - 3) Closure sections and cutoffs for field length adjustment.
 - 4) Bulkheads, including details for removal of test bulkheads and repair of linings.
 - 5) All other pertinent information required for the manufacture and installation of the product.
 - b. Joint Details:
 - 1) Push-on joints.
 - 2) Restrained joints.
 - 3) Flanged joints.
 - 4) Mechanical Joints.
- 8. Product data for the following:
 - a. Pipe and fittings:
 - 1) Material data.
 - 2) Chemical and physical test reports.
 - 3) Manufacturer's recommendation for maximum allowable joint deflection.
 - b. Coatings and Linings:
 - 1) Technical data sheets itemizing chemical composition, technical and performance information that indicates compliance with this Specification.
 - 2) Color chart, if applicable.
 - 3) Surface preparation requirements.
 - 4) Curing requirements.
 - 5) Manufacturer's name, product number or name.
 - 6) Coating or lining thickness.
 - c. Flanged Joints:

- 1) For each flanged connection: Reference standard, class, dimensional data, bolt hole number, pattern and diameter, bolt diameter and length, face condition (raised or flat).
 - d. Gaskets and Bolting: Technical data sheets itemizing chemical composition, technical and performance information that indicates compliance with this Specification.
 - e. Wall Sleeves: Dimensional data, including sleeve length, thickness, and diameter.
 - 9. Pipe handling equipment and methods for loading and unloading pipe.
 - a. Pipe support requirements for storage.
 - 1) Minimum allowable width, quantity, and location of contact points to prevent excess deflections.
 - b. Pipe moving support requirements: Minimum allowable sling width.
 - 10. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.
- B. Informational Submittals:
- 1. Certificates.
 - a. Manufacturer's Certificate of Compliance that products furnished meet requirements of this Specification.
 - b. Ductile Iron Pipe Installation: Certificate that training has been provided to Contractor's installation crews regarding proper pipe handling and storage procedures.
 - 2. Reports:
 - a. Factory Hydrostatic Test Reports.
 - b. Field Hydrostatic Test Reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Pipe and Fittings:
 - a. American Ductile Iron Pipe.
 - b. McWane Ductile.
 - c. US Pipe.
 - 2. Flanged Adaptors (flanged coupling adaptors):
 - a. Smith Blair, Style 913 (steel).
 - b. Dresser, Style 128 (steel).
 - c. Romac Style FCA501 (cast iron).
 - 3. Restrained Flanged Adaptors (restrained flanged coupling adaptors):
 - a. Romac Style Alpha FC (ductile iron).
 - b. Smith Blair Style 911 (ductile iron).
 - 4. Compression Sleeve Coupling:
 - a. Smith Blair, Style 431 (cast iron).
 - b. Dresser, Style 153 (cast iron).
 - c. Romac Industries, Style EC501 (ductile iron).
 - 5. Mechanical (Grooved) coupling:
 - a. Victaulic, Style 31.
 - 6. Insulating Couplings:
 - a. Smith Blair, Style 416.

- b. Dresser, Style 39.
- c. Romac, Style IC400.
- 7. Reducing Couplings:
 - a. Smith Blair, Style 415.
 - b. Dresser, Style 62.
 - c. Romac, Style RC501 (ductile).
- 8. Transition Coupling:
 - a. Smith Blair, Style 413.
 - b. Dresser, Style 62.
 - c. Romac, Style TC400.
- 9. Ceramic Epoxy Lining:
 - a. "PROTECTO 401" by Induron.
 - b. "CERAMAPURE PL-90" by Induron.
 - c. "Permox-CTF" by Permite.
- 10. Glass Lining:
 - a. C&B Piping: CBGL911 Porcelain Glass Lining.
 - b. US Pipe: Vitco SG-14 Glass Lining.
- 11. Polyethylene Encasement Tape:
 - a. Chase, Chasekote 750.
 - b. Kendall, Polyken 900.
 - c. 3 M, Scotchrap 50.
 - d. V-Bio Polywrap.
- 12. Restrained joints:
 - a. American (Flex-Ring) - 4 inches to 54 inches.
 - b. American (Lok-Ring) - 54 inches to 64 inches.
 - c. U.S. Pipe (TR-Flex) - 4 inches to 36 inches.
 - d. U.S. Pipe (HP Lok) - 30 inches to 64 inches.
- 13. Expansion joints:
 - a. Smith-Blair (Style 611).
 - b. Dresser (Style 63).
 - c. Or approved equal.
- 14. Dismantling joints:
 - a. Smith-Blair (Style 975).
 - b. Dresser (Style 131).
 - c. Or approved equal.

2.2 MATERIALS

- A. Ductile Iron Pipe:
 - 1. AWWA/ANSI C115/A21.15.
 - 2. AWWA/ANSI C150/A21.50.
 - 3. AWWA/ANSI C151/A21.51.
- B. Fittings and Flanges:
 - 1. AWWA/ANSI C110/A21.10.
 - 2. AWWA/ANSI C153/A21.53.
 - a. Do not use for pump suction piping.

3. AWWA/ANSI C115/A21.15.

C. Nuts and Bolts:

1. Buried:
 - a. T-Bolts for mechanical joints: Per AWWA/ANSI C111/A21.1.
 - b. Other bolts and nuts: ASTM A307.
2. Heads and dimensions per ASME B1.1.
3. Threaded per ASME B1.1.
4. Project ends 1/4 to 1/2 inches beyond nuts.

D. Gaskets:

1. Flanged Joints:
 - a. For pipe sizes between 4 and 64 inches and maximum working pressures not exceeding 250 psig: SBR in accordance with AWWA C111.
 - b. For pipe sizes between 4 and 24 inches and maximum working pressures greater than 250 psig: In accordance with ASME B16.21.
2. Mechanical and push-on joints: in accordance with AWWA C-111.
 - a. Maximum pressure: 350 psi.

E. Polyethylene Encasement: Per AWWA/ANSI C105/A21.5.

2.3 MANUFACTURED UNITS

A. Couplings:

1. Flanged adaptors:
 - a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
2. Compression sleeve coupling:
 - a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
 - e. Provide field coating for buried couplings per AWWA C203.

2.4 FABRICATION

- A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.
- B. Furnish cast parts with lacquer finish compatible with finish coat.
- C. Minimum Pressure or Thickness Class: See Drawings.

2.5 ACCESSORIES

A. Couplings:

1. For pipe with plain end by plain end (Bolted Sleeve Coupling):
 - a. In accordance with AWWA C219.
 - b. Coupling linings for use in potable water systems: conformance with NSF 61B.

- c. Rated for appropriate operating pressure and restraint.
- 2. For pipe with flange by flange ends (Dismantling Joints).
 - a. Self-contained flanged restrained joint fitting, including both flange components and sufficient harness bars to withstand the imposed thrust.
 - b. Design pressure rating: equal to or greater than flange rating.
- 3. Provide bolts, nuts, and washers (when required) of suitable quality, workmanship, and yield strength to ensure compatibility with the coupling design and rated pressure.
 - a. Select materials to minimize the possibility of galvanic corrosion.
- 4. See Paragraph 2.2 of this Specification for gasket requirements.

2.6 SOURCE QUALITY CONTROL

A. Factory Test:

- 1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install piping complete with jointing materials and accessories, anchors, and other appurtenances.
- B. Prepare trench as specified in Specification Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
- C. Unless otherwise permitted by Engineer, maximum length of open trench: 300 linear feet or the amount of pipe that can be installed in a single day, whichever is less.
- D. A. Handling and Storage:
 - 1. Stack pipe no higher than the maximum height given in AWWA C600.
 - a. Alternate bell ends with spigot ends.
- E. Protection of Appurtenances:
 - 1. Wrap buried ductile iron pipe appurtenances with polyethylene, following the procedures of AWWA C600.
- F. Installation of buried bolted joints:
 - 1. Coat buried bolted joints with wax tape then wrap in polyethylene.

3.2 LAYING PIPE

- A. Trenching, embedment, and backfilling of buried piping: conform to Specification Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities, and to the details indicated on the Drawings.
 - 1. Do not install pipe when water is in the trench.
- B. Before placement of pipe in the trench, ensure each pipe or fitting is clean of any foreign substance, keep clean thereafter.
 - 1. Cover openings of pipes and fittings in the trench during non-working hours.
- C. Handle pipe with proper equipment in a manner to prevent distortion or damage.
 - 1. Use of hooks, chains, wire ropes, or clamps that could damage pipe, damage coating or lining is not permitted.
 - 2. Use heavy canvas, or nylon slings of suitable strength for lifting and supporting materials.
- D. Lift pipe during unloading or lifting into trench using one or more slings as required to prevent uncontrolled swinging, damage to pipe, or harm to workers.

1. Design slings to bear uniformly against pipe.
- E. CLSM:
1. The terms CLSM and Flow Fill are synonymous in this specification.
 2. If pipe zone or embedment material is CLSM, lay pipe directly on moist sandbag supports in preparation for CLSM.
 3. Place sandbag supports to provide at least 6 inches of CLSM below bottom of pipe.
 4. Space supports at a maximum interval of 8 feet and one set within 3 feet on both sides of each joint.
 5. Provide additional sandbags as needed to support pipe on line and grade.
 6. Place CLSM in lifts or provide hold downs to prevent pipe floatation.
- F. Form bell holes at the ends of pipe to prevent point loading at the bells or couplings.
1. Make excavation outside normal trench section at field joints for field connections, welding, and application of coatings.
- G. Lay each section of pipe to the set line and grade.
1. Installation tolerances as hereinafter specified.
- H. Locate horizontal deflections on alignment as shown on the Drawings.
- I. Locate vertical deflections on alignment, and match pipe angle point locations indicated on Drawings.
- J. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades.
1. Make changes by the deflection of joints or by using fittings.
 2. Do not install misfit joints that will be detrimental to the strength and water tightness of the finished joint, including the strength and water tightness of the protective lining at the finished joint.
- K. Make minor field adjustments by pulling standard joints.
1. The allowable deflection of field joints is as follows:
 - a. Maximum Allowable Angle: 50 percent of manufacturer's recommended, or angle that results from 3/4 inch pull out from normal joint closure, whichever is less.
- L. For grades exceeding 10 percent lay pipe in an uphill direction except for short runs that may be permitted by the Engineer.
1. Block pipe which is laid on a downhill grade and hold in place until sufficient support is furnished by the following pipe to prevent movement.
- M. Whenever pipe laying is stopped at the end of the day, seal the open end of the line to prevent entry by animals, dirt, and debris.
1. Design seals to prevent drying out of the interior of the pipe.
 2. Maintain continuous dewatering when necessary to prevent groundwater or surface water from entering the pipeline.
 3. Maintain continuous dewatering until pipe trench is fully backfilled and any anti-floatation provisions shown on the drawings are installed.
 4. Remove water from the trench to the level indicated in Specification Section 31 23 33 prior to resuming pipe laying operations.
- N. Cold Weather Protection:
1. Do not install pipe upon a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation.

2. Do not lay pipe unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.

O. Alignment and Grade:

1. Lay pipe to the lines and grades indicated on the Drawings.
 - a. Pipelines or runs intended to be straight shall be laid straight.
 - b. Curves in push on joint pipe may be formed by opening the joint.
 - 1) Maximum joint openings and deflections: 50 percent of that recommended by the pipe manufacturer.
2. Use survey equipment to indicate alignment and grade.
 - a. Take at least one elevation reading on each segment of pipe.
 - b. Make periodic elevation measurements with surveying instruments to verify accuracy of grades.
 - c. Verify survey set up at least daily using an independent benchmark or temporary benchmark.

P. Tolerances:

1. Alignment and Grade Tolerances
 - a. Plus or minus 0.05 foot in grade.
 - 1) High and low points will not be acceptable, except where indicated on the Drawings.
 - b. Plus or minus 0.20 foot in alignment, except where indicated differently on the Drawings.
2. Observe stricter tolerances than specified above as necessary to maintain minimum cover, to maintain required clearances, to place carrier pipe inside the casing pipe, to make pipe connections to existing piping, to maintain the correct slope in the run to prevent high or low points along the pipeline other than those locations indicated on the Drawings.

Q. Protection of Pipe:

1. Take precautions to protect the pipe from damages at locations where the Contractor proposes to cross the installed pipeline with heavy equipment.
2. Acceptable precautions include:
 - a. Backfilling the pipe trench as necessary to protect the pipe.
 - b. Concrete encasing the pipe.
 - c. Placing steel plating over the pipe above the final pipe zone or embedment.
3. Repair damage to the pipe caused by Contractor's operation.

3.3 JOINTING

A. Joining Method - Push-On Mechanical (Gland-Type) Joints:

1. Install in accordance with AWWA/ANSI C111/A21.11.
2. Assemble mechanical joints carefully according to manufacturer's recommendations.
3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
4. Do not overstress bolts.
5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.
6. Apply wax tape per C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.

B. Joining Method - Push-On Joints:

1. Install in accordance with AWWA/ANSI C151/A21.51.
2. Assemble push-on joints in accordance with manufacturer's directions.

3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
4. Assure the gasket groove is thoroughly clean.
5. Flex rubber gasket inward and insert in the gasket recess of the bell socket.
 - a. For cold weather installation, warm gasket prior to placement in bell.
6. Enter spigot end of the pipe into the socket with care used to keep the joint from contacting the ground.
 - a. Complete the joint by forcing the plain end to the bottom of the socket in a manner approved by the Engineer.
7. Check each joint with a feeler gauge to ensure proper installation of the gasket.
8. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot end is inserted to the full depth of the joint.
9. File or grind field cut pipe joints to resemble a spigot end as recommended by the manufacturer.
 - a. Field cutting allowed only on gauged.
10. Field-cut end repairs are to be done in accordance with the pipe manufacturer's recommendations.
 - a. Taper of bevel: approximately 30 degrees with centerline of pipe and approximately 1/4 inches back.

C. Joining Method - Flanged Joints:

1. Install in accordance with AWWA/ANSI C115/A21.15.
2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
3. Make flange faces flat and perpendicular to pipe centerline.
4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
5. Allow one flange free movement in any direction while bolts are being tightened.
6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
7. Gradually tighten flange bolts uniformly to permit even gasket compression.

D. Joining Method - Mechanical Joints:

1. Thoroughly clean the last 8 inches outside of the spigot and the inside of the bell to remove oil, grit, excess coating, and other foreign matter from the joint and then paint with a thin film of non-toxic, water soluble gasket lubricant.
2. After preparation of the spigot, slip gland onto the spigot end of the pipe with the lip extension of the gland toward the plain end.
3. Paint the rubber gasket with the gasket lubricant and place on the spigot end with the thick edge toward the gland.
4. Push the entire section of the pipe forward to seat the spigot end in the bell, then press the gasket into place within the bell.
 - a. Locate the gasket evenly around the entire joint.
5. Move the gland toward the bell and center with the gland lip against the gasket.
 - a. Insert all of the bolts and finger tighten nuts.
 - b. Tighten all nuts with a torque limiting wrench following the range of torque given in AWWA C600.

- 1) Tighten bolts spaced 180 degrees apart alternately in order to produce an equal pressure on all parts of the gland.
 6. Deflect joints scheduled for deflection after joint assembly but before tightening the bolts.
 - a. Maximum deflection for mechanical joints: 50-percent of the manufacturers maximum recommended deflection.
 7. Apply wax tape per AWWA C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.
- E. Joining Method – Mechanical (Grooved/shouldered) Coupling Joint:
1. Arrange piping so that pipe ends are in full contact.
 2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
 3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.
 4. Utilize grooving tools from the same manufacturer of the couplings and fittings.
 5. For buried piping, apply wax tape per C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings
- F. Flange Adaptors 12 inches and Less:
1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
 2. Drill holes not more than 1/8 inches larger than diameter of stud projection.
- G. Wax Tape Coating System:
1. After installation, coat all buried nuts and bolts with a wax tape coating system in accordance with:
 - a. AWWA C217.
 - b. Manufacturer's printed instructions.
 2. Cut strips of wax tape and apply them around all bolts and nuts so that there are no voids or spaces under the tape.
 3. Apply a sufficient amount of tape to completely encapsulate all bare metal.
- H. Cutting:
1. Do not damage interior lining material during cutting.
 2. Use abrasive wheel cutters or saws.
 3. Make square cuts.
 4. Bevel and free cut ends of sharp edges after cutting.
- I. Support exposed pipe in accordance with Section 40 05 00.
- J. Install polyethylene encasement on all buried piping in full compliance to AWWA/ANSI C105/A21.5.
1. Encase underground appurtenances required as part of installation.
 2. Clean all material to be wrapped prior to wrapping operations.
 3. Do not trap soil or embedment material shall not be trapped between the polyethylene material and the item to be protected during installation.
 4. Secure polyethylene encasement at ends, seams, overlaps and folds by adhesive tape or plastic tie straps approved for such purpose.
 5. Provide sufficient slack in contouring the encasement around buried items to prevent stretching the material where it bridges irregularities and to prevent damage by backfilling operations.
 - a. Make sections 2 feet longer than pipe section to be covered.
 6. Where tapping polyethylene encased pipe, first wrap location of tap with three layers of polyethylene adhesive tape.

- a. Make tap through tape.
 7. Slip tube over pipe while pipe is suspended immediately before placing in trench.
 8. After installing in trench, pull tube ends over joint and overlap.
 9. Fasten securely in-place on each side of each joint with joint tape or strapping.
 10. Pull loose tube along pipe barrel up snugly around pipe and fasten in-place with joint tape at 3 feet intervals.
 11. Completely cover fittings and connections with film held snugly in-place with joint tape or strapping.
 12. Repair cuts, tears, punctures and other damage to the polyethylene material with adhesive tape and a short length of additional polyethylene material, if needed.
 - a. Allow Engineer to inspect all repairs prior to all backfilling activities.
- K. Install restrained joint systems where shown on the drawings.

3.4 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 40 05 00.

END OF SECTION

SECTION 33 05 31.11
POLYVINYL CHLORIDE GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. PVC gravity sewer pipe and fittings.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 23 33 - Trenching, Backfilling, Compacting For Utilities.
 - 2. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. See Specification Section 40 05 00.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. PVC (polyvinyl chloride) materials:
 - 1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2) D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
 - 3) D2729, Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 6) F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 7) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 8) F1336, Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings
 - 9) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

1.3 DEFINITIONS

- A. DR: Dimension Ratio, Outside Diameter/Minimum Wall Thickness, both in inches [millimeters]
- B. Diametral Deflection: reduction in diameter caused by earth and surcharge loads acting on the installed pipe.
- C. PS: Pipe Stiffness, PSI
- D. SDR: Standard Dimension Ratio.

1.4 SUBMITTALS

- A. Comply with Section 40 05 00 – Pipe and Pipe Fittings – Basic Requirements, relative to required Submittals.
- B. Where an option for joint type is specified, submit jointing method(s) selected and where each will be used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Chevron Phillips Chemical Company LP - Performance Pipe Division (DriscoPlex).
 - 2. WL Plastics.
 - 3. JM Eagle
 - 4. Pipeline Plastics.
 - 5. Or equal.

2.2 PVC DRAINAGE AND SEWER PIPING

- A. Materials:
 - 1. PVC pipe and fittings: rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C per ASTM D1784.
- B. Pipe:
 - 1. ASTM D3034
 - a. DR 26.
 - 2. Ensure impact strengths and pipe stiffnesses are in full compliance to these Specifications.
- C. Joints
 - 1. Elastomeric gasket joint meeting requirements of ASTM D3212.
 - a. Gaskets (seals) per ASTM F477.
- D. Fittings:
 - 1. Elastomeric Joints: Per ASTM D3034 and ASTM D3034

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Identify each length of pipe clearly at intervals of 5 feet or less per governing ASTM Standard for each type of pipe used.

3.2 INSTALLATION

- A. See Section 31 23 33 - Trenching, Backfilling, Compacting For Utilities.
- B. Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
- C. Infiltration and Exfiltration:
 - 1. Infiltration and Exfiltration maximum rates: See Section 40 05 00
 - a. Observe full instructions of the Engineer for carrying of testing procedures.
 - b. Perform tests only during presence of the Engineer or his authorized representative.
 - 2. Should any test on any section of pipeline disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.
- D. Diametral Deflection:
 - 1. After backfilling, check each section of pipe for diametral deflection by pulling a mandrel through the pipe.
 - 2. Pipe with deflection exceeding 3% of the inside diameter: remove and replace to provide a deflection of less than 3%.

3. Retest any repaired pipe.

END OF SECTION

SECTION 33 05 33.23

POLYETHYLENE PRESSURE PIPE AND TUBING (AWWA C901 AND AWWA C906)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene (PE) pipe, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
2. Section 40 05 00 - Pipe and Fittings: General Requirements

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer of PE Pipe:

- a. Obtain all PE pipe and fittings from one manufacturer, unless otherwise acceptable to Owner and Engineer.
- b. Manufacturer of pipe required by this Section shall be regularly engaged in the business of manufacturing PE piping of the size and type(s) required for the Work. Upon Engineer's request, submit documentation of manufacturer's prior furnishing of PE pipe of the type(s) required for not less than five other projects, similar in size and complexity to the PE piping Work of this Project, in North America.
- c. Equipment:
 - 1) Qualify each extrusion line and molding machine to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D1598.
- d. QA and QC Program:
 - 1) PE pipe manufacturer shall have documented quality assurance and quality control programs as part of manufacturer's routine business.
 - 2) PE piping manufacturer shall maintain permanent Quality Control (QC) and Quality Assurance (QA) records.

2. Installer:

- a. Use one entity for all PE pipe Work, unless otherwise acceptable to Owner and Engineer.
- b. Installer shall be experienced with PE piping installation work similar in scope and complexity to the Work of this Section. When required by Engineer, submit documentation of successful completion of not less than five similar projects to the PE piping Work completed within the past five years.
- c. Where PE pipe joints are made by fusing, fusion machine operators shall have been trained by fusion machine manufacturer within 12 months of starting to perform joint fusion Work. Submit documentation of such training, acceptable to Engineer, when requested by Engineer.
- d. Installer's training and qualifications shall be acceptable to PE pipe Supplier retained for the Project.

B. Referenced Standards:

1. American National Standards Institute (ANSI):

- a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
- b. B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

- c. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
2. ASTM International (ASTM):
 - a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - b. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
 - c. A194, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - d. A536, Standard Specification for Ductile Iron Castings.
 - e. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - f. D638, Standard Test Method for Tensile Properties of Plastics.
 - g. D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - h. D1505, Test Method for Density of Plastics by the Density-Gradient Technique.
 - i. D1598, Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
 - j. D1599, Test Method for Short-Time Hydraulic Failure Pressure of Plastics Pipe, Tubing and Fittings.
 - k. D2239, Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - l. D2290, Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method.
 - m. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
 - n. D2737, Standard Specification for Polyethylene (PE) Plastic Tubing.
 - o. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 - p. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - q. D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - r. D3350, Standard Specification for Polyethylene (PE) Plastics Pipe and Fittings Materials.
 - s. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - t. F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
 - u. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
 3. American Water Works Association (AWWA).
 - a. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. through 144 In.
 - b. C901, Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. through 3 In. for Water Service.
 - c. C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 65 In. for Waterworks.
 4. Plastic Pipe Institute (PPI):
 - a. TR-3, Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Material.
 - b. PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds.

5. Military Specification (Mil Spec):
 - a. QQ-P-416F, Plating, Cadmium Electro Deposited.
6. National Sanitation Foundation International (NSF):
 - a. 14, Plastic Piping Components and Related Materials.
 - b. 61, Drinking Water System Components – Health Effects.

1.3 DEFINITIONS

- A. DIOD: Ductile Iron Outside Diameter.
- B. CTS: Copper Tube Size.
- C. DR: Dimension Ratio, Outside Diameter/Minimum Wall Thickness, both in inches.
- D. Diametral Deflection: reduction in diameter caused by earth and surcharge loads acting on the installed pipe.
- E. ESCR: Environmental Stress Crack Resistance.
- F. HDB: Hydrostatic Design Basis per ASTM D2837.
- G. IPS: Iron Pipe Size.
- H. SDR: Standard Dimension Ratio.
- I. SIDR: Standard Inside Diameter Ratio.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Shop Drawings:
 - a. Dimensioned, scaled drawings showing Contractor's proposed deviations from piping alignment shown on the Drawings.
 - b. Where necessary, include both plans and profiles and section views in Shop Drawings.
 2. Product Data:
 - a. Manufacturer's published catalog information and specifications for each size and type of PE piping required, including pipe, fittings, and jointing materials.
 - b. Clearly indicate in product data submittal the reference standards with which pipe and appurtenances comply.
 - c. Where couplings are required, submit coupling manufacturer's catalog literature and specifications for the specific couplings proposed.
- B. Informational Submittals; Submit the following:
 1. Supplier Instructions:
 - a. Submit manufacturer's written instructions for handling, storing, and installing piping furnished.
 2. Source Quality Control:
 - a. Submit documentation from manufacturer that piping materials furnished were inspected at the production facility and successfully passed manufacturer's quality control procedures.
 - b. Manufacturer's affidavit certifying piping materials furnished comply with AWWA standard C906.
 3. Fusion machines proposed for joining pipe/fittings.
 4. Field Quality Control:
 - a. Documentation of temperature and pressure profiles from data logger for each butt fusion joint.
 - b. Results of field quality control testing and inspections required in this Section.

- c. Documentation of temperature and pressure profiles from data logger for each butt fusion joint.
- 5. Qualifications:
 - a. Piping materials manufacturer, when requested by Engineer.
 - b. Installer, when requested by Engineer, including documentation of training in use of joint fusion equipment.
 - c. Documentation showing fusion machine operators have been trained within 12 months prior to installation.

1.5 DELIVERY, HANDLING, AND STORAGE

- A. In addition to requirements elsewhere in the Contract Documents, also comply with the following:
 - 1. During handling and installation avoid conditions where pipe bends excessively and avoid imparting kinks in the pipe.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. PE Pipe and Fittings:
 - a. Chevron Phillips Chemical Company LP - Performance Pipe Division (DriscoPlex).
 - b. WL Plastics.
 - c. JM Eagle.
 - d. Pipeline Plastics.
 - e. Or equal.
 - 2. Butt Fusion Equipment:
 - a. McElroy Manufacturing, Inc.
 - b. Or equal.
 - 3. Adaptor Couplings
 - a. Central Plastics Co.
 - b. Poly-Cam, Inc.
 - c. Or equal.

2.2 MATERIALS

- A. Pipe:
 - 1. AWWA C906.
 - a. PE 4710 polyethylene material.
 - b. ASTM D3350 cell classification 445574C.
 - c. Minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73 degF when tested in accordance with PPI TR-3.
- B. Fittings:
 - 1. Same material and thickness as adjoining pipe.
 - a. Fittings may be one DR lower (thicker) than the adjoining pipe.
 - 2. Molded fittings:
 - a. Butt fused: ASTM D3261.
 - b. Socket: ASTM D2683.
 - c. Electrofusion: ASTM F1055.

3. Fabricated fittings: Fabricate from same material as pipe.
- C. Back-up flanges:
1. Stainless steel: ASTM A182, dimensions per AWWA C207.
 2. Ductile iron: ASTM A536 Grade 70-50-5, dimensions per ANSI B16.1.
- D. Nuts and Bolts:
1. Buried:
 - a. T-Bolts for mechanical joints: Per AWWA/ANSI C111/A21.1
 - b. Other bolts and nuts: ASTM A307 [ASTM A193/A194 Grade B8 Class 1] [ASTM A193/A194 Grade B8M, Class 1].
 - c. Wax Tape Coatings per AWWA C217.
 2. Exposed: Mechanical galvanized ASTM B695, Class 40 [ASTM A193/A194 Grade B8, Class 1] [ASTM A193/A194 Grade B8M, Class 1].
 3. Heads and dimensions per ASME B1.1.
 4. Threaded per ASME B1.1.
 5. Project ends 1/4 to 1/2 inches beyond nuts.
- E. Gaskets: See individual piping systems in Section 40 05 00.

2.3 MANUFACTURED UNITS

- A. Adaptor Fittings:
1. Mechanical joint: Adaptor fitting butt fused to pipe.
 - a. Capable of developing same pressure rating as specified for pipe.
 - b. Restrained.
 - c. Central Plastics MJ Adaptor or equal.
- B. Butt Fusion Equipment:
1. Designed to create a joint at least as strong as the adjacent pipe.
 2. Equipment to contain stops to prevent excessive pressure on pipe ends during fusion process.
 3. Equipment to plane pipe ends prior to fusion process.
 4. Provide a data logger to document temperatures and pressures for each butt fusion joint.

2.4 DESIGN CRITERIA

- A. DR: See Drawings.
- B. Pipe Inside Diameter (ID):
1. Minimum allowable pipe outside diameter: Per AWWA C906, Table 4 (DIOD sizing).
- C. Stub flanges: Design to develop full pressure specified for pipe with blind flange connected to back up flange.

2.5 FABRICATION

- A. Pipe:
1. Clearly mark pipe and fittings per AWWA C906.
 2. Service Indication:
 - a. Provide integral color or longitudinal color banding at 180 degrees apart.
 - 1) Water: Blue.
 - 2) Sewer: Green.
 - 3) Reclaimer Water: Purple.

- B. Stub flanges:
 - 1. Design for use with backing flange.
 - 2. Fabricate per manufacturers recommendations to develop full pressure specified for pipe with blind flange attached.

2.6 SOURCE QUALITY CONTROL

- A. Materials:
 - 1. Incoming polyethylene materials:
 - a. Inspect for density per ASTM D1505, melt rate per ASTM D1248, and carbon [and color] containment.
 - b. Provide certification from material supplier for a minimum of 30% of all incoming polyethylene materials.
 - c. PE pipe manufacturer shall verify certifications prior to processing into finished pipe or fittings.
 - 2. Outgoing materials:
 - a. Manufacturer to inspect for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut.
 - b. Perform tests to determine density, melt flow rate, carbon content, and carbon dispersion.
 - c. Test representative samples of the pipe provided to determine hoop tensile strength and ductility by either quick burst per ASTM D1599 or ring tensile per ASTM D2290.
- B. Equipment:
 - 1. Qualify each extrusion line and molding machine to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D1598.
- C. Quality Control Program:
 - 1. Pipe and fitting manufacturer shall maintain permanent Quality Control (QC) and Quality Assurance (QA) records.
 - 2. Certified copies of the quality control data taken during product manufacture shall be supplied to the Owner upon request.
- D. Factory Inspection:
 - 1. PE pipe manufacturer's production and quality assurance facilities shall be open and available for inspection by Owner and its authorized representatives.

PART 3 - EXECUTION

3.1 GENERAL

- 1. Locations: Provide PE piping at the locations shown on the Drawings or as otherwise shown and indicated in the Contract Documents.
- 2. Install PE piping in accordance with:
 - a. Section 31 23 00 - Earthwork and 31 23 33 - Trenching, Backfill, and Compacting for Utilities.
 - b. Other provisions of the Contract Documents.
 - c. Laws and Regulations.

3.2 INSTALLATION

- A. General:

1. Locations: Provide PE piping at the locations shown on the Drawings or as otherwise shown and indicated in the Contract Documents.
 2. Install PE piping in accordance with:
 - a. Manufacturer's recommendations.
 - b. Section 31 23 00 - Earthwork and 31 23 33 - Trenching, Backfill, and Compacting for Utilities.
 - c. Other provisions of the Contract Documents.
 - d. Laws and Regulations.
 3. Field repairs of pipe and fittings are not permitted, with the exception that portions of straight pipe which are damaged may be cut off provided this alteration is in accordance with the manufacturer's established procedures.
- B. Joining method - Fusion Joints:
1. Joint Fusing – General:
 - a. Comply with ASTM F2620, the Contract Documents, pipe manufacturer's written instructions, and fusion machine manufacturer's written recommendations. Where any of the foregoing are inconsistent, comply with the more-stringent requirement. When unclear, request and obtain from Engineer written interpretation or clarification.
 - b. Fusion joiner shall be appropriately qualified and experienced in making the type of fusion joint required (butt fusion, socket fusion or sidewall fusion). Fusion joiner shall perform fusion jointing only for the types of joints for which such person possesses appropriate qualifications and experience.
 - c. Cost of certifying its workers and performing testing required for fused joints is Contractor's responsibility.
 - d. Plane ends of joints in fusion machine prior to heating.
 - e. Push pipe ends together in fusion machine and visually inspect compatibility and alignment of the two ends.
 - f. Comply with pipe manufacturer's written procedures and recommended heating time for pipe ends based upon pipe diameter and ambient temperature.
 - g. Visually inspect joint immediately upon removal of heating element to verify blistering of pipe has not occurred. Blistering of pipe is unacceptable.
 - h. Do not remove pipe from fusion machine until pipe has cooled in accordance with the pipe manufacturer's written instructions.
 2. PE pipe 1 inch diameter and smaller shall be socket fused.
 3. PE pipe joints 1.5 inch diameter and larger shall be butt fused.
 4. Electro-Fusion Fittings:
 - a. Comply with pipe fitting manufacturer's written instructions.
 - b. Ensure ends of connecting pipe are round when fusing.
 - c. Couplings: Provide means to place pipe ends in compression when fusion coupler is heated/cooled until connection process is complete.
- C. Joining method – Flanged Joints:
1. Slide back up flange on PE pipe.
 2. Install stub flange on end of pipe with butt fusion.
 3. Make flange faces flat and perpendicular to pipe centerline.
 4. Allow one flange free movement in any direction while bolts are being tightened.
 5. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
 6. Gradually tighten flange bolts uniformly to permit even gasket compression.
 7. Check bolt torque after 24 hours to ensure that stress relief has not occurred.

D. Joining method – Mechanical Joint:

1. Use only for joining PE pipe to DIP or PVC (AWWA C900).
2. Install MJ adapter on end of PE pipe with butt fusion.
3. Clean components before installation.
 - a. Clean bolts and nuts by wire brushing.
 - b. Lubricate bolts with vegetable-based oil only.
4. Insert nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
5. Execute care when tightening joints to prevent undue strain upon adjoining pipe.
6. Test joint for leakage.
 - a. If joint leaks under pressure testing, loosen or remove nuts and bolts, reset, or replace the gasket, reinstall or retighten bolts and nuts, and retest the joints.
 - b. Completed joints shall be watertight.
7. Check bolt torque after 24 hours to ensure that stress relief has not occurred.

E. Install buried pipe [per Section 40 05 00] and per details shown on Drawings.

1. Allow pipe to stabilize to trench bottom or casing temperature before final tie-in or backfilling.
2. For field sweeps, the minimum cold bending allowable radius:

DR	Minimum Radius
≤9	20 times pipe OD
>9 - 13.5	25 times pipe OD
>13.5 - 21	27 times pipe OD
>21	30 times pipe OD
With flange or fitting inside sweep	100 times pipe OD

3.3 FIELD QUALITY CONTROL

- A. Use only fusion machine operators who have been trained by machine manufacturer no more than 12 months prior to installation of first fused joint.
- B. Visually inspect all pipe for gouges.
 1. Gouges in excess of 10% of the pipe wall thickness are not acceptable.
 2. In area where excessive gouges are present, cut out affected pipe section and butt fused to remaining pipe to make a continuous section.
- C. Check integrity of the heating plate in the fusion equipment a minimum of twice per each 8-hour work shift for temperature uniformity.
- D. Butt-fused specimen joint inspection and testing per ASTM F2620, Appendix X4.
 1. Visually inspect all joints during and after joining to ensure that the joint meets the requirements of the butt fusion welding procedure.
 2. On every day that butt fusions are to be made, prepare a trial butt-fused joint specimen.
 3. Allow specimen to cool completely and cut into test straps.
 4. Test straps:
 - a. Length: 12 inches (min) or 30 times the wall thickness.
 - b. Location of fusion: Center of strap.
 - c. Width: 1 inch (min) or 1.5 times the wall thickness.

5. Visually examine the straps for voids or discontinuities.
 6. Deform the straps by bending, torque, or impact.
 7. If failure of the joint occurs outside of the joint area, the test is acceptable.
- E. Diametral Deflection:
1. After backfilling, check each section of pipe for deflection by pulling a mandrel through the pipe.
 2. Pipe with deflection exceeding 3% of the inside diameter: remove backfill and replace to provide a deflection of less than 3%.
 3. Retest any repaired pipe.
- F. Hydrostatically test installed pipe and fittings in accordance with Section 40 05 00.
1. Provide butt fused stub flanges, back up flanges and blind flanges on both ends of each pipe string for hydrostatic testing prior to and following installation.

END OF SECTION

SECTION 33 11 13
WATER MAIN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coordination and interface with existing facilities and utilities.
 - 2. Connections to existing water mains.
 - 3. Testing, flushing and disinfection.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 22 19 - Finish Grading.
 - 2. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.
 - 3. Section 40 05 61 - Gate Valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Water Work Association (AWWA):
 - a. B300, Standard for Hypochlorites.
 - b. B301, Standard for Liquid Chlorine.
 - c. C651, Standard for Disinfecting Water Mains.

1.3 SUBMITTALS

- A. Submit results of the leakage tests, identifying the specific length of pipe tested, the test pressure, the duration of test and the amount of leakage.
- B. Submit satisfactory bacteriological test reports on disinfection requirements.
- C. Submit qualifications for lab performing disinfection analysis.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe: Refer to Specification Section 40 05 00.
- B. In-Line Valves:
 - 1. Refer to Specification Section 40 05 61.
 - 2. Provide adjustable valve boxes.
 - a. Include price of valve boxes in price of valve installed complete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install water main to the line and grade on the Drawings.
 - 1. Water mains to be staked at a minimum 100 feet interval with depth of cuts monitored.
- C. Field verify depth of utilities that will be crossed.
 - 1. Adjust water main elevation as required during construction.

2. No separate payment will be made for field verification or adjustment of main depths as required.
- D. Contractor will restore all existing structures or services damaged by Contractor's operations at no cost to Owner.

3.2 INTERRUPTION OF SERVICE

- A. Interruption of service to water users shall not exceed 4 hours.
1. Notify property owners of interruption a minimum of 24 hours in advance.

3.3 UNDERGROUND SERVICES

- A. Notify utility representative prior to construction to obtain available information on location of existing utilities.
1. Contractor shall be responsible for locating all utilities.
- B. Existing water services are [not] to be connected to the new water mains.
1. Damage to existing water service to be repaired, using pipe and union the same size and material equal to existing service or other material approved by Engineer.

3.4 DRIVEWAY REMOVAL AND REPLACEMENT

- A. All Portland cement concrete and asphalt noted for removal and replacement shall be cut prior to removal.
1. Cut by sawing, vertical cut to be 1 inch minimum.
 2. The remaining depth of section may be broken out in a manner subject to Engineers approval.
 3. Width of section removed to be either a width not greater than the outside diameter of the water main plus 4 feet-0 inches or broken out to the nearest joint.
- B. Replace Portland cement concrete and asphalt equal to or better than original paving plus 2 inches.
- C. Debris resulting from the above operations shall be removed and hauled as directed by the Engineer.
- D. Include driveway removal and replacement in cost of the bid unit price of the water main.

3.5 GRAVEL SURFACED DRIVES AND ROADWAYS

- A. Restore all damaged gravel surfaced drives and roadways to a condition equal to or better than original.
1. Payment to be at bid unit price for this item.
 2. Replacement gravel gradation.

3.6 PROTECTION OF EXISTING UTILITIES

- A. Contractor to verify the location of all underground utilities.
1. Omission from, or the inclusion of utility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground utilities.
- B. A representative of the underground utilities shall be notified 24 hours in advance of crossings.

3.7 CONNECTIONS TO EXISTING WATER MAINS

- A. Make connections to existing water mains as shown on Drawings, by attaching to existing or changed fitting.
1. Cost for making connections shall include cost of all fittings including flexible couplings, and shall be included in the bid unit price of the water main.

- B. Where the connection is made to an existing water main which can be adequately isolated from the distribution system, it shall be termed a "dry connection."
- C. Contractor is responsible for controlling and disposing of water in the trench at no additional cost to the Owner.

3.8 SEWER CROSSINGS

- A. Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a vertical separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.
 - 1. A water main may be laid closer than 10 feet if the crown of the sewer is at least 18 inches below the water main invert.
 - 2. In the event 18 inches of vertical separation cannot be provided at a sewer crossing, the sewer shall be removed for a distance of 10 feet on each side of the water main and replaced with one 20 feet length of ductile iron pipe of the same size.
- B. Concrete collars shall be provided at each end of the ductile iron pipe to connect to the existing sewer pipe as shown on the Drawings.
- C. Payment for crossings shall be included in the bid unit price of the water main.

3.9 TREES

- A. Do not remove trees without written instructions from the Engineer unless tree removal is shown on drawings.
 - 1. No separate payment will be made for tree removal and the cost shall be included in the bid unit price for transmission main.

3.10 FENCES, SIGNS, MAILBOXES, ETC.

- A. Restore all damaged fences, signs, mailboxes, etc., to their original conditions.
 - 1. No separate payment will be made for these items.

3.11 FIELD QUALITY CONTROL

- A. Sealing, Flushing, and Disinfection of Potable Water Systems:
 - 1. Maintain interior of all pipes, fittings and other accessories free from dirt and foreign material at all times.
 - a. If, in the opinion of the Engineer, the pipe contains dirt that will not be removed by flushing, the pipe interior shall be cleaned and swabbed with bactericidal solution.
 - b. At close of day's work or whenever workmen are absent from jobsite, plug, cap or otherwise provide watertight seal from open ends of pipe to prevent ingress of foreign material.
 - c. If water is in trench, seal shall remain in place until trench is pumped dry.
 - 2. After favorable performance of pressure test and prior to final acceptance, thoroughly flush the entire potable water piping system and perform disinfection as prescribed.
 - a. Perform all work including preventative measures during construction in full compliance to AWWA C651.
 - 3. Flush each segment of the system to provide a flushing velocity of not less than 2.5 feet per second.
 - 4. Drain flushing water to location approved by the Owner.
 - 5. Perform disinfection using one of the following forms:
 - a. Application of chlorine gas-water mixture by means of solution-feed chlorinating device.
 - 1) Liquid chlorine shall comply with AWWA B301.
 - b. Application of calcium hypochlorite, or sodium hypochlorite.
 - 1) Chlorine compounds shall comply with AWWA B300.

6. Disinfect pipe with chlorinated water as per AWWA C651.
 - a. Method of application of chlorine shall be by continuous feed method or slug method.
 - b. During disinfection procedure, ensure that initial and residual chlorine concentrations meet AWWA C651 requirements by testing by an approved method as directed by the Owner.
 - c. Cost of testing shall be included in the Bid Unit Price for water mains and no separate payment will be made for this item.
7. Tag the system during the disinfection procedure.
8. Following disinfection for required contact period, neutralize chlorine residual in water by treating with reducing agent.
 - a. Refer to AWWA C651.
 - b. Flush all treated water from pipeline at its extremities until replacement water throughout pipe, upon test is proved comparable in quality to water in existing system.
 - c. Take two samples to test for bacteriological quality as directed by Engineer.
 - d. Repeat disinfection procedure until two satisfactory results are obtained.
 - e. Quality of water delivered by the new water main to remain satisfactory for a minimum period of two days.
9. Secure satisfactory bacteriological reports on samples from the system.
 - a. Ensure all sampling and testing procedures are in full compliance to AWWA C651, and applicable requirements of the location the Site is in.
 - 1) No separate payment will be made for this item.
10. The Owner will provide the water required to fill the main initially and will pay for the water required to flush the main once.
 - a. Filling and flushing shall be performed during periods of low usage, between the hours of midnight and 4:00 AM.
 - b. Flushing water will be based on a maximum of 8 hours total.
 - c. Any additional refilling or refushing to be at the Contractor's expense at the City's commercial water rates.

END OF SECTION

SECTION 33 16 23
GROUND-LEVEL STEEL WATER STORAGE TANKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for painting and disinfecting ground-level steel water storage tanks.
- B. Related Requirements: Include, but are not necessarily limited to:
 - 1. Section 03 00 05 - Concrete.
 - 2. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 REFERENCES

- A. Terminology:
 - 1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
 - a. "Ground-level steel water storage tank" (and derivative terms) is a generic reference to the type of tanks required by this Section. When the tank's diameter is greater than its height, the tank may also be known as a "reservoir-type" tank. When the tank's diameter is less than its height, the tank may also be known as a "standpipe".
- B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:
 - 1. American Concrete Institute (ACI):
 - a. 318 - Building Code Requirements for Structural Concrete.
 - 2. American National Standards Institute (ANSI):
 - a. Z535.1 - Standard for Safety Colors.
 - 3. American Petroleum Institute (API):
 - a. 650 - Welded Tanks for Oil Storage.
 - 4. American Society of Civil Engineers (ASCE):
 - a. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
 - 5. American Water Works Association (AWWA):
 - a. D100 - Welded Carbon Steel Tanks for Water Storage.
 - b. D102 - Coating Steel Water-Storage Tanks.
 - 6. Association for Materials Protection and Performance (formerly National Association of Corrosion Engineers (NACE))
 - a. NACE SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 - 7. ASTM International (ASTM).
 - a. A36 - Standard Specification for Carbon Structural Steel.
 - b. A516 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service.

1.3 SUBMITTALS

- A. Conform to the requirements of Section 013300-Submittals.
- B. Contractor shall submit a color exhibit depicting the tank with proposed color.
- C. Submit product data for paint along with color chart.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. Coatings shall comply with ANSI/NSF Standard 61. The approval of interior coatings and sealers shall be based on written certification of compliance. Manufacturer's published data shall be submitted concerning transportation, storage, mixing, thinning, pot life, application, curing, etc.
- B. Contractor shall furnish one of the proprietary systems specified herein. All coatings shall be supplied by one coating manufacturer.
 1. Tnemec Co., Inc.
 2. Sherwin-Williams Corporation.
 3. Approved Equal.

2.2 PAINTING SYSTEMS

- A. The roof vent, safety climbing devices, and any other non-painted items shall be removed prior to cleaning and painting.
- B. All paint must be new and purchased for this project.
- C. Interior Wet Areas: Interior wet surfaces are any surfaces exposed to stored water or its vapor. Interior wet areas shall be coated with a three-coat high-build zinc-epoxy-epoxy system, NSF Standard 61 approved for use in potable water. The minimum dry film thickness of the interior coating system shall be 10.5 Mils. Manufacturers' recommended curing times and recoat windows between each coat must be strictly adhered to.
 1. Three-coat high-build zinc-epoxy-epoxy system manufactured by Tnemec Company, Inc.
 - a. (full) Primer Coat – Tnemec Series 91-H₂O or 94-H₂O Hydro-Zinc applied at 2.5 – 3.5 Mils DFT. Pit Filler – All designated pits shall be filled with Tnemec Pit Filler. Follow Tnemec recommendations for application methods/procedures. Payment for this item shall be based on unit pricing provided by the Contractor in the bid.
 - b. Stripe Coat – All vertical/horizontal seams, ceiling overlapping plate edge, ceiling support beams, support columns, ceiling to shall joint, nuts, bolts, ladders, pits, and all other irregular surfaces shall receive one (1) coat of Tnemec Series N140-1255 (Beige) applied to a dry film thickness of 2.0 – 3.0 Mils DFT. Application shall be spray and back brush and/or rolled. Applied coating shall not be recoated until minimum recoating time has been satisfied as per manufacturer's recommendations.
 - c. (full) Intermediate Coat – Tnemec Series N140-1255 (Beige) Pota-Pox applied at 4.0 – 6.0 Mils DFT.
 - d. (full) Finish Coat – Tnemec Series N140-15BL (Tank White) applied at 4.0 – 6.0 Mils DFT. Total DFT = 10.5 – 15.5 Mils
 2. Three-coat high-build zinc-epoxy-epoxy system manufactured by Sherwin Williams Corporation.
 - a. (full) Primer Coat – Corothane I Galvapac Two-Pack Zinc-rich Primer B65 Series applied at 2.5 – 3.5 Mils DFT. Pit Filler – All designated pits shall be filled with Sherwin Williams Steel Seam FT-910. Follow Sherwin-Williams's recommendations for application methods/procedures. Payment for this item shall be based on unit pricing provided by the Contractor in the bid.
 - b. Stripe Coat – All vertical/horizontal seams, ceiling overlapping plate edge, ceiling support beams, support columns, ceiling to shall joint, nuts, bolts, ladders, pits, and all other irregular surfaces shall receive one (1) coat of Macropoxy 646 PW, B58 Series (Light Blue/Mill White) applied to a dry film thickness of 2.0 – 3.0 Mils DFT. Application shall be spray and back brush and/or rolled. Applied coating shall not be recoated until minimum recoating time has been satisfied as per manufacturer's recommendations.

- c. (full) Intermediate Coat – Macropoxy 646 PW, B58 Series (Light Blue/Mill White) applied at of 4.0 – 6.0 Mils DFT.
 - d. (full) Finish Coat – Macropoxy 646 PW, B58 Series (Mill White) applied to a dry film thickness of 4.0 – 6.0 Mils DFT. Total DFT = 10.5 – 15.5 Mils.
- D. **EXTERIOR SURFACES:** Exterior surfaces are all surfaces exposed to the weather. Exterior surfaces shall be coated with a three coat high-build zinc-epoxy- polyurethane system. The minimum dry film thickness of the exterior coating system shall be 7.0 Mils. Manufacturers' recommended curing times and recoat windows between each coat shall be strictly adhered to.
- 1. Three-coat high-build zinc-epoxy-polyurethane system manufactured by Tnemec Company, Inc.:
 - a. (full) Primer Coat – Tnemec Series 90-97 Tnemec-Zinc applied at 2.5 –3.5 Mils DFT.
 - b. (full) Intermediate Coat – Tnemec Series N69 Epoxyline II applied at 2.5 – 3.5 Mils DFT. Color shall contrast with Primer and Finish Coat colors. The color of this coat of paint shall closely match that of the one (1) finish coat, but be a little darker.
 - c. (full) Finish Coat – Tnemec Series 1074 (U) Endura Shield (high gloss) applied at 2.0 – 3.0 Mils DFT (Color to be selected by the AW). Total DFT = 7.0 – 10.0 Mils
 - 2. Three-coat high-build zinc-epoxy-polyurethane system manufactured by Sherwin-Williams Corporation.
 - a. (full) Primer Coat – Corothane I Galvapac Two-Pack Zinc-rich Primer B65 Series applied at 2.5 – 3.5 Mils DFT.
 - b. (full) Intermediate Coat – Macropoxy 646, B58 Series applied at 2.5 – 3.5 Mils DFT. Color shall contrast with primer and finish coat colors. The color of this coat of paint shall closely match that of the one (1) finish coat, but a little darker.
 - c. (full) Finish Coat – Hi-Solids Polyurethane B65 Series applied at 2.0 –3.0 Mils DFT (Color to be selected by the AW). Total DFT = 7.0 – 10.0 Mils

2.3 FLEXIBLE SEALANT

- A. Flexible sealant shall be Sikaflex-1A or approved equal. Sealant color shall be white for all interior applications.

2.4 SAFETY REQUIREMENTS

- A. The Contractor shall comply with all health and safety regulations and requirements of OSHA (or State Health and Safety Regulatory Agency), and the paint and abrasive manufacturers. Should vents, holes, rigging attachments, or any other modification, cutting, or welding be required to meet safety standards, they may be accomplished at the expense of the Contractor upon submitting of details in writing to, and with subsequent approval by Owner.

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. All equipment, (compressor, sand pots and paint pumps, etc.) shall be in good operating condition and of sufficient capacity to provide satisfactory results for cleaning and painting.
- B. Spray equipment and tip size shall be used as recommended in the paint manufacturer's instructions.
- C. Compressed air for blasting and painting shall be free from detrimental amounts of water or oil. Adequate traps and/or dryers shall be provided.
- D. Adequate lighting shall be provided inside the tank to properly allow for safety, workmanship and inspection.
- E. Air hoods, respirators and proper and sufficient ventilation shall be provided during blasting, painting and curing.

- F. Contractor must have sufficient explosion proof ventilation equipment to properly and efficiently expel dust and paint fumes out of unit to prevent injury to workmen or the accumulation of volatile gases.
- G. Contractor shall have available at the site, all inspection and measuring equipment such as wet and dry film thickness gages, wet-bulb, dry-bulb measuring equipment, steel temperature measuring equipment, holiday detector equipment, etc., as required by this Specification.

3.2 SURFACE PREPARATION

- A. All removable and non-painted appurtenances such as roof vents, safe climbing devices, antennas, markers, etc, shall be removed by the Contractor prior to any exterior coating work. These items shall be cleaned, protected, and stored during coating work, and re-installed following completion of all work. Modification/calibration required to make appurtenances operable, such as screen repair, straightening of safe climb bars, calibration of antenna, etc shall be included in the Contractors' scope of work.
- B. All interior steel surfaces shall be prepared in the shop in accordance with SSPC- SP10 "Near White Blast Cleaning". Steel shall be thoroughly cleaned of rust, mill scale, dirt and all other foreign substances.
- C. Shop primed surfaces shall be inspected in the field after tank erection. Failure of the shop primer to meet manufacturer's requirements shall be sufficient cause for removal of the shop primer, re-cleaning and application of a field prime coat at no additional expense to Owner. Recoat windows shall be adhered to and/or proper procedures followed if maximum recoat time frames are exceeded.
- D. Field:
 - 1. Prior to any field coating application, all unused brackets shall be removed from the interior and exterior surfaces. All underlying areas shall be ground smooth. All weld burrs, weld spatter, scars and rough edges shall be ground smooth. Sealed welded containment lugs shall be left in place.
 - 2. All weld seams and any rusted or abraded areas, including rust bloom shall be ground smooth and properly cleaned.
 - 3. All areas of seam deterioration, weld undercut and pitting deeper than 1/8" shall be clearly marked for repair. Repair shall be done by arc-gouging and welding. All welding shall be done in accordance with AWWA D100 Standard for Welded Steel Tanks for Water Storage.
 - 4. Contractor shall conduct field measurement of the surface profile of blasted cleaned steel in accordance with ASTM D4417.
- E. Contractor shall be responsible for any dust, debris and/or paint droplets which leave property and/or cause damage to neighboring property. Insufficient containment of abrasive debris and/or generation of nuisance dust beyond AW's property limits is just cause for shut-down of the job until proper protective measures are in place and violations have been remedied.
- F. After any and all surface preparation, shop and field, all surfaces shall be thoroughly washed and completely cleaned of any residue or dust before applying sealer or primer, shop or field coatings.

3.3 SHOP PRIMING

- A. Fabricated steel plates may be shop primed, subject to all of the requirements of this Specification. Contractor is required to notify Owner at least two weeks in advance of any shop coating. Owner reserves the right to inspect, or have an authorized representative present to inspect all shop coating operations. Failure to provide proper notification in advance of shop coating is cause for rejection of the primer coat and grounds for complete removal and repainting in the field, at no additional cost to Owner.
- B. Primer used on internal surfaces, shall be tested and certified for potable water contact in accordance with NSF Standard 61. Priming shall occur before the formation of rust and after observation of the surface by the Owner.

- C. If applicable, Contractor shall apply the specified primer in the shop, in accordance with manufacturer's recommendations. Steel plates shall be primed leaving a four inch margin along all edges that are to be welded. ANY PRIMER APPLIED TO AREAS THAT ARE TO BE WELDED MUST BE REMOVED IN THE FIELD PRIOR TO WELDING. WELDING OF PAINTED SURFACES WILL NOT BE PERMITTED.

3.4 STRIPE COAT

- A. Special attention shall be given to welds, lap joints, bolt heads and nuts, threads, corners, member intersections, and other deviations from smooth surfaces. These areas shall be primed by brush after complete priming. Inaccessible areas shall be primed with the Aluminum platelet material.

3.5 INTERMEDIATE COAT

- A. After curing of the prime coat and stripe coat, the primed interior and exterior surfaces shall be cleaned of all dust, overspray, abrasive, and other contaminants which may cause premature coating failure and given one intermediate coat paint.

3.6 FINISH COAT

- A. After curing of intermediate coat, the interior/exterior surfaces shall be cleaned of all dust, overspray, abrasive, and other contaminants which may cause premature coating failure and given one finish coat. If the finish coat is not applied before the recoat window expires, then the intermediate coat surfaces shall be scarified by abrasive blasting or other method recommended by the manufacturer in order for the finish coat to properly bond to the intermediate coat.

3.7 SEALER APPLICATION

- A. After cleaning, rough weld areas, areas where sealing is required or depressions where paint will not properly fill voids, these areas shall be sealed with an epoxy seam sealer recommended by the respective paint manufacturer as listed below. The seam sealer shall be applied to designated locations after the prime coat and prior to the intermediate coat.
1. Tnemec Company, Inc. – Surfacing Epoxy Series 215.
 2. Sherwin-Williams - Steel Seam FT910.
- B. Seam sealer shall be applied as per the recommendations of the respective paint manufacturer to the roof and shell manholes, vent to shell intersection and all piping connections, unless seal welding of the area has been performed.

3.8 FLEXIBLE SEALANT

- A. After final curing of the finish interior coat, a flexible polyurethane sealant shall be applied to the roof stiffener-to-roof interfaces, if any, the circumferential stiffener angle-to-roof plate intersection, the unwelded roof lap seams and at the center hub connections or any other areas which are difficult to paint and subject to corrosion and movement. Sealant shall be applied in accordance with all manufacturers' recommendations and in a neat and workmanlike manner. Sealant shall be approved for use in potable water and shall be certified by EPA, ANSI/NSF and any applicable local health regulatory agencies.

3.9 INSPECTION

- A. All cleaning and painting shall be subject to inspection by a designated representative of Owner and/or the paint manufacturer.
- B. The Contractor shall make all work accessible to Owner's representative by having available the appropriate rigging and equipment. Any rigging removed prior to proper inspection and approval shall be reinstalled at the Contractor's expense. This shall also apply at the one year anniversary inspection.
- C. The Contractor shall have available at the site a calibrated Elcometer or MikroTest gauge for measuring dry film thickness and uniformity of the paint coating.

3.10 CURING

- A. The water tank shall remain empty with all hatches and vents open for a minimum of seven days following the last coating operations. Forced air ventilation shall be provided, if deemed necessary by Owner, to facilitate complete and timely curing.
- B. Following the recommended curing time, Owner's representative, along with a representative of the paint manufacturer will perform testing to ensure that the coatings have properly cured. At a minimum, MEK rub tests shall be conducted. The Contractor is required to obtain from the paint manufacturer certification that the coatings have been applied in accordance with all recommendations and in a proper state of cure prior to disinfection and filling of the tank.
- C. The Contractor shall be responsible for tank disinfection upon completion of repair/rehabilitation work.

3.11 TEMPORARY FENCING

- A. Contractor shall install a chain-link fence along the perimeter of the site. Contractor shall submit a sketch of their fencing for Owner approval. Contractor shall coordinate with Owner if temporary fencing and construction activities would affect parking area or other common areas adjacent to the site. Vehicular access and exit gates shall be clearly marked.
- B. Contractor shall provide adequate areas for pedestrians and clearly restrict areas that would represent a hazard due to construction activities.
- C. Contractor shall use a standard galvanized chain-link with a minimum fence height of 6 feet. The fencing hardware shall be galvanized steel to prevent rust. Chain-link fence fabric shall be a minimum of 9 gauge, and shall be tied on the side of the fence with a minimum 9 gauge wire ties not clips. Bottom of fence fabric must be within two inches of grade level.

3.12 DISINFECTION

- A. SCOPE:
 - 1. The Contractor shall clean and disinfect the water storage tank after all work has been completed and inspected and prior to placing the tank into service. This Specification will also apply upon completion of the one-year anniversary inspection.
 - 2. Contractor will furnish water for flushing and disinfecting tank.
- B. Prior to performing any disinfection procedure, Contractor will be required to submit his proposed method of disinfection, including the exact type and amount of disinfecting agent to be used with a specific volume of water, the tools and methods of application and the intended amount of residual chlorine. The Contractor is responsible to satisfy that the persons performing the disinfection procedure are qualified and have been trained in the appropriate safety measures.
- C. Due to the toxicity of chlorine fumes, men performing work under this Section should be equipped with the appropriate respiratory protection and personal protective equipment and should be attended by other personnel who are in the vicinity where work is to be performed.
- D. MATERIALS AND EQUIPMENT
 - 1. Furnish liquid chlorine and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.
 - 2. Furnish pumps, pressure washer, sprayer, hose, nozzle and other equipment for spraying and washing the interiors of the tank.
 - 3. Provide NSF Standard 60 certified products per Listing of Certified Drinking Water Treatment Chemicals - Health Effects
- E. COORDINATION
 - 1. The Contractor must notify Owner at least seven days in advance of the disinfection procedure to allow Owner adequate time to arrange the necessary operation modifications for refilling the tank promptly upon completion of the disinfection procedure.

2. The Contractor will not discharge any chlorinated rinse water from the tank prior to coordination with Owner.

F. PREPARATION

1. All interior painting shall be completed in the tank prior to cleaning and disinfection of the tank. The tank should remain empty for a minimum period of seven (7) days with all manholes, hatches, drains and plugs, etc., open to permit paint fumes to escape.
2. Following the seven day period, provisions should be made to perform the rinsing operation. The following equipment will be needed:
 - a. A pump of sufficient capacity to supply enough water for spray rinsing.
 - b. A length of fire hose and a nozzle for spraying. On elevated tanks the hose should extend up through the riser to the tank.
 - c. Adequate flow of water with sufficient pressure to rinse all interior surfaces.
3. The interior surfaces should be thoroughly rinsed and particular attention should be given to laps, crevices, corners or any areas in which the solid material might collect. The rinse water along with any contaminants should be carefully removed from the tank and connected piping and disposed of properly per local base requirements.

G. APPLICATION OF DISINFECTANT

1. Application of disinfectant shall be performed in accordance with chlorination methods set forth in the current ANSI/AWWA C652 *Disinfection of Water Storage Facilities*.

H. TESTING

1. Bacteriological tests of new, repaired, or cleaned tanks are required to be absent for total coliform bacteria before being placed online. Bacteriological tests will be made by Contractor. Tanks will not be accepted and placed into service until the results of the bacteriological tests are acceptable.
2. Bacteriological tests shall be provided to the respective State Department of Environmental or Department of Health or the respective governing agency, per the State and local requirements, and approved and accepted by the governing agency prior to tanks being accepted by Owner or being placed into service.
3. Should the initial treatment prove to be ineffective, in the opinion of Owner, the Contractor shall repeat the chlorination procedure at no additional cost to Owner until satisfactory results are obtained.

3.13 ANNIVERSARY INSPECTION

- A. Contractor shall inspect the interior surfaces and exterior surfaces of the tank within one year after coating work has been completed to determine whether any repair work is necessary.
- B. It shall be the Contractor's responsibility to contact Owner and arrange a suitable date for inspection work.
- C. The method of inspection shall be specified and agreed with Owner. Contractor shall confirm the date of inspection and notify Owner 30 days in advance.
- D. Contractor shall provide Owner with an inspection report covering the one year anniversary inspection, stating the number and type of failures observed, if any, the percentage of the surface area where failure has occurred, the names of the persons responsible for making the inspection, and the type and location of coatings repairs shall be prepared. Color photographs illustrating each type of failure shall be included in the report.
- E. Any location where layers of coating have been peeled off, bubbled, cracked, and location where rusting is evident, shall be considered to be a failure of the coating system. Rust stains emanating from inaccessible areas, such as unwelded roof plate lap joints, and areas where roof plates cross supporting members will be considered acceptable as the rust does not affect the integrity of the coating surface.

- F. Contractor shall repair points where failures are observed by removing the deteriorated coating, cleaning the surface, and recoating with the same coating system. Manufacturer's cure time requirement for coating repair shall be observed.

END OF SECTION

SECTION 40 05 00
PIPE AND PIPE FITTINGS - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Process piping systems.
 2. Utility piping systems.
 3. Plumbing piping systems.
- B. Related Specification Sections include but are not necessarily limited to:
1. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
 - b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
 - c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
 2. American Iron and Steel Institute (AISI).
 3. American Society of Mechanical Engineers (ASME):
 - a. B16.3, Malleable Iron Threaded Fittings.
 - b. B16.5, Pipe Flanges and Flanged Fittings.
 - c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
 - d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
 - e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - f. B36.19, Stainless Steel Pipe.
 - g. B40.100, Pressure Gauges and Gauge Attachments.
 4. ASTM International (ASTM):
 - a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
 - c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - f. A197, Standard Specification for Cupola Malleable Iron.
 - g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

- i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - j. A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.
 - k. A536, Standard Specification for Ductile Iron Castings.
 - l. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
 - m. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
 - n. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
 - o. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
 - p. B88, Standard Specification for Seamless Copper Water Tube.
 - q. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - r. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - s. C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 - t. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - u. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - v. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
 - w. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - x. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - y. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - z. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.
 - aa. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - bb. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
5. American Water Works Association (AWWA):
- a. B300, Standard for Hypochlorites.
 - b. C200, Standard for Steel Water Pipe - 6 inches and Larger.
 - c. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 inches through 144 inches.
 - d. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
 - e. C606, Standard for Grooved and Shouldered Joints.
 - f. C651, Standard for Disinfecting Water Mains.
 - g. C800, Standard for Underground Service Line Valves and Fittings.
6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
- a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

- d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
 - 7. Chlorine Institute, Inc. (CI):
 - a. Pamphlet 6, Piping Systems for Dry Chlorine.
 - 8. Cast Iron Soil Pipe Institute (CISPI):
 - a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - 9. International Plumbing Code (IPC).
 - 10. National Fire Protection Association (NFPA):
 - a. 54, National Fuel Gas Code.
 - b. 69, Standard on Explosion Prevention Systems.
 - 11. Underwriters Laboratories, Inc. (UL).
- B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 DEFINITIONS

- A. Hazardous Gas Systems: Digester gas, chlorine gas, sulfur dioxide gas, carbon dioxide gas, lab gases.
- B. HPIC: High performance industrial coating.
- C. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

- A. Piping Systems Organization and Definition:
 - 1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
 - 2. See PIPING SYSTEMS SCHEDULE in PART 3.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
 - c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
 - 1) Attach technical product data on gaskets, pipe, fittings, and other components.
 - 2. Fabrication and/or Layout Drawings:
 - a. Exterior yard piping drawings (minimum scale 1 inch equals 10 feet) with information including:
 - 1) Dimensions of piping lengths.
 - 2) Invert or centerline elevations of piping crossings.
 - 3) Acknowledgement of bury depth requirements.
 - 4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
 - 5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
 - 6) Line slopes and vents.

- b. Interior piping drawings (minimum scale 1/8 inches equals 1 foot) with information including:
 - 1) Dimensions of piping from column lines or wall surfaces.
 - 2) Invert dimensions of piping.
 - 3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
 - 4) Location and type of pipe supports and anchors.
 - 5) Locations of valves and valve actuator type.
 - 6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
 - 7) Acknowledgement of valve, equipment and instrument tag numbers.
 - 8) Provisions for expansion and contraction.
 - 9) Line slopes and air release vents.
 - 10) Rough-in data for plumbing fixtures.
 - c. Schedule of interconnections to existing piping and method of connection.
- B. Contract Closeout Information:
- 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Informational Submittals:
- 1. Qualifications of lab performing disinfection analysis on water systems.
 - 2. Test reports:
 - a. Copies of pressure test results on all piping systems.
 - b. Reports defining results of dielectric testing and corrective action taken.
 - c. Disinfection test report.
 - d. Notification of time and date of piping pressure tests.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe coating during handling using methods recommended by manufacturer.
 - 1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit.
 - 1. Repair abrasions, scars, and blemishes.
 - 2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Insulating unions:
 - a. "Dielectric" by Epco.
 - 2. Dirt strainers (Y type):
 - a. Mueller (#351).
 - b. Sarco.
 - c. Armstrong.

3. Chemical strainers (Y type):
 - a. Chemtrol.
 - b. Asahi.
4. Dry disconnect couplings:
 - a. Kamlock.
5. Dielectric flange kit:
 - a. PSI.
 - b. Maloney.
 - c. Central Plastics.
6. Pipe saddles (for gage installation):
 - a. Dresser Style 91 (steel and ductile iron systems).
 - b. Dresser Style 194 (nonmetallic systems).
7. Expansion joint at FRP and poly tanks:
 - a. PROCO.
 - b. Garlock, Style 215.
8. Elastomeric bellows type expansion joints:
 - a. Garlock, Guardian 200/204.
 - b. PROCO, equivalent model.
 - c. Red Valve, equivalent model.
 - d. Or equal.
9. Dismantling Joint
 - a. Romac DJ400.
 - b. Smith Blair 972.

2.2 PIPING SYSTEMS SCHEDULE

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping systems schedule located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

- A. Insulating Components:
 1. Dielectric flange kits:
 - a. Flat faced.
 - b. 1/8 inches thick dielectric gasket, phenolic, non-asbestos.
 - c. Suitable for 175 psi, 210 degrees F.
 - d. 1/32 inches wall thickness bolt sleeves.
 - e. 1/8 inches thick phenolic insulating washers.
 2. Dielectric unions:
 - a. Screwed end connections.
 - b. Rated at 175 psi, 210 degrees F.
 - c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.
- B. Dirt Strainers:
 1. Y-type.
 2. Composition bronze.
 3. Rated for test pressure and temperature of system in which they are installed.
 4. 20 mesh Monel screen.

5. Threaded bronze plug in the blowoff outlet.
 6. Threaded NPT end connections.
- C. Strainers for Chemical Applications:
1. Y-type.
 2. Strainers of same material, test pressure, and temperature rating as system in which strainer is placed.
- D. Reducers:
1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
 2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.
- E. Protective Coating and Lining:
1. Include pipe, fittings, and appurtenances where coatings, linings, coating, tests and other items are specified.
 2. Piping systems scheduled in the PIPING SYSTEM SCHEDULES Article of this Section that are indicated to receive HPIC shall receive surface preparation and primer applied in the fabrication facility, at the coating applicator's shop, or other off-site location acceptable to the Engineer. Intermediate and topcoats are to be field applied unless noted otherwise.
- F. Underground Warning Tape:
1. See Drawings.
- G. Pressure Gages:
1. See Specification Section 01 61 03.
- H. Dry Disconnect Couplings:
1. Adapters:
 - a. Male adapters: Size shown on Drawings.
 - b. Adapters:
 - 1) Female NPT end connection for sludge and flush applications.
 - 2) Male NPT end connection for chemical applications.
 - c. Construct adapters for sludge applications from cast iron or steel.
 - d. Construct adapters for chemical and PVC system applications 3 inches and below from polypropylene.
 - 1) Above 3 inches size, provide stainless steel units.
 2. Couplers:
 - a. Built-in valve and spring loaded poppet which close automatically when disconnected.
 - b. Designed to remain with only one arm locked in closed position.
 - c. Construct couplers for sludge applications fabricated from material utilized for adapters.
 - d. Construct couplers for chemical and PVC system applications 3 inches and less from polypropylene with stainless steel arms and pins.
 - 1) Above 3 inches, provide stainless steel units.
 - e. Gasket: Compatible with conveyed liquid.
 3. Dust caps: For all adapters.
- I. Sacrificial Anode Cathodic Protection:
1. 3 pound magnesium sacrificial anodes, prepackaged in a cloth bag containing 75% hydrated gypsum, 20% bentonite and 5% anhydrous sodium sulphate.
 2. TW 600 V or an HMWPE insulated copper lead attached to the anode.

- J. Valves:
 - 1. See schematics and details for definition of manual valves used in each system under 4 inches in size.
 - a. See Drawings schedule for valve types 4 inches and above and for automatic valves used in each system.
- K. Expansion Joints at FRP and Poly Tanks:
 - 1. Materials:
 - a. Bellows: PTFE-62.
 - b. Flanges: PVC.
 - c. Limit bolts and nuts: 316 stainless steel.
 - d. Reinforcing rings: Stainless steel.
 - 2. Pressure rating at 70 degrees F: 70 psiG.
 - 3. Minimum axial movement: 3/8 inches.
- L. Elastomeric Bellows Type Expansion Joints:
 - 1. Provide reducing type where indicated on the Drawings.
 - 2. Flanges: ANSI 125/150.
 - 3. Materials:
 - a. Bellows:
 - 1) Sludge service: Natural rubber.
 - 2) Hot Water (over 100 degrees F): EPDM.
 - 3) All other: Compatible with fluid.
 - b. Restraint:
 - 1) Provide restraint limit bolts (control rods) and nuts to restrain joint at test pressure of piping.
 - 2) Control rod material: 316 stainless steel.
 - c. Working pressure: Equal to or greater than test pressure of connecting piping.
 - d. Minimum axial movement: 3/8 inches.
 - 4. Arches:
 - a. Sludge service: Provide single filled arches.
 - b. All other service: Provide double open arches.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

- A. Unless otherwise shown on the Drawings, provide a minimum of 4 feet and maximum of 8 feet earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.
- B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 and as shown on Drawings.
- C. When entering or leaving structures with buried joint piping, install joint within 2 feet of point where pipe enters or leaves structure.
 - 1. Install second joint not more than 6 feet nor less than 4 feet from first joint.
- D. Install expansion devices as necessary to allow expansion and contraction movement.
- E. Laying Pipe In Trench:
 - 1. Excavate and backfill trench in accordance with Specification Section 31 23 33.

2. Clean each pipe length thoroughly and inspect for compliance to specifications.
 3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
 4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
 5. Except for first two joints, before making final connections of joints, install two full sections of pipe with earth tamped alongside of pipe or final with bedding material placed.
 6. Lay pipe in only suitable weather with good trench conditions.
 - a. Never lay pipe in water except where approved by Engineer.
 7. Seal open end of line with watertight plug if pipe laying stopped.
 8. Remove water in trench before removal of plug.
- F. Lining Up Push-On Joint Piping:
1. Lay piping on route lines shown on Drawings.
 2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
 3. Observe maximum deflection values stated in manufacturer's written literature.
 4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
 5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.
- G. Anchorage and Blocking:
1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
 2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
 - a. Concrete blocks shall not cover pipe joints.
 3. Provide bearing area of concrete in accordance with drawing detail.
- H. Install underground hazard warning tape.
- I. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

- A. Install piping in vertical and horizontal alignment as shown on Drawings.
- B. Alignment of piping smaller than 4 inches may not be shown; however, install according to Drawing intent and with clearance and allowance for:
1. Expansion and contraction.
 2. Operation and access to equipment, doors, windows, hoists, moving equipment.
 3. Headroom and walking space for working areas and aisles.
 4. System drainage and air removal.
- C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 and as shown on the Drawings.
- D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.
- E. Pipe Support:
1. Use methods of piping support as shown on Drawings.
 2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
 - a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.

3. Size pipe supports with consideration to specific gravity of liquid being piped.
- F. Locate and size sleeves and castings required for piping system.
1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.
- G. Use reducing fittings throughout piping systems.
1. Bushings will not be allowed unless specifically approved.
- H. Equipment Drainage and Miscellaneous Piping:
1. Provide drip pans and piping at equipment where condensation may occur.
 2. Hard pipe stuffing box leakage to nearest floor drain.
 3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
 - a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
 - b. Hard pipe drainage to nearest floor drain.
 4. Collect system condensate at drip pockets, traps and blowoff valves.
 5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
 6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
 - a. Size to handle application with 3/4 inches being minimum size provided.
- I. Unions:
1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
 2. Mechanical type couplings may serve as unions.
 3. Additional flange unions are not required at flanged connections.
- J. Install expansion devices as necessary to allow expansion/contraction movement.
- K. Provide full face gaskets on all systems.
- L. Anchorage and Blocking:
1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.
- M. Equipment Pipe Connections:
1. Equipment - General:
 - a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
 - b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
 - c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
 - 1) Provide tightening torque in accordance with manufacturer's recommendations.
 - d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
 - e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.

- f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
 - g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
 - h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.
 - 1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - 2) Realign as necessary, install flange bolts and make equipment connection.
 - i. Provide utility connections to equipment shown on Drawings, scheduled or specified.
2. Plumbing and HVAC equipment:
- a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
 - b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.
 - c. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
 - 1) Provide wheel handle stop valve at each laboratory sink water supply.
 - 2) Minimum size: 1/2 inches.
 - d. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.
 - 1) Size trap as required by IPC.
 - e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed.
- N. Provide insulating components where dissimilar metals are joined together.
- O. Instrument Connections:
- 1. See drawing details.

3.3 CONNECTIONS WITH EXISTING PIPING

- A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.
- B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.
- C. Undertake connections in fashion which will disturb system as little as possible.
- D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.
- E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.
- F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.
- G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 ACCESS PROVISIONS

- A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping and piping appurtenances requiring service.

- B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 inches size.

3.5 CATHODIC PROTECTION

- A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.
- B. Make all connections from wire or cable by Thermit Cadwelding accomplished by operators experienced in this process.
- C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50% of the straight line length.
- D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.6 HEAT TRACING

- A. Not used.

3.7 PRESSURE GAGES

- A. Provide at locations shown on the Drawings and specified.

3.8 FIELD QUALITY CONTROL

- A. Pipe Testing - General:
 - 1. Test piping systems as follows:
 - a. Test exposed, non-insulated piping systems upon completion of system.
 - b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
 - c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
 - d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
 - 2. Isolate equipment which may be damaged by the specified pressure test conditions.
 - 3. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
 - a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
 - b. Notify the Engineer 24 hours prior to each test.
 - 4. Completely assemble and test new piping systems prior to connection to existing pipe systems.
 - 5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
 - 6. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

- B. Pressure Testing:
 - 1. Testing medium: Unless otherwise specified in the PIPING SYSTEMS SCHEDULE, utilize the following test media.
 - a. Process systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
2 inches and smaller	75 psi or less	Water
2 inches and smaller	Greater than 75 psi	Water

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Greater than 2 inches	3 psi or less	Water
Greater than 2 inches	Greater than 3 psi	Water

- b. Laboratory gases and natural gas systems: Cylinder nitrogen.
- c. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 inches	Gravity	25 psiG or less	Water
Above 48 inches	Gravity	25 psiG or less	Water
All sizes	Pumped	250 psiG or less	Water

2. Allowable leakage rates:

- a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage goal at the specified test pressure throughout the duration of the test.
- b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers (groundwater level is below the top of pipe):
 - 1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head on test section of 3 feet.
 - 2) Average head is defined from groundwater elevation to average pipe crown.
 - 3) Acceptable test head leakage rate for heads greater than 3 feet: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to the 1/2 power).
- c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is above the top of pipe):
 - 1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 feet.
 - 2) Leakage rate at heads greater than 6 feet: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) equals 82 by (actual head to the 1/2 power).
- d. Large diameter (above 48 inches) gravity plant piping systems shall have a maximum exfiltration of 25 GPD per inch-mile.
- e. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5% of the specified test pressure throughout the duration of the test.
- f. For low pressure (less than 25 psiG) air testing, the acceptable time for loss of 1 psiG of air pressure shall be:

PIPE SIZE (IN DIA)	TIME, MINUTES/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8

PIPE SIZE (IN DIA)	TIME, MINUTES/100 feet
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3
48	7.6

3. Hydrostatic pressure testing methodology:
 - a. General:
 - 1) All joints, including welds, are to be left exposed for examination during the test.
 - 2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
 - 3) Provide temporary restraints for expansion joints for additional pressure load under test.
 - 4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
 - 5) Do not coat or insulate exposed piping until successful performance of pressure test.
 - b. Soil, waste, drain and vent systems:
 - 1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
 - 2) Eliminate leaks before proceeding with work or concealing piping.
 - 3) Minimum test heights shall be 10 feet above highest stack inlet.
 - c. Larger diameter (above 36 inches) gravity plant piping:
 - 1) Plug downstream end of segment to be tested.
 - a) Provide bracing as required.
 - 2) Fill segment and upstream structure to normal operating level as per hydraulic profile.
 - 3) Allow 24 hours for absorption losses.
 - a) Refill to original level.
 - 4) Provide reservoir to maintain constant head over duration of test.
 - 5) Record reservoir water volume at beginning and end of test.
4. Natural gas systems - testing methodology:
 - a. Maintain specified test pressure until each joint has been thoroughly examined for leaks by means of soap suds and glycerin.
 - b. Wipe joints clean after test.
5. Air testing methodology:
 - a. General:
 - 1) Assure air is ambient temperature.
 - b. Low pressure air testing:

- 1) Place plugs in line and inflate to manufacturer's designated seal pressure.
- 2) Check plugs for proper sealing.
- 3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psiG greater than ground water or allowable limits of ASTM F1417.
 - a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and accuracy of 1% of full range.
- 4) Allow 2 minutes for air pressure to stabilize.
- 5) After stabilization period (3.5 psiG minimum pressure in pipe) discontinue air supply to line segment.
- 6) Record pressure at beginning and end of test.

C. Dielectric Testing Methods and Criteria:

1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.
2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.9 CLEANING, DISINFECTION AND PURGING

A. Cleaning:

1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
 - a. Pig high pressure air piping before connecting to valves or instruments.
4. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
 - a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
 - b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
5. After erection of piping and tubing, but prior to installation of service outlet valves, blow natural gas [, liquefied petroleum gas] and digester gas systems clear of free moisture and foreign matter by means of air, nitrogen or carbon dioxide.
 - a. Oxygen shall never be used.
6. Clean chlorine piping in accordance with CI Pamphlet 6.
7. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

B. Disinfection of Potable Water Systems:

1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
4. Flush each segment of system to provide flushing velocity of not less than 2.5 feet per second.

5. Drain flushing water to sanitary sewer.
 - a. Do not drain flushing water to receiving stream.
6. Use continuous feed method of application.
 - a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
 - a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
 - a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of Missouri.

C. Purging Natural gas and Digester Gas:

1. Existing piping:
 - a. Turn off gas supply.
 - b. Vent line pressure outdoors.
 - c. If section exceeds the following, then remaining gas shall be displaced with an inert gas.
 - 1) 50 feet for 2-1/2 inches pipe.
 - 2) 30 feet for 3 inches pipe.
 - 3) 15 feet for 4 inches pipe.
 - 4) 10 feet for 6 inches pipe.
 - 5) Any length for 8 inches or larger pipe.
2. New piping:
 - a. Including but not limited to:
 - 1) All fuel gas piping.
 - 2) Digesters.
 - 3) Digester gas equipment.
 - 4) Fuel gas trains.
 - b. Purge air filled system with fuel gas:
 - 1) Providing piping length is less than:
 - a) 30 feet for 3 inches pipe.
 - b) 15 feet for 4 inches pipe.
 - c) 10 feet for 6 inches pipe.
 - d) Any length for 8 inches and larger pipe.
 - 2) Providing a moderately rapid and continuous flow of fuel gas is introduced.
 - a) Introduce fuel gas at one end.
 - b) Vent air at opposite end.
 - 3) Provided fuel gas flow is continuous without interruption until vented gas is free of air.
 - 4) The point of discharge shall not be left unattended during purging.
 - c. If the piping is 3 inches or larger and exceeds lengths stated above.
 - 1) Purge air with inert gas in accordance with NFPA 54 and NFPA 69.
 - 2) Purge inert gas with fuel gas.
3. Discharge of purged gases:

- a. Open end of piping shall not discharge into confined spaces or areas where there are sources of ignition.

3.10 LOCATION OF BURIED OBSTACLES

- A. Furnish exact location and description of buried utilities encountered and thrust block placement.
- B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.
- C. Include such information as location, elevation, coverage, supports and additional pertinent information.
- D. Incorporate information on "As-Recorded" Drawings.

3.11 PIPE INSULATION

- A. Insulate pipe and pipe fittings in accordance with Drawings.

3.12 PIPING SYSTEM SCHEDULES

1. Piping Materials shown on Drawings.

END OF SECTION

SECTION 40 05 19
DUCTILE IRON PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ductile iron piping, fittings, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
1. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 REFERENCE

- A. Referenced Standards:
1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 2. ASTM International (ASTM):
 - a. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - b. A536, Standard Specification for Ductile Iron Castings
 - c. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 3. American Water Works Association (AWWA):
 - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - b. C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe.
 - c. C606, Standard for Grooved and Shouldered Joints.
 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C104/A21.4, Standard for Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.
 - b. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - c. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - d. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - e. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - f. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
 - g. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - h. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
 - i. C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Comply with Section 40 05 00 - Pipe - Basic Requirements.
 2. Certification of factory hydrostatic testing.

3. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Flanged Adaptors (flanged coupling adapters):
 - a. Smith Blair, Style 913 (steel).
 - b. Dresser, Style 128 (steel).
 - c. Romac Style FCA501 (cast iron)
 2. Restrained Flanged Adaptors (restrained flanged coupling adapters):
 - a. Romac Style Alpha FC (ductile iron).
 - b. Smith Blair Style 911 (ductile iron).
 3. Compression Sleeve Coupling:
 - a. Smith Blair, Style 431 (cast iron).
 - b. Dresser, Style 153 (cast iron).
 - c. Romac Industries, Style EC501 (ductile iron).
 4. Mechanical (Grooved) coupling:
 - a. Victaulic, Style 31.
 5. Insulating Couplings:
 - a. Smith Blair, Style 416.
 - b. Dresser, Style 39.
 - c. Romac, Style IC400
 6. Reducing Couplings:
 - a. Smith Blair, Style 415.
 - b. Dresser, Style 62.
 - c. Romac, Style RC501 (ductile)
 7. Transition Coupling:
 - a. Smith Blair, Style 413.
 - b. Dresser, Style 62.
 - c. Romac, Style TC400
 8. Ceramic Epoxy Lining:
 - a. "PROTECTO 401" by Induron.
 - b. "CERAMAPURE PL-90" by Induron
 - c. "Permox-CTF" by Permite.
 9. Glass Lining:
 - a. C&B Piping: CBGL911 Porcelain Glass Lining.
 - b. US Pipe: Vitco SG-14 Glass Lining.
 10. Polyethylene Encasement Tape:
 - a. Chase, Chasekote 750.
 - b. Kendall, Polyken 900.
 - c. 3 M, Scotchrap 50.
 - d. V-Bio Polywrap.
 11. Restrained joints:
 - a. American (Flex-Ring) - 4 inches to 54 inches.

- b. American (Lok-Ring) - 54 inches to 64 inches.
 - c. U.S. Pipe (TR-Flex) - 4 inches to 36 inches.
 - d. U.S. Pipe (HP Lok) - 30 inches to 64 inches.
 - e. Or equal.
12. Expansion joints:
- a. Smith-Blair (Style 611).
 - b. Dresser (Style 63).
 - c. Or equal.
13. Dismantling joints:
- a. Smith-Blair (Style 975).
 - b. Dresser (Style 131).
 - c. Or equal.

2.2 MATERIALS

- A. Ductile Iron Pipe:
- 1. AWWA/ANSI C115/A21.15.
 - 2. AWWA/ANSI C150/A21.50.
 - 3. AWWA/ANSI C151/A21.51.
- B. Fittings and Flanges:
- 1. AWWA/ANSI C110/A21.10.
 - 2. AWWA/ANSI C153/A21.53
 - a. Do not use for pump suction piping.
 - 3. AWWA/ANSI C115/A21.15.
 - 4. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.
- C. Nuts and Bolts:
- 1. Buried:
 - a. T-Bolts for mechanical joints: Per AWWA/ANSI C111/A21.1
 - b. Other bolts and nuts: ASTM A307.
 - 2. Heads and dimensions per ASME B1.1.
 - 3. Threaded per ASME B1.1.
 - 4. Project ends 1/4 to 1/2 inches beyond nuts.
- D. Gaskets: See individual piping system requirements in Section 40 05 00.
- E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.
- 1. Manufactured from ductile iron conforming to ASTM A536.
 - 2. Gaskets: Flushseal® type, grade to suit the intended service.
- F. Polyethylene Encasement: Per AWWA/ANSI C105/A21.5.
- G. See Piping Schedules in Section 40 05 00.

2.3 MANUFACTURED UNITS

- A. Couplings:
- 1. Flanged adaptors:
 - a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.

- c. Supply flanges meeting standards of adjoining flanges.
 - d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
2. Compression sleeve coupling:
- a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
 - e. Provide field coating for buried couplings per AWWA C203.
3. Mechanical (grooved) couplings:
- a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 40 05 00.
 - b. Provide all mechanical groove couplings, flange adapters, fittings, and appurtenant items from the same manufacturer.
 - c. Utilize units defined in the MANUFACTURERS Article.

2.4 FABRICATION

- A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.
- B. Furnish cast parts with lacquer finish compatible with finish coat.

2.5 LININGS AND COATINGS

- 1. All sewer pipe should be Protecto 401 lined.

2.6 SOURCE QUALITY CONTROL

- A. Factory Test:
 - 1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Joining Method - Push-On Mechanical (Gland-Type) Joints:
 - 1. Install in accordance with AWWA/ANSI C111/A21.11.
 - 2. Assemble mechanical joints carefully according to manufacturer's recommendations.
 - 3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
 - 4. Do not overstress bolts.
 - 5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.
- B. Joining Method - Push-On Joints:
 - 1. Install in accordance with AWWA/ANSI C151/A21.51.
 - 2. Assemble push-on joints in accordance with manufacturer's directions.
 - 3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
 - 4. Assure the gasket groove is thoroughly clean.
 - 5. For cold weather installation, warm gasket prior to placement in bell.

6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 inches back.
- C. Joining Method - Flanged Joints:
1. Install in accordance with AWWA/ANSI C115/A21.15.
 2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
 3. Make flange faces flat and perpendicular to pipe centerline.
 4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
 5. Allow one flange free movement in any direction while bolts are being tightened.
 6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
 7. Gradually tighten flange bolts uniformly to permit even gasket compression.
- D. Joining Method – Mechanical (Grooved) Coupling Joint:
1. Arrange piping so that pipe ends are in full contact.
 2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
 3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.
 4. Utilize grooving tools from the same manufacturer of the couplings and fittings.
- E. Flange Adaptors 12 inches and Less:
1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
 2. Drill holes not more than 1/8 inches larger than diameter of stud projection.
- F. Wax Tape Coating System:
1. After installation, coat all buried nuts and bolts with a wax tape coating system in accordance with:
 - a. AWWA C217.
 - b. Manufacturer's printed instructions.
 2. Cut strips of wax tape and apply them around all bolts and nuts so that there are no voids or spaces under the tape.
 3. Apply a sufficient amount of tape to completely encapsulate all bare metal.
- G. Cutting:
1. Do not damage interior lining material during cutting.
 2. Use abrasive wheel cutters or saws.
 3. Make square cuts.
 4. Bevel and free cut ends of sharp edges after cutting.
- H. Support exposed pipe in accordance with Section 40 05 00.
- I. Install buried piping in accordance with Section 40 05 00.
- J. Install restrained joint systems where specified in Section 40 05 00 under specific piping system.

3.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 40 05 00.
- B. Wax Tape Coating Testing:

1. Inspect each wax tape-wrapped component.
 - a. Verify primer was applied to substrate surfaces.
 - b. Ensure the wax tape has fully encapsulated all portions of the substrate.
 - c. Ensure that the wax tape is in intimate contact with the substrate.
 - d. Verify that the wax tape has been applied to the specified thickness.
2. Do not backfill until this inspection is complete and the wax tape application is approved by the Engineer.

END OF SECTION

SECTION 40 05 31

PIPE - PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic pipe.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. See Specification Section 40 05 00.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. PVC (polyvinyl chloride) materials:
 - 1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
 - 3) D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 8) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - 10) F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.
 - b. Installation:
 - 1) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 2. American Water Works Association (AWWA):
 - a. PVC (polyvinyl chloride) materials:
 - 1) C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.
 - b. Polyethylene (PE) materials:
 - 1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inches through 3 IN, for Water Service.
 - 3. NSF International (NSF).

1.3 SUBMITTALS

- A. See Specification Section 40 05 00.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

A. General:

1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
2. Furnish materials in full compliance to following material specifications:
 - a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
 - b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

B. Pipe:

1. Furnish pipe meeting requirements of ASTM D1785.
2. Pipe 2 inches and less to be solvent welded.
3. Pipe larger than 2 inches may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:

1. Furnish flanges and unions at locations shown on Drawings.
2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
3. For pipe larger than 2 inches, provide 150 pound socket type PVC flange.
4. For pipe 2 inches and less, provide socket type PVC union with Buna O-rings.
5. Use flat, full faced natural rubber gaskets at flanged connections.
 - a. Furnish heavy hex head bolts, each with one heavy hex nut, ASTM F593 Type 316 stainless steel.
6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Installation:

1. Field threading PVC will not be permitted.
 - a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
 - b. Female adapters are not acceptable.
2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
 - a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DEGF.
 - b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
 - c. Support riser clamps on spring hangers.
 - d. Do not clamp PVC tightly or restrict movement for expansion and contraction.

2.2 PRESSURE PIPING (UNDERGROUND)

- A. Materials: Furnish materials in full compliance with following requirements:
 - 1. Sizes 1/2- through 3-inch diameter: AWWA C901 PE with Pressure Class of 200 PSI.
 - 2. Sizes 4- through 60-inch diameter: AWWA C900 PVC with Pressure Class of 200 PSI.
 - 3. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.
 - 4. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than pipe pressure rating meeting performance requirements of ASTM D3139.
- B. Installation:
 - 1. Field threading of PVC pipe will not be permitted.
 - 2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

2.3 PVC DRAINAGE, SEWER PIPING

- A. Materials:
 - 1. Furnish materials in full compliance to the following material specification.
 - 2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C as described in specification ASTM D1784.
 - 3. The requirements of this Specification are intended to provide for pipe and fittings suitable for non-pressure drainage of wastewater and surface water.
 - 4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of ASTM D3212.
 - 5. Supply to the Engineer all information and sample of joining method for his evaluation.
 - a. Only joining methods acceptable to the Engineer will be permitted.
 - 6. Provide pipe and fittings meeting or exceeding the following requirements:
 - a. 4-27 inches diameter: ASTM D3034 and ASTM F679, SDR 35.
 - b. 8-30 inches diameter: ASTM F794.
 - c. 4-18 inches diameter: ASTM F949.
 - 7. Ensure impact strengths and pipe stiffnesses in full compliance to these Specifications.
- B. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
 - 1. Provide for a maximum deflection of not more than 3%.

2.4 PVC TUBING

- A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.
- B. Materials:
 - 1. Furnish clear outer braided tubing with braid outside the walls.
 - 2. Have tubing manufactured of nylon with working temperatures from 5 to 180 degrees F.
 - 3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
 - 4. Provide tubing with working pressure of 75 psi at 180 degrees F.
 - 5. Ensure that tubing is self-extinguishing and fire resistant.
- C. Fittings:
 - 1. Install tubing with nylon fittings and connectors.
 - 2. Use barbed type adapters with stainless steel clamps.
 - 3. Provide fittings capable of withstanding temperatures from a -70 to 250 degrees F.

4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Identify each length of pipe clearly at intervals of 5 feet or less.
 1. Include manufacturer's name and trademark.
 2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING (UNDERGROUND)

- A. Installation:
 1. Field threading of PVC pipe will not be permitted.
 2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PVC DRAINAGE, SEWER PIPING

- A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
 1. Provide for a maximum deflection of not more than 3%.
- B. Infiltration and Exfiltration:
 1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 hours.
 2. For exfiltration, all the pipe and fittings shall exceed performance requirements by the test procedure as specified in Section 40 05 00.
 3. Observe full instructions of the Engineer for carrying of testing procedures.
 - a. Perform tests only during presence of the Engineer or his authorized representative.
 4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.
- C. Deflection:
 1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
 2. Pipe with deflection exceeding 5% of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5%.
 3. Any repaired pipe shall be retested.

3.4 PVC TUBING

- A. Fittings:
 1. Install tubing with nylon fittings and connectors.
 2. Use barbed type adapters with stainless steel clamps.
 3. Provide fittings capable of withstanding temperatures from a -70 to 250 degrees F.
 4. Ensure fittings have the same pressure and temperature rating as the tubing.
- B. Trays:
 1. Flat smoothed bottom tray for supporting flexible hoses when there is a chance that the hoses may pulse or move.

END OF SECTION

SECTION 40 05 61
GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gate valves.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 40 05 51 - Common Requirements for Process and Utility Valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. American Water Works Association (AWWA):
 - a. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - b. C504, Standard for Rubber-Seated Butterfly Valves.
 - c. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
 - 3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-9, Spot Facing for Bronze, Iron and Steel Flanges.
 - b. SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - c. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS

- A. OS&Y: Outside Screw and Yoke.
- B. NRS: Non-rising Stem.
- C. RS: Rising Stem.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 40 05 51.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 VALVES: WATER, STEAM CONDENSATE, STEAM TO 125 PSI, AIR; 2-1/2 INCHES AND SMALLER

- A. Class 125 bronze gate valve.

- B. Comply with MSS SP-80.
- C. Materials:
 - 1. Body, bonnet, wedge: Bronze.
 - 2. Stem: Silicon bronze.
 - 3. Packing: Aramid fibers with graphite (Kevlar®).
- D. Design Requirements:
 - 1. 125 psi steam, 200 psi non-shock WOG.
 - 2. Screw in bonnet, non-rising stem, solid wedge.
- E. Manufacturers:
 - 1. Nibco.
 - 2. Stockham.

2.3 VALVES: STEAM CONDENSATE, STEAM TO 125 PSI, AIR; 3 INCHES AND LARGER

- A. Class 125 iron body gate valve.
- B. Comply with MSS SP-70.
- C. Materials:
 - 1. Body, bonnet, wedge: Cast iron, ASTM A126, Class B.
 - 2. Stem: Brass, bronze, or copper silicon alloy.
- D. Design Requirements:
 - 1. 125 psi steam to 400 degrees F, 200 psi WOG.
 - 2. Bolted bonnet, OS&Y, solid wedge, bronze mounted.
- E. Manufacturers:
 - 1. Nibco.
 - 2. Stockham.

2.4 VALVES: WATER (HOT, COLD, HEATING, COOLING, SERVICE, PROCESS, POTABLE, NON-POTABLE, AND WASTEWATER)

- A. Double Disc Gate Valve, 3 to 12 inches (Water Application):
 - 1. Comply with AWWA C500.
 - 2. Materials:
 - a. Seating surfaces, stems, stem nut: Bronze.
 - b. Body, disc: Cast iron.
 - 3. Design requirements:
 - a. 200 psi working pressure.
 - b. Buried: NRS, O-ring stem seal, 2 inches operation nut.
 - c. Exposed: NRS, O-ring stem seal, handwheel.
 - 4. Manufacturers:
 - a. American Flow Control.
 - b. Clow.
 - c. M&H.
 - d. Mueller.
- B. Resilient Wedge Gate Valves, 2 to 48 inches (Water, Wastewater Application):
 - 1. Comply with AWWA C509.

2. Materials:
 - a. Stem and stem nut: Bronze.
 - 1) Wetted bronze parts in low zinc bronze.
 - 2) Aluminum bronze components: Heat treated per AWWA C504.
 - b. Body, gate: Cast iron.
 - c. Resilient wedge: Fully encapsulated rubber wedge. Ethylene Propylene Diene Monomer (EPDM).
 3. Design requirements:
 - a. Minimum 200 PSIG working pressure.
 - b. Buried: NRS, O-ring stem seal, 2 inches square operating nut.
 - c. Exposed: OS&Y, stuffing box stem seal, handwheel.
 - d. Counter clockwise open rotation.
 - e. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces.
 - 1) Comply with AWWA C550.
 - 2) Wetted bronze parts in low zinc bronze.
 - 3) Aluminum bronze components: Heat treated per AWWA C504.
 4. Manufacturers:
 - a. Clow.
 - b. Mueller.
 - c. American Flow Control.
 - d. M & H.
- C. Double Disc Gate Valves, 14 to 48 inches (Water, Wastewater Application):
1. Comply with AWWA C500.
 2. Materials:
 - a. Seating surfaces, stem, stem nut: Bronze.
 - b. Body, discs: Cast iron.
 3. Design requirements:
 - a. 150 psi working pressure.
 - b. NRS O-ring stem seal.
 - c. Provide gear actuator, 20 inches and larger valves.
 - d. Provide roller tracks and scrapers for horizontal valves size 16 inches and larger.
 - e. Provide bypass valve sized per AWWA C500.
 4. Manufacturers:
 - a. Clow.
 - b. Mueller.
 - c. American Flow Control.
 - d. M & H.
- D. Knife Gate Valves, 2 to 36 inches (Wastewater Sludge Application):
1. Materials:
 - a. Body construction:
 - 1) 2 to 4 inches: Cast stainless steel.
 - 2) 6 to 24 inches: Cast iron body with stainless steel lining.
 - b. Wetted parts: Stainless steel Type 316.
 - c. Packing: Flax, 150 degrees F max.

- d. Stem: Stainless steel, double pitch thread.
- e. Resilient seat material (2 to 36 inches): Butadiene.
- 2. Design requirements:
 - a. Working pressure (WOG non-shock):
 - 1) 2 to 24 inches: 150 psi.
 - 2) 30 to 36 inches: 125 psi.
 - 3) Actuator: Geared actuator for valves 20 inches and larger.
- 3. Manufacturers:
 - a. DeZurik, Series L.
 - b. Fabri-Valve.

2.5 VALVES: STEAM, 125 TO 200 PSI

- A. 2 inches and Smaller:
 - 1. Class 300 bronze gate valve.
 - 2. 300 psi steam, 600 psi WOG, (non-shock).
 - 3. Comply with MSS SP-80.
 - 4. Materials:
 - a. Body, bonnet, wedge: Bronze.
 - b. Stem: Silicon bronze alloy.
 - c. Packing: Teflon or TFE impregnated fiber.
 - 5. Design requirements:
 - a. Union bonnet, rising stem, solid wedge disc, handwheel.
 - 6. Manufacturers:
 - a. Nibco.
 - b. Stockham.
- B. 2-1/2 inches and Larger:
 - 1. Class 250 iron body gate valve.
 - 2. 250 psi steam, 500 psi WOG (non-shock).
 - 3. Comply with MSS SP-70.
 - 4. Materials:
 - a. Body: Cast iron, cast bronze trim.
 - b. Stem: Silicon copper alloy.
 - c. Packing: Teflon or TFE impregnated fiber.
 - 5. Design requirements:
 - a. Bolted bonnet, OS&Y, solid wedge disc, handwheel.
 - 6. Manufacturers:
 - a. Nibco.
 - b. Stockham.

2.6 ACCESSORIES

- A. Refer to Drawings and valve schedule for type of actuators.
 - 1. Furnish actuator integral with valve.

2.7 FABRICATION

- A. General:
 - 1. Provide valves with clear waterways the full diameter of the valve.

- B. Spot valves in accordance with MSS SP-9.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where larger buried valves utilize smaller bypass valves, provide a second valve box installed over the bypass valve operating nut.
- B. Do not install gate valves inverted or with the stems sloped more than 45 degrees from the upright unless the valve was ordered and manufactured specifically for this orientation.

END OF SECTION

SECTION 40 05 62
PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plug valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250.
 - 2. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - b. A536, Standard Specification for Ductile Iron Castings.
 - c. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
 - 3. American Water Works Association (AWWA):
 - a. C517 Resilient-Seated Cast-Iron Eccentric Plug Valves

1.3 SUBMITTALS

- A. Shop Drawings:
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.

2.2 NON-LUBRICATED ECCENTRIC PLUG VALVES (SEWAGE, SLUDGE, SEWAGE GAS APPLICATIONS)

- A. Manufacturers:
 - 1. DeZurik.
 - 2. Henry Pratt.
 - 3. Millikin.
 - 4. ValMatic.
- B. Materials:
 - 1. Body: Cast-iron ASTM A126, Class B.
 - 2. Plug: One or two-piece construction ductile iron, ASTM A536 65-45-12 or cast iron, ASTM A126 Class B.
 - 3. Plug facing: Grease and/or petroleum-resistant resilient Neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240.

4. Shaft bearing bushings: Permanently lubricated TFE or Delrin sleeve type stainless steel or bronze.
5. Valve seats: Welded-in overlay of 90% nickel, (minimum 1/8 inches thick).
6. Stem seal: per AWWA C517, Section 4.4.7.

2.3 LUBRICATED SEAL PLUG VALVES (NATURAL GAS APPLICATIONS)

A. Manufacturers:

1. Nordstrom.
2. Walworth.
3. Millikin.

B. Materials:

1. Body: Cast iron ASTM A126, Class B.
2. Plug: Cast iron ASTM A126, Class B.
3. Plug facing: Teflon on tapered plug.
4. Valve seats: Gas-resistant lubricant/sealant.

2.4 NON-LUBRICATED ECCENTRIC PLUG (HEATING-COOLING WATER APPLICATIONS)

A. Manufacturers:

1. DeZurik Figure 499.
2. Millikin Series 603.
3. Victaulic Series 365.

B. Materials:

1. Body: Cast iron, ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Bearings: Bronze or nickel.
4. Plug seal: Isobutene-isoprene (250 degrees F).

2.5 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuator.

1. Furnish actuator integral with valve.

B. Refer to Specification Section 40 05 51 for actuator requirements.

2.6 DESIGN REQUIREMENTS

A. Non-Lubricated Eccentric Plug Valves (Wastewater, Sludge):

1. Port area:
 - a. Valves 4 inches through 20 inches: Equal to or exceed 80% of full pipe area.
 - b. Valves greater than 20 inches: 100% equivalent full pipe area.
2. Valve body: Fitted with bolted bonnet.
3. Stem seal: Adjustable and replaceable without disassembling valve or bonnet.
4. Designed for seating drip tight in any flow direction.
5. Rating:
 - a. 1/2 through 12 inches, 175 psi working pressure.
 - b. 14 through 36 inches, 150 psi working pressure.
 - c. Three-way valves, 125 psi working pressure.
6. Actuator:

- a. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent entry of dirt or water.
 - b. Positive identification on actuator indicating valve position.
 - c. Adjustable stop to set closing torque.
- B. Lubricated Plug Valves (Natural Gas):
- 1. Pressure lubricated valve with sealed ports and grooves.
 - a. Re-seatable under full pressure in any position.
 - 2. Pressure rating: 200 psi WOG.
 - 3. Port area: Minimum 60% of pipe area.
 - 4. Acceptable to local gas company.
- C. Non-Lubricated Eccentric Plug Valve-(HVAC):
- 1. Port area: Valves 1/2 inches through 2-1/2 inches: Equal to or exceed 100% of full pipe area.
 - 2. Valve body: Fitted with threaded bonnet or bolted bonnet.
 - 3. End connections:
 - a. Flanges: In full accordance with ASME B16.1, Class 125 including facing, drilling and thickness.
 - b. Threaded connection: In full compliance with NPT.
 - 4. Stem seal: Self-adjusting U-cups or multiple O-ring seals.
 - 5. Shut-off: Designed for setting drip-tight at the full rated pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with valve stem horizontal, plug seat on inlet side and with plug rotating up into the open position for valves in horizontal lines.
- B. Install valve with actuator above pipe or plug centerline.

END OF SECTION

SECTION 40 05 66
CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Check valves 2.5-inch diameter and smaller.
2. Swing check valves, three-inch to 24-inch diameter.
3. Cushioned swing check valves, three-inch to 24-inch diameter.
4. Double door check valves.
5. Silent check valves.
6. Rubber flapper swing check valves, two-inch to 24-inch diameter.
7. Ball check valves, 0.5-inch to four-inch diameter.
8. Duckbill check valves.

1.2 REFERENCES

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. American Water Works Association (AWWA):
 - a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 in. through 24 in. NPS.
3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - b. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Valve Manufacturers:
 - a. Manufacturer shall be a business regularly engaged in manufacturing and furnishing check valves of the type required and similar equipment.
 - b. Manufacturer shall be able to document having furnished not less than [50] check valves, of the type required, of size equal to or larger than those required for the Work, during the past [five] years.
 - c. When requested by Engineer, submit qualifications statement indicating manufacturer's record of manufacturing and furnishing check valves of the types and sizes required and furnish documentation of compliance with qualifications requirements of this Article.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:
 - a. Manufacturer's written instructions for delivery, handling, storage, installation, and startup.

B. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data:
 - a. Submit in accordance with Section 01 78 23 - Operations and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 CHECK VALVES: 2.5 INCHES AND SMALLER

- A. Class 125 Bronze Swing Check Valves (Fuel Oil, Compressed Air, Water, Wastewater):
 - 1. Comply with MSS SP-80.
 - 2. Manufacturers:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Nibco T413-V.
 - 2) Stockham B-319Y.
 - 3. Materials:
 - a. Body, bonnet, disc: Bronze.
 - 4. Design requirements:
 - a. 125 psi steam to 406 degrees F, 200 psi WOG.
 - b. Horizontal swing, renewable disc.
- B. Class 150 Bronze Lift Check Valves (Fuel Oil, Compressed Air):
 - 1. Comply with MSS SP-80.
 - 2. Manufacturers:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Stockham b-322B.
 - 2) Powell 158B.
 - 3. Materials:
 - a. Body, cap, disc holder: Bronze.
 - b. Disc: Buna-N.
 - 4. Design requirements:
 - a. 150 psi to 150 degrees F, 300 psi WOG.
 - b. Lift check, union cap.
- C. Class 200 Bronze Swing Check Valves (Steam 125 to 200 psi):
 - 1. Comply with MSS SP-80.
 - 2. Manufacturers:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Nibco T473B.
 - 2) Stockham B345.
 - 3. Materials:
 - a. Body, bonnet, disc: Bronze.
 - 4. Design requirements:
 - a. 200 psi steam to 550 degrees F, 400 psi WOG.
 - b. Horizontal swing, Y-pattern.
 - c. Renewable disc.

2.2 SWING CHECK VALVES: 3 INCHES TO 24 INCHES

- A. Swing Check Valves (Water, Wastewater, Sludge):
 - 1. Comply with AWWA C508.
 - 2. Manufacturers:

- a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Clow.
 - 2) America Darling.
 - 3) GA Industries.
 - 3. Materials:
 - a. Body and cover: Cast iron.
 - b. Seat ring, hinge: Bronze.
 - c. Disc:
 - 1) 3 to 4 inches: Bronze.
 - 2) 6 to 24 inches: Cast iron with bronze face.
 - d. Hinge shaft: Stainless steel.
 - e. Bearings, connecting hardware: Bronze.
 - 4. Design requirements:
 - a. 175 psi working pressure (3 to 12 inches).
 - b. 150 psi working pressure (14 to 24 inches).
 - c. Furnish with outside weight and lever or lever and spring.
- B. Class 125 Iron Check Valves (Steam to 125 psi, Fuel Oil):
 - 1. Comply with MSS SP-71.
 - 2. Manufacturers:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Nibco F-918B.
 - 2) Stockham 373 1/2.
 - 3. Materials:
 - a. Iron body, bronze mounted.
 - b. Seat ring, disc face: Bronze.
 - c. Hinge pin: Bronze or stainless steel.
 - d. Connecting hardware: Bronze or plated steel.
 - 4. Design requirements:
 - a. 125 psi steam to 450 degrees F, 200 psi WOG.
 - b. Bolted cap.
- C. Class 250 Iron Check Valves (Steam 125 to 250 psi):
 - 1. Comply with MSS SP-71, Type 1.
 - 2. Manufacturers:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Nibco F-968-B.
 - 2) Stockham F-947.
 - 3. Materials:
 - a. Iron body, bronze mounted.
 - b. Seat ring, disc face: Bronze.
 - c. Hinge pin: Brass.
 - d. Connecting hardware: Bronze.
 - 4. Design requirements:

- a. 250 psi steam to 450 degrees F, 500 psi WOG.
- b. Bolted cap.

2.3 CUSHIONED SWING CHECK VALVES: 2 INCHES TO 24 INCHES

- A. Class 250.
 1. Comply with AWWA C508.
- B. Manufacturers:
 1. Air:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) GA Industries, Figure 250D Class 250.
 - 2) APCO Series 6000.
 2. Oil:
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) GA Industries Figure 25-DXH.
 - 2) APCO Series 6000B.
- C. Materials:
 1. Body, cover, disc, levers: Cast iron or cast steel.
 2. Seat: Bronze or stainless steel.
 3. Seat ring: Bronze or rubber (Buna-N).
 4. Hinge: Stainless steel.
 5. Cushion cylinder: Metallic corrosion resistant material.
- D. Design Requirements:
 1. Seat ring: Replaceable.
 2. Hinge: Extend out both sides with lever and weight.
 3. Cushion: Air type with adjustable speed control.

2.4 DOUBLE DOOR CHECK VALVES

- A. Class 250.
- B. Manufacturers:
 1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. APCO Series 9000 (2 to 48 inches).
 - b. Nibco W920-W (2 to 24 inches).
 - c. Technocheck by Techno Corporation.
- C. Materials:
 1. Body: Cast iron wafer style.
 2. Doors:
 - a. 2 to 12 inches: Aluminum bronze.
 - b. 14 to 54 inches: Ductile iron, bronze faced.
 3. Hinge and stop pins: Stainless steel, 316.
 4. Spring: Stainless steel, T316.
 5. Seat: Buna-N.

2.5 SILENT CHECK VALVES

- A. ASME B16.1, Class 250.
- B. Manufacturers:
 - 1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. APCO Series 300 or 600.
 - b. GA Industries, Figures 280 or 290.
 - 2. Materials:
 - a. Body: Cast iron.
 - b. Plug and seat: Bronze.
 - c. Spring: Stainless steel.
- C. Design Requirements:
 - 1. Body type:
 - a. 1 to 10 inches: Wafer.
 - b. 3 to 30 inches: Flanged center guided, globe style.

2.6 RUBBER FLAPPER SWING CHECK VALVES: 2 INCHES TO 24 INCHES

- A. ASME B16.1, Class 125 (175 psi).
- B. Acceptable Manufacturer:
 - 1. APCO Series 100.
- C. Materials:
 - 1. Body and cover: Cast iron.
 - 2. Flapper: Buna-N, steel reinforced.

2.7 BALL CHECK VALVES: 1/2 INCHES TO 4 INCHES

- A. Manufacturers:
 - 1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. R&G Sloane.
 - b. Corr Tech.
- B. Performance Criteria:
 - 1. Pressure Rating: 150 psi at 73 degrees F.
- C. Materials:
 - 1. Body: PVC.
 - 2. Ball: Glass filled or polypropylene.
 - 3. Seals: Viton or EPDM.
- D. Design Requirements:
 - 1. Connectors: Double union.

2.8 DUCKBILL CHECK VALVES

- A. Manufacturers:
 - 1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. Red Valve, Tideflex Series TF-1 slide on type.

- b. Proco Products, Series 700 ProFlex Rubber Check Valve.
- c. Onyx Valve Company, Series DBF.

B. Description:

- 1. Provide at locations shown on the Drawings and as otherwise indicated in the Contract Documents duckbill check valves.
- 2. Duckbill check valves provided shall be one-piece, elastomeric, one-way flow devices, installed to allow flow only in the intended direction, without a separate seating surface that is part of the valve.
- 3. Shall not freeze open or closed.
- 4. Low hydraulic head loss.

C. Performance Criteria:

- 1. Size: As shown on the Drawings.
- 2. Upstream Hydrostatic Head Required for Opening: Two inches of water, maximum.

D. Materials, Assembly, Fabrication:

- 1. Duckbill/Sleeve: EPDM.
- 2. Mounting to Pipe:
 - a. Slide-on type with Type 316 stainless steel mounting bands
 - b. Elastomeric flanged, ANSI B16.1 Class 125/150 with stainless steel backing rings.
- 3. Markings: Permanently bond to valve the following information: Manufacturer's business name, valve model, valve size, and serial name.

2.9 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections:

- 1. Perform manufacturer's standard factory tests and inspections on materials and equipment furnished. Correct defects prior to shipment to the Site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation – General:

- 1. Provide check valves at locations shown and indicated in the Contract Documents.
- 2. Install in accordance with the Contract Documents and manufacturer's written instructions. In event of conflict between the Contract Documents and manufacturer's written instructions, obtain written interpretation or clarification from Engineer.
- 3. Comply with:
 - a. Section 01 61 03 - Equipment - Basic Requirements.
 - b. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.
- 4. Before installing, ensure each check valve is clean and free of dirt and debris.

3.2 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

- 1. Promptly after installing, before installing connecting pipe, verify proper and free operation of check valve.
- 2. Hydrostatically test check valves together with associated piping.
- 3. To extent practical, prior to Substantial Completion, verify proper operation of each installed check valve.

END OF SECTION

SECTION 43 21 00
PUMPING EQUIPMENT - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pumping equipment.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 01 61 03 - Equipment - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ANSI/Hydraulic Institute (ANSI/HI):
 - a. 9.6.3, Rotodynamic (Centrifugal and Vertical) Pumps – Guideline for Allowable Operating Region.
 - b. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
 - c. 9.6.6, Rotodynamic Pumps for Pump Piping.
 - d. 11.6, Rotodynamic Submersible Pump for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests.
 - e. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
- B. Coordinate all mechanical seal systems specified to ensure pump and seal compatibility.
- C. Pump/motor and VFD coordination: See Specification Section 01 61 03.

1.3 DEFINITIONS

- A. The abbreviations used in this section are defined as follows:
 - 1. AOR: Allowable Operating Range.
 - 2. BEP: Best Efficiency Point.
 - 3. IPS: Iron Pipe Size.
 - 4. NPSH3: Net Positive Suction Head for 3% head loss.
 - 5. POR: Preferred Operating Range.
 - 6. TDH: Total Dynamic Head.
 - 7. TEFC: Totally Enclosed Fan Cooled.
 - 8. VFD: Variable Frequency Drive.
- B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 61 03.
 - 2. Product technical data including:
 - a. Performance data and curves with flow (GPM), head (FT), horsepower, hydraulic efficiency, rotating speed (RPM), AOR, BEP, POR, NPSH3 requirements, minimum bowl submergence requirements for vertical mixed flow, axial and turbine pumps.
 - b. Pump accessory data.
 - c. Bearing supports, shafting details and lubrication provisions.

- 1) Bearing life calculations.
 - 2) Critical speed calculations.
 - d. Solids passage information.
- 3. Certifications:
 - a. Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
 - b. Verification of Primary and Secondary conditions in POR and AOR.
- 4. Test reports:
 - a. Factory hydrostatic test.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Informational Submittals:
 - 1. Certifications:
 - a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Pumps:
 - a. See individual pump Specification Sections.
 - 2. Mechanical seals:
 - a. Chesterton.
 - b. John Crane.
 - c. Garlock.
 - d. Or as noted in the individual pump Specification Sections.
 - 3. Seal water station:
 - a. Chesterton.
 - b. John Crane.
 - c. AESSEAL.

2.2 CENTRIFUGAL PUMP DESIGN

- A. Provide units with increasing head characteristics from the end run out portion of the curve to:
 - 1. Shut-off condition.
 - 2. For Mixed flow, Axial Flow and Propeller pumps to the right hand edge of the AOR.

2.3 ACCESSORIES

- A. See Specification Section 01 61 03.
- B. Each Unit:
 - 1. Lifting eye bolts or lugs.
 - 2. Plugged gage cock connection at suction and discharge nozzles.
 - 3. Tapped and plugged openings for casing and bearing housing vents and drains.
 - 4. Fittings for properly adding flushing lubricant.

5. Pressure relief fittings for grease lubrication.
- C. Packing Seal:
1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
 2. Minimum of five rings graphite impregnated synthetic packing.
 3. Provide minimum 1/4 inches diameter supply tap and 1/2 inches diameter minimum drain tap.
 4. Provide split Teflon or bronze water seal ring.
 5. Adjustable split follower cast iron or bronze gland.
- D. Mechanical Seals:
1. Provide as specified in the narrow-scope pump sections.
 2. Provide rotating balanced O-ring type.
 3. Provide water lubrication - cooling.
 4. Materials:
 - a. Metal parts except springs: 316 stainless steel.
 - b. Springs: Hastelloy C.
 - c. Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.
 - d. Elastomers: Viton.
- E. Seal Water Station:
1. Provide one unit per pump with manual shut-off valve on all pumps with seals.
 2. Features:
 - a. Pressure regulating.
 - b. Flow regulating.
 - c. Cleanable flow tube(s) while in service.
 - d. Hose barb connection.
 - e. Liquid filled pressure gage.
 3. Materials of construction:
 - a. Flowmeter tubes: Polysulfone.
 - b. Unit body: Polyoxymethylene.
 - c. Pressure gage: 316 stainless steel case and wetted parts.
 - d. Pressure regulating valve: 316 stainless steel.
 - e. Flow regulating valve: 316 stainless steel.
 - f. Tube fittings: 316 stainless steel.
 - g. Mounting brackets: 316 stainless steel.
 4. Service:
 - a. Temperatures up to 150 degrees F.
 - b. Pressure up to 140 psiG.
 5. Connection:
 - a. Hose barb threaded to pump.
 - b. Hose barb to seal water unit.
 - c. Reinforced polyurethane hose:
 - 1) Minimum size: 3/8 inches ID.
 - 2) Minimum pressure rating:
 - a) At 180 degrees F: 115 psi.
 - b) At 73 degrees F: 200 psi.

- 3) Minimum wall thickness: 1/8 inches.
- d. Non-potable water to shut-off valve: See Section 40 05 00 with isolation ball valve.
- 6. Mounting:
 - a. To pump or pipe flange with stainless steel bracket.
 - b. Maximum distance from non-potable water to shut-off ball valve to seal water station and seal water station to pump seal, 2 feet each direction.

2.4 FABRICATION

- A. Pump Support:
 - 1. Design base to support weight of drive, shafting and pump.
 - 2. Comply with HI vibration limitations.
 - 3. Mount horizontal pump, motor and coupling on single piece drip lip type machine base.
 - 4. Mount vertical pumps on single piece pedestal machine base.
 - 5. Mount vertical turbine/propeller/can pumps on a rigid machined base plate attached to the discharge elbow. Base plate to be bolted to the pump can or an independent rigid machined sole plate grouted to the concrete substructure with anchor rods and leveled with jackscrews.
 - 6. Fabricate to withstand all operating loads transmitted from the pump and drive.
 - 7. On vertically configured end suction centrifugal pumps when supplied with a fabricated steel mounting frame and suction elbow, the suction elbow shall be a long radius reducing elbow with greater than 50% area reduction to comply with Table 9.6.6.3.2 of ANSI/HI 9.6.6 standard for straight pipe lengths.

2.5 SOURCE QUALITY CONTROL

- A. Verification primary design condition in POR.
- B. Verification secondary design condition in AOR.
- C. Factory hydrostatic test all pumps at 150% of shut-off head for a minimum of five minutes.
- D. If specifically required in the individual pump specification sections, provide factory tests:
 - 1. All units:
 - a. Conduct tests in accordance with HI.
 - 1) Shut-off head and design condition: Positive unilateral performance tolerance meeting Grade 1U per ANSI/HI 14.6 for Rotodynamic Pumps.
 - 2) Shut-off head and design conditions: Positive unilateral performance tolerances meeting Grade 1U per ANSI/HI 11.6 for Rotodynamic Submersible Pumps.
 - 2. All pumps:
 - a. Head (FT) versus flow (GPM) pump curves:
 - 1) Efficiencies along curve.
 - 2) Brake horsepower along each curve.
 - 3. Results certified by a registered professional engineer.
- E. Statically and dynamically balance each pump per ANSI/HI standards.
 - 1. If specifically required in the individual pump specification sections or in Specification Section 01 61 03, field vibration test pumps:
 - a. To meet requirements of ANSI/HI 9.6.4 for Rotodynamic Pumps at any point on the pumps and motor.
- F. To meet requirements of ANSI/HI 11.6 for Submersible Pumps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 01 61 03.
- B. Floor or Pad-Mounted Units (Non-Submersible):
 - 1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
 - 2. Assure no unnecessary stresses are transmitted to equipment flanges.
 - 3. Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
 - 4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
 - 5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
 - 6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
 - 7. Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.
 - a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - b. Realign as necessary, install flange bolts and make equipment connection.
 - 8. Provide pressure gage, visible from grade or operating floor, on discharge of all pumps and on suction and discharge of all non-submersible units.
- C. Submersible Units:
 - 1. Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.
 - a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - b. Realign as necessary, install flange bolts and make equipment connection.
 - 2. Provide discharge pressure gage visible from grade or operating floor.

3.2 FIELD QUALITY CONTROL

- A. Provide services of equipment manufacturer's field service representative(s) to:
 - 1. Inspect equipment covered by this Specification Section.
 - 2. Supervise pre-start adjustments and installation checks.
 - 3. Conduct initial start-up of equipment and perform operational checks.
 - 4. Instruct Owner's personnel for the specified minimum number of hours at jobsite on operation and maintenance of each of the specified pumping equipment.

END OF SECTION

SECTION 43 25 13

PUMPING EQUIPMENT - SUBMERSIBLE END-SUCTION SEWAGE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submersible sewage pumps in a [wet pit] [dry pit] application for pumping of [unscreened wastewater] [screened wastewater] [return and waste activated sludge].
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.
 - 2. Section 26 24 19 - Motor Control Equipment.
 - 3. Section 43 21 00 - Pumping Equipment - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Bearing Manufacturers Association (ABMA).
 - 2. American National Standards Institute (ANSI).
 - 3. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - 4. FM Global (FM).
 - 5. Hydraulic Institute (HI):
 - a. Standards for Centrifugal, Rotary and Reciprocating Pumps.
 - 6. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 7. National Fire Protection Agency (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 500, Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2.
 - 8. Underwriters Laboratories, Inc. (UL).
 - a. 62, Flexible Cord and Fixture Wire.

1.3 SYSTEM DESCRIPTION

- A. [Provide brief description of the system, including pump service, number of pumps, pump tag numbers, variable or constant speed, etc.].
- B. Provide single source coordination responsibility through the pump manufacturer for the entire system including but not limited to the following:
 - 1. Pumps.
 - 2. Motors.
 - 3. Reduced Voltage Solid State Soft Starters.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Requirements in Specification Section 01 61 03.
 - 2. Requirements in Specification Section 43 21 00.
- B. Operation and Maintenance Manuals:

1. See Specification Section 01 78 23 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
- C. Project Information:
 1. Executed Manufacturer's Installation Certification Form.

1.5 SHIPPING

- A. Per Section 01 61 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Sulzer – ABS.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Lift Station 2:
 1. Design Condition:
 - a. Flow: 90 GPM.
 - b. Head: 142 feet.
- B. Lift Station 8:
 1. Design Condition:
 - a. Flow: 180 GPM.
 - b. Head: 326 feet.

2.3 MATERIALS

- A. Lift Station 2 and 8:
 1. Pump case: Cast iron, ASTM A48, Class 35.
 2. Motor housing: Cast iron, ASTM A48, Class 25 or Class 30.
 3. Impeller: Cast Iron, ASTM A-532 Class III, Type A.
 4. Shaft: Stainless Steel, Series 300 or 400.
 5. Wear Surfaces: Hardened Stainless Steel wear rings with the stationary ring harder than the rotating ring.
 6. O-rings: Nitrile (Buna-N) or fluorocarbon (Viton).
 7. Fasteners: Stainless steel.
 8. Lower ring seal: Tungsten-carbide both faces or Silicon Carbide both faces.
 9. Upper ring seal: Tungsten-carbide both faces or carbon and ceramic or carbon and Ni-resist.
 10. Seal metal parts: Stainless steel.
- B. Dry Pit Applications:
 1. Pump base: Fabricated steel.
 2. Suction elbow and hand hole cover: Cast iron, ASTM A48, Class 35.
- C. Wet Pit Applications:
 1. Guide rails: Type 316 Stainless steel.
 2. Lifting chains and cables: Type 316 Stainless steel.

3. Base elbow: Cast iron, ASTM A48, Class 35.

2.4 COMPONENTS

A. General:

1. Provide pumps capable of handling raw, unscreened sewage.
2. Where watertight sealing is required, machine and fit mating surfaces with O-rings.
3. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.

B. Impeller:

1. Provide solids-handling type dynamically balanced impeller in accordance with HI standards.
2. Provide adjustable impeller that will provide effective sealing between the suction cover and impeller.

C. Shaft:

1. Design shaft for a maximum deflection of 0.004 inches at the stuffing box as calculated at the design condition.

D. Mechanical Seal:

1. Seal shaft with double mechanical seal running in an oil filled chamber.
2. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
3. Hold interface in contact by its own spring system.

E. Bearings:

1. Support shaft on upper and lower permanently lubricated bearings with a minimum ABMA L-10 life of 50,000 hours.

F. Motors:

1. Provide pump with FM, UL, or CSA listed motor approved for area classification shown on Drawings.
2. Provide induction type motor with a squirrel cage rotor, of totally submersible design without loss of watertight integrity to a depth of at least 65 feet, constructed with epoxy or poly-seal encapsulated windings, air-filled or dielectric oil filled, with Class H insulation rated for 180 degrees C and rated for continuous duty operation.
3. Motor shall be capable of running continuously in an unsubmerged condition while pumping under load without damage to motor or seal.
4. The motor horsepower provided shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through runout.
5. The motor shall be designed and assembled by the same manufacturer as the pump.
6. The motor shall be equipped with a closed loop cooling system where the cooling medium is circulated through the pump motor cooling jacket. The pumped fluid shall not be circulated through the cooling jacket. An impeller in the lower motor coolant reservoir will circulate coolant around the motor housing. The cooling system shall provide sufficient cooling for continuous operation whether the pump is submerged in the pumped media or surrounded by air in liquid or ambient temperatures of up to 40 degrees C.
7. Cooling system will provide sufficient cooling for the entire range of pump operating speeds.

G. Power and Control Cables:

1. Provide power and control cables which are listed per NEC requirements and approved for the installation types indicated on the drawings. As a minimum the cable shall be suitable for installation in conduit and for submersible applications.

2. Size cables in accordance with applicable NFPA 70 specifications.
 3. Provide 30 feet power cable and control cable.
 4. Provide each cable with a strain relief, cord grip, and explosion proof seal installed in accordance with NFPA 70, Article 500.
 5. Minimum acceptable cable type: "SO-Water Resistant" per UL 62.
- H. Temperature Monitor:
1. Furnish each phase of the motor with thermal switches embedded in the motor windings.
 2. Should high temperature be sensed in the windings, the thermal switch will open, shut the pump down, and sound an alarm. Should any one of the thermal switches detect high temperature, it will automatically reset once the stator temperature returns to normal.
 3. Set temperature of the temperature monitors not higher than 90% of insulation temperature rating.
- I. Leak Detection:
1. Provide sensors inside the terminal board and the stator chamber to detect water intrusion
 2. If water is detected inside the terminal board or the stator chamber, a switch will stop the pump and sound an alarm.
- J. Coatings:
1. Apply two-component oxirane ester or polyamidoamine epoxy system to the exterior of the pump casing and motor housing.
- K. Wet Pit Applications:
1. Provide sliding guide bracket integral to pump unit which properly aligns the pump discharge with the discharge connection elbow for watertight seal during pumping.
 2. Guide the entire weight of the pumping unit to the base discharge elbow by guide rail(s).
 3. The guide rail(s) shall not support any portion of the weight of the pump.
 4. Provide chains or cable of sufficient strength to lift pumps from sump.
 5. Furnish guiding rail assembly and the discharge flange assembly of nonsparking components.
 6. Design pump to allow for removal without entering the wet well and without removal of bolts, nuts or other fastenings.
 7. Provide pump unit connecting to discharge connection with a simple downward motion without rotation. The entire weight of the pumping unit shall wedge tightly against the discharge elbow flange forming a seal without the use of bolts, gaskets, or o-rings.
 8. Provide necessary sliding guide bracket and discharge connection which, when bolted to the floor of the sump and to the discharge line, will receive the pump discharge connecting flange without need of adjustment, fasteners, clamp, or similar devices.
 9. No portion of the pump shall bear directly on the floor.
- L. Dry Pit Applications:
1. Provide suction elbow with integral handhole and rubber gasketed cover.
 - a. Provide handhole cover with surfaces to match the internal contours of the suction elbow.
 - b. Provide with ANSI 125 pound flat face flange for connection to suction piping.
 - c. 1-1/2 inches tapped connection.
 - d. Suction elbow must be long-radius and have greater than 50% area reduction from the inlet to the outlet of the elbow.
 2. Provide a fabricated heavy duty support stand designed for the pump furnished. Provide stand with openings sized to allow access to the suction elbow for dismantling, easy access

to the hand hole cover and its fastening hardware, and access to any tapped connections into the suction elbow.

3. Provide ANSI 125 pound pump suction and discharge flanges.

2.5 ACCESSORIES

- A. See Specification Section 43 21 00 - Pumping Equipment: Basic Requirements.
- B. Controls:
 1. See Electrical and Instrument and Controls Designs for controls requirements.
- C. Unhide the following text if a winch is required.

2.6 SOURCE QUALITY CONTROL

- A. Secure from the pump manufacturer the following inspections and tests on each pump before shipment from factory:
 1. Check impeller, motor rating and electrical connections for compliance with this Specification Section.
 2. Test motor and cable insulation for moisture content or insulation defects.
 3. Prior to submergence, run pump dry to establish correct rotation and mechanical integrity.
 4. Run pump submerged for 30 minutes.
 5. After operational test #4, perform insulation test (#2) again.
- B. Factory test of head (FT) versus flow (GPM) for all pumps being provided as specified in Specification Section 43 21 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 43 21 00.
- B. For wet pit pumps, permanently install discharge connection elbow in wet well along with discharge piping.
- C. Seal pump cable end with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

3.2 FIELD QUALITY CONTROL

- A. See Specification Section 43 21 00.

END OF SECTION

APPENDIX - MDNR OPERATING PERMIT

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION



MISSOURI STATE OPERATING PERMIT

General Operating Permit

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No MOR100038

Owner: OA-Facilities Mgmt, Design, and Construc
Address: 301 West High Street, Hst Rm 370
Jefferson City, MO 65101

Continuing Authority: OA Facilities Mgmt Design Construction
301 West High St.
HST SOB Rm 730
Jefferson City, MO 65102

Facility Name: Office of Administration
Facility Address: OA-FMDC, PO Box 809 301 W High street
JEFFERSON CITY, MO 65102

Legal Description: Land Grant 02681, Cole County
UTM Coordinates: 571840.000/4270368.000
Receiving Stream: Tributary to Wears Creek (U)
First Classified Stream - ID#: 100K Extent-Remaining Streams (C) 3960.00
USGS# and Sub Watershed#: 10300102 - 1304

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein.

FACILITY DESCRIPTION All Outfalls SIC #1629

All Outfalls - Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling and other activity that results in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution of waters of the state)

Issued to a city, county, state or federal agency, other governmental jurisdiction, or other private area-wide projects as determined by the Department on a case-by-case basis

This permit authorizes only wastewater, including storm water, discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System, it does not apply to other regulated areas. This permit may be appealed in accordance with RSMo Section 644.051.6 and 621.250, 10 CSR 20-6.020, and 10 CSR 20-1.020.

August 01, 2022

Issue Date

Chris Wieberg, Director
Water Protection Program

July 04, 2027

Expiration Date

I. APPLICABILITY

A. Permit Coverage and Authorized Discharges

1. This Missouri State Operating Permit (permit) authorizes the discharge of stormwater and certain non-stormwater discharges from land disturbance sites that disturb one or more acres, or disturb less than one acre when part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project.

A Missouri State Operating Permit must be issued before any site vegetation is removed or the site disturbed. Any site owner/operator subject to these requirements for stormwater discharges and who disturbs land prior to permit issuance from the Missouri Department of Natural Resources (Department) is in violation of both State regulations per 10 CSR 20-6.200(1)(A) and Federal regulations per 40 CFR 122.26. The owner/operator of this permit is responsible for compliance with this permit [10 CSR 20-6.200 (3)(B)].

2. This general permit is issued to a city, county, state or federal agency, other governmental jurisdiction, or other private area-wide projects as determined by the Department on a case-by-case basis, for land disturbance projects performed by or under contract to the permittee.
3. This permit authorizes stormwater discharges from land disturbance support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas, concrete, or asphalt batch plants) provided appropriate stormwater controls are designed, installed, and maintained and the following conditions are met and addressed in the Stormwater Pollution Prevention Plan (SWPPP). The permittee is responsible for compliance with this permit for any stormwater discharges from construction support activity.
 - (a) The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
 - (b) The support activity is not a commercial operation or serve multiple unrelated construction sites;
 - (c) The support activity does not continue to operate beyond the completion of the construction activity at the project it supports;
 - (d) Sediment and erosion controls are implemented in accordance with the conditions of this permit; and
 - (e) The support activity is strictly stormwater discharges or non-stormwater discharges listed in PART I, APPLICABILITY, Condition A.4. Support activities which discharge process water shall apply for separate coverage (e.g., a concrete batch plant discharging process water shall be covered under a MOG49).
4. This permit authorizes non-stormwater discharges associated with your construction activity from the following activities provided that these discharges are treated by appropriate Best Management Practices (BMPs) where applicable and addressed in the permittee's site specific SWPPP required by this general permit:
 - (a) Discharges from emergency fire-fighting activities;
 - (b) Hydrant flushing and water line flushing, provided the discharged water is managed to avoid instream water quality impacts;
 - (c) Landscape watering, including to establish vegetation;
 - (d) Water used to control dust;
 - (e) Waters used to rinse vehicles and equipment, provided there is no discharge of soaps, solvents, or detergents used for such purposes;
 - (f) External building washdown, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (e.g., paint or caulk containing polychlorinated biphenyls (PCBs))
 - (g) Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. Directing pavement wash waters directly into any water of the state, storm drain inlet, or stormwater conveyance (constructed or natural site drainage features), unless the conveyance is connected to an effective control, is prohibited;
 - (h) Uncontaminated air conditioning or compressor condensate;
 - (i) Uncontaminated, non-turbid discharges of ground water or spring water;
 - (j) Foundation or footing drains where flows are not contaminated with process materials; and
 - (k) Uncontaminated construction dewatering water discharged in accordance with requirements found in this permit for specific dewatering activities.

B. Permit Restrictions and Limitations

1. This permit does not authorize the discharge of process wastewaters, treated or otherwise.
2. For sites operating within the watershed of any Outstanding National Resource Water (which includes the Ozark National Riverways and the National Wild and Scenic Rivers System), sites that discharge to an Outstanding State Resource Water, or facilities located within the watershed of an impaired water as designated in the Clean Water Act (CWA) Section 303(d) list with an impairment for sedimentation/siltation:
 - (a) This permit authorizes stormwater discharge provided no degradation of water quality occurs due to discharges from the permitted facility per 10 CSR 20-7.031(3)(C).
 - (b) A site with a discharge found to be causing degradation or contributing to an impairment by discharging a pollutant of concern, during an inspection or through complaint investigations, may be required to become a no discharge facility or obtain a site-specific permit with more stringent monitoring and SWPPP requirements.
3. This permit does not allow placement of fill material into any stream or wetland, alteration of a stream channel, or obstruction of stream flow unless the appropriate CWA Section 404 permitting authority provides approval for such actions or determines such actions are exempt from Section 404 jurisdiction. Additionally, this permit does not authorize placement of fill in floodplains unless approved or determined exempt by appropriate federal and/or state floodplain development authorities.
4. This operating permit does not affect, remove, or replace any requirement of the National Environmental Policy Act; the Endangered Species Act; the National Historic Preservation Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; or any other relevant acts. Determination of applicability to the above mentioned acts is the responsibility of the permittee. Additionally, this permit does not establish terms and conditions for runoff resulting from silvicultural activities listed in Section 402(1)(3)(a) of the Clean Water Act.
5. Compliance with all requirements in this permit does not supersede any requirement for obtaining project approval from an established local authority nor remove liability for compliance with county and other local ordinances.
6. The Department may require any facility or site authorized by a general permit to apply for a site-specific permit [10 CSR 20-6.010(13)(C)].
7. If a facility or site covered under a current general permit desires to apply for a site-specific permit, the facility or site may do so by contacting the Department for application requirements and procedures.
8. Any discharges not expressly authorized in this permit and not clearly disclosed in the permit application cannot become authorized or shielded from liability under CWA section 402(k) or Section 644.051.16, RSMo, by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including any other permit applications, funding applications, the SWPPP, discharge monitoring reporting, or during an inspection. Discharges at the facility not expressly authorized by this permit must be covered by another permit, be exempt from permitting, or be authorized through some other method.

II. EXEMPTIONS FROM PERMIT REQUIREMENTS

1. Sites that discharge all stormwater runoff directly to a combined sewer system (as defined in 40 CFR 122.26 and 40 CFR 35.2005) connecting to a publicly owned treatment works which has consented to receive such a discharge are exempt from Department stormwater permit requirements.
2. Land disturbance activities that disturb less than one (1) acre of total land area which are not part of a common plan or sale where water quality standards are not exceeded are exempt from Department stormwater permit requirements.

3. Oil and gas related activities as listed in 40 CFR 122.26(a)(2)(ii) where water quality standards are not exceeded are exempt from Department stormwater permit requirements.
4. Linear, strip, or ribbon construction or maintenance operations meeting one (1) of the following criteria are exempt from Department stormwater permit requirements:
 - (a) Grading of existing dirt or gravel roads which does not increase the runoff coefficient and the addition of an impermeable surface over an existing dirt or gravel road;
 - (b) Cleaning or routine maintenance of roadside ditches, sewers, waterlines, pipelines, utility lines, or similar facilities;
 - (c) Trenches two (2) feet in width or less; or
 - (d) Emergency repair or replacement of existing facilities as long as BMPs are employed during the emergency repair.

III. REQUIREMENTS

1. The permittee shall post a public notification sign at the main entrance to the site, or a publically visible location, with the specific MOR100 permit number. The public notification sign must be visible from the public road that provides access to the site's main entrance. An alternate location is acceptable provided the public can see it and it is noted in the SWPPP. The public notification sign must remain posted at the site until the site is finalized.
2. The permittee shall be responsible for notifying the land owner and each contractor or entity (including utility crews and city employees or their agents) who will perform work at the site of the existence of the SWPPP and what actions or precautions shall be taken while on site to minimize the potential for erosion and the potential for damaging any BMP. The permittee is responsible for any damage a subcontractor may do to established BMPs and any subsequent water quality violation resulting from the damage.
3. Ensure the design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:
 - (a) Control stormwater volume, velocity, and peak flow rates to minimize soil erosion;
 - (b) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion and scour;
 - (c) Minimize the amount of exposed soil during construction activity;
 - (d) Minimize the disturbance of steep slopes;
 - (e) Minimize sediment discharges from the site. Address factors such as:
 - 1) The amount, frequency, intensity, and duration of precipitation;
 - 2) The nature of resulting stormwater runoff;
 - 3) Expected flow from impervious surfaces, slopes, and drainage features; and
 - 4) Soil characteristics, including the range of soil particle size expected to be present on the site.
 - (f) Provide and maintain natural buffers around surface waters as detailed in Part V. BMP REQUIREMENTS Condition 7, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration and filtering, unless infeasible; and
 - (g) Minimize soil compaction and preserve topsoil where practicable.

A 2-year, 24-hour storm event can be determined for the project location using the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 which can be located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html, or the permittee can determine local rainfall distribution for a 2-year, 24 hours storm event using multi-decade local high density rain gauge data, as approved by the Department.

4. BMPs for land disturbance [10 CSR 20-6.200(1)(D)2] are a schedule of activities, practices, or procedures that reduces the amount of soil available for transport or a device that reduces the amount of suspended solids in runoff before discharge to waters of the state. The term BMPs are also used to describe the sediment and erosion controls and other activities used to prevent stormwater pollution. BMPs are divided into two main categories: structural or non-structural; and they are also classified as temporary or permanent. Temporary BMPs may be added and removed as necessary with updates to the SWPPP as specified in the requirements below.

5. Installation of BMPs necessary to prevent soil erosion and sedimentation at the downgradient project boundary (e.g. buffers, perimeter controls, exit point controls, storm drain inlet protection) must be complete prior to the start of all phases of construction. By the time construction activity in any given portion of the site begins, downgradient BMPs must be installed and operational to control discharges from the initial site clearing, grading, excavating, and other earth-disturbing activities. Additional BMPs shall be installed as necessary throughout the life of the project.
6. All BMPs shall be maintained and remain in effective operating condition during the entire duration of the project, with repairs made within the timeframes specified elsewhere in this permit, until final stabilization has been achieved.
 - (a) Ensure BMPs are protected from activities that would reduce their effectiveness.
 - (b) Remove any sediment per the BMP manufacturer's instructions or before it has accumulated to one-half of the above-ground height of any BMP that collects sediment (i.e., silt fences, sediment traps, etc.)
 - (c) The project is considered to achieve final stabilization when Part V. BMP REQUIREMENTS, Condition 13 is met.
7. Minimize sediment trackout from the site and sediment transport onto roadways.
 - (a) Restrict vehicle traffic to designated exit points.
 - (b) Use appropriate stabilization techniques or BMPs at all points that exit onto paved roads or areas outside of the site.
 - (c) Use additional controls or BMPs to remove sediment from vehicle and equipment tires prior to exit from facility where necessary.
 - (d) Any sediment or debris that is tracked out past the exit pad or is deposited on a roadway after a precipitation event shall be removed by the shorter of either the same business day (for business days only), or by the end of the next business day if track-out occurs on a non-business day, and before predicted rain events. Remove the track-out sediment by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. Sediment or debris tracked out on pavement or other impervious surfaces shall not be disposed of into any stormwater conveyance, storm drain inlet, or water of the state.
 - (e) Stormwater inlets susceptible to receiving sediment or other pollutants from the permitted land disturbance site shall have curb inlet protection. This may include inlets off the active area where track out from vehicles and equipment could impact the stormwater runoff to those inlets.
8. Concrete washout facilities shall be used to contain concrete waste from the activities onsite, unless the washout of trucks and equipment is managed properly at an off-site location. The washout facility shall be managed to prevent solid and/or liquid waste from entering waters of the state by the following:
 - (a) Direct the wash water into leak-proof containers or pits designed so that no overflows can occur due to inadequate sizing or precipitation;
 - (b) Locate washout activities away from waters of the state, stormwater inlets, and/or stormwater conveyances where practicable. If not practicable, use BMPs to reduce risk of waste leaving the washout facility;
 - (c) Washout facilities shall be cleaned, or new facilities must be constructed and ready for use, once the washout is 75% full;
 - (d) Designate the washout area(s) and conduct such activities only in these areas.
 - (e) Ensure contractors are aware of the location, such as by marking the area(s) on the map or signage visible to the truck and/or equipment operators.
9. Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state.
 - (a) Provide solid and hazardous waste management practices, including providing trash containers, regular site cleanup for proper disposal of solid waste such as scrap building material, product/material shipping waste, food/beverage containers, spent structural BMPs;
 - (b) Provide containers and methods for proper disposal of waste paints, solvents, and cleaning compounds.
 - (c) Manage sanitary waste. Portable toilets shall be positioned so that they are secure and will not be tipped or knocked over and so that they are located away from waters of the state and stormwater inlets and stormwater conveyances.
 - (d) Ensure the storage of construction materials be kept away from drainage courses, stormwater conveyances, storm drain inlets, and low areas.

10. All fueling facilities present shall at all times adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers.
11. Any hazardous wastes that are generated onsite shall be managed, stored, and transported according to the provisions of the Missouri Hazardous Waste Laws and Regulations.
12. Store all paints, solvents, petroleum products, petroleum waste products, and storage containers (such as drums, cans, or cartons) so they are not exposed to stormwater or provide other prescribed BMPs (such as plastic lids and/or portable spill pans) to prevent the commingling of stormwater with container contents. Commingled water may not be discharged under this permit. Provide spill prevention, control, and countermeasures to contain the spill. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall prevent the contamination of groundwater.
13. Implement measures intended to prevent the spillage or loss of fluids, oil, grease, fuel, etc. from vehicles and equipment to thereby prevent the contamination of stormwater from these substances. This may include prevention measures such as, but not limited to, utilizing drip pans under vehicles and equipment stored outdoors, covering fueling areas, using dry clean-up methods, use of absorbents, and cleaning pavement surfaces to remove oil and grease.
14. Spills, Overflows, and Other Unauthorized Discharges.
 - (a) Any spill, overflow, or other discharge not specifically authorized in the permit above are unauthorized.
 - (b) Should an unauthorized discharge cause or permit any contaminants, other than sediment, or hazardous substance to discharge or enter waters of the state, the unauthorized discharge must be reported to the regional office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department's Environmental Emergency Response hotline at (573) 634-2436. Leaving a message on a Department staff member voice-mail does not satisfy this reporting requirement.
 - (c) A record of all spills shall be retained with the SWPPP and made available to the Department upon request.
 - (d) Other spills not reaching waters of the state must be cleaned up as soon as possible to prevent entrainment in stormwater but are not required to be reported to the Department.
15. The full implementation of this operating permit shall constitute compliance with all applicable federal and state statutes and regulations in accordance with RSMo 644.051.16 and the CWA §402(k); however, this permit may be reopened and modified or alternatively revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Clean Water Act §§ 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) if the effluent standard or limitation so issued or approved contains different conditions or is otherwise more stringent than any effluent limitation in the permit or controls any pollutant not limited in the permit. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, termination, notice of planned changes, or anticipated non-compliance does not stay any permit condition.

IV. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) MANAGEMENT REQUIREMENTS

1. The primary requirement of this permit is the development and implementation of a SWPPP which incorporates site specific practices to best minimize the soil exposure, soil erosion, and the discharge of pollutants, including solids for each site covered under this permit.

The purpose of the SWPPP is to ensure the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants in stormwater discharges associated with the land disturbance activities [40 CFR 122.44 (k)(4)] from entering waters of the state above established general and narrative criteria; compliance with Missouri Water Quality Standards; and compliance with the terms and conditions of this general permit.

- (a) **The SWPPP must be developed and implemented prior to conducting any land disturbance activities and must be specific to the land disturbance activities at the site.**
- (b) The permittee shall fully implement the provisions of the SWPPP required under this permit as a condition of this general permit throughout the term of the land disturbance project. Failure to develop, implement, and maintain a SWPPP may lead to immediate enforcement action.

- (c) The SWPPP shall be updated any time site conditions warrant adjustments to the project or BMPs.
 - (d) Either an electronic copy or a paper copy of the SWPPP, and any required reports, must be accessible to anyone on site at all times when land disturbance operations are in process or other operational activities that may affect the maintenance or integrity of the BMP structures and made available as specified under Part VIII. STANDARD PERMIT CONDITIONS, Condition 1 of this permit. The SWPPP shall be readily available upon request and should not be sent to the Department unless specifically requested
2. Failure to implement and maintain the BMPs chosen, which can be revised and updated, is a permit violation. The chosen BMPs will be the most reasonable and cost effective while also ensuring the highest quality water discharged attainable for the facility. Facilities with established SWPPPs and BMPs shall evaluate BMPs on a regular basis and change the BMPs as needed if there are BMP deficiencies.
 3. The SWPPP must:
 - (a) List and describe the location of all outfalls;
 - (b) List any allowable non-stormwater discharges occurring on site and where these discharges occur;
 - (c) Incorporate required practices identified below;
 - (d) Incorporate sediment and erosion control practices specific to site conditions;
 - (e) Discuss whether or not a 404 Permit is required for the project; and
 - (f) Name the person(s) responsible for inspection, operation, and maintenance of BMPs. The SWPPP shall list the names and describe the role of all owners/primary operators (such as general contractor, project manager) responsible for environmental or sediment and erosion control at the land disturbance site.
 4. The SWPPP briefly must describe the nature of the land disturbance activity, including:
 - (a) The function of the project (e.g., low density residential, shopping mall, highway, etc.);
 - (b) The intended sequence and timing of activities that disturb the soils at the site; and
 - (c) Estimates of the total area expected to be disturbed by excavation, grading, or other land disturbance support activities including off-site borrow and fill areas;
 5. In order to identify the site, the SWPPP shall include site information including size in acres. The SWPPP shall have sufficient information to be of practical use to contractors and site construction workers to guide the installation and maintenance of BMPs.
 6. The function of the SWPPP and the BMPs listed therein is to prevent or minimize pollution to waters of the state. A deficiency of a BMP means it was not effective in preventing or minimizing pollution of waters of the state.

The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs.

Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, (Document number EPA 833-R-06-004) published by the United States Environmental Protection Agency (USEPA) in May 2007. This manual as well as other information, including examples of construction SWPPPs, is available at the USEPA internet site at https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf; and <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp>.

The latest version of *Protecting Water Quality: A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri*, published by the Department. This manual is available at: <https://dnr.mo.gov/document-search/protecting-water-quality-field-guide>.

The permittee is not limited to the use of these guidance manuals. Other guidance publications may be used to select appropriate BMPs. However, all BMPs must be described and justified in the SWPPP. Although the use of these manuals or other resources is recommended and may be used for BMP selection, they do not supersede the conditions of this permit. They may be used to inform in the decision making process for BMP selection but they are not themselves part of the permit conditions.

The permittee may retain the SWPPP, inspection reports, and all other associated documents (including a copy of this permit) electronically pursuant to RSMo 432.255. The documents must be made available to all interested persons in either paper or electronic format as required by this permit and the permittee must remit a copy (electronic or otherwise) of the SWPPP and inspection reports to the Department upon request.

7. The SWPPP must contain a legible site map, multiple maps if necessary, identifying:
 - (a) Site boundaries of the property;
 - (b) Locations of all waters of the state (including wetlands) within the site and half a mile downstream of the site's outfalls;
 - (c) Location of all outfalls;
 - (d) Direction(s) of stormwater flow (use arrows) and approximate slopes before and after grading activities;
 - (e) Areas of soil disturbance and areas that will not be disturbed (or a statement that all areas of the site will be disturbed unless otherwise noted);
 - (f) Location of structural and non-structural BMPs, including natural buffer areas, identified in the SWPPP;
 - (g) Locations where stabilization practices are expected to occur;
 - (h) Locations of on-site and off-site material, waste, borrow, or equipment storage areas and stockpiles;
 - (i) Designated points where vehicles will exit the site;
 - (j) Location of stormwater inlets and conveyances including ditches, pipes, man-made conduits, and swales; and
 - (k) Areas where final stabilization has been achieved.
8. An individual shall be designated by the permittee as the environmental lead. This environmental lead shall have knowledge in erosion, sediment, and stormwater control principles, knowledge of the permit, and the site's SWPPP. The environmental lead shall ensure all personnel and contractors understand any requirements of this permit may be affected by the work they are doing. The environmental lead or designated inspector(s) knowledgeable in erosion, sediment, and stormwater control principles shall inspect all structures that function to prevent or minimize pollution of waters of the state.
9. Throughout coverage under this permit, the permittee shall amend and update the SWPPP as appropriate during the term of the land disturbance activity. All SWPPP modifications shall be signed and dated. The permittee shall amend the SWPPP to incorporate any significant site condition changes which impact the nature and condition of stormwater discharges. At a minimum, these changes include whenever the:
 - (a) Location, design, operation, or maintenance of BMPs is changed;
 - (b) Design of the construction project is changed that could significantly affect the quality of the stormwater discharges;
 - (c) The permittee's inspections indicate deficiencies in the SWPPP or any BMP;
 - (d) Department notifies the permittee in writing of deficiencies in the SWPPP;
 - (e) SWPPP is determined to be ineffective in minimizing or controlling erosion and sedimentation (e.g., there is visual evidence of excessive site erosion or sediment deposits in streams, lakes, or downstream waterways, sediment or other wastes off site); and/or
 - (f) Department determines violations of water quality standards may occur or have occurred.
10. Site Inspections: The environmental lead, or a designated inspector, shall conduct regularly scheduled inspections. These inspections shall be conducted by a qualified person, one who is responsible for environmental matters at the site, or a person trained by and directly supervised by the person responsible for environmental matters at the site. Site inspections shall include, at a minimum, the following:
 - (a) For disturbed areas that have not achieved final stabilization, all installed BMPs and other pollution control measures shall be inspected to ensure they are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
 - (b) For areas on site that have achieved either temporary or final stabilization, while at the same time active construction continues on other areas, ensure that all stabilization measures are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
 - (c) Inspect all material, waste, borrow, and equipment storage and maintenance areas that are covered by this permit. Inspect for conditions that could lead to spills, leaks, or other accumulations of pollutants on the site.
 - (d) Inspect all areas where stormwater typically flows within the site, including drainage ways designed to divert, convey, and/or treat stormwater.

- (e) All stormwater outfalls shall be inspected for evidence of erosion, sediment deposition, or impacts to the receiving stream. If a discharge is occurring during an inspection, the inspector must observe and document the visual quality of the discharge and take note of the characteristics of the stormwater discharge, including turbidity, color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants.
 - (f) When practicable the receiving stream shall also be inspected for a minimum of 50 feet downstream of the outfall.
 - (g) The perimeter of the site shall be inspected for evidence of BMP failure to ensure concentrated flow does not develop a new outfall.
 - (h) The SWPPP must explain how the environmental lead will be notified when stormwater runoff occurs.
11. Inspection Frequency: All BMPs must be inspected in accordance to one of the schedules listed below. The inspection frequency shall be documented in the SWPPP, and any changes to the frequency of inspections, including switching between the options listed below, must be documented on the inspection form:
- (a) At least once every seven (7) calendar days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday; or
 - (b) Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches of precipitation or greater, or the occurrence of runoff from snowmelt. To determine if a storm event of 0.25 inches or greater has occurred on the site, the permittee shall either keep a properly maintained rain gauge on site, or obtain the storm event information from a weather station near the site location.
 - 1) Inspections are only required during the project's normal working hours.
 - 2) An inspection must be conducted within 24 hours of a storm event which has produced 0.25 inches. The inspection shall be conducted within 24 hours of the event end, or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - 3) If it is elected to inspect every 14 calendar days and there is a storm event at the site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, the permittee shall conduct an inspection within 24 hours of the end of the storm or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - (c) Areas on site that have achieved stabilization, while at the same time active construction continues on other areas, may reduce inspection frequency to monthly, for those stabilized areas, if the following conditions exist:
 - 1) For areas where disturbed portions have undergone temporary stabilization, inspections shall occur at least once a month while stabilized and when re-disturbed shall follow either frequency outlined in (a),(b), or (c) above.
 - 2) Areas on site that have achieved final stabilization must be inspected at least once per month until the permit is terminated.
 - (d) If construction activities are suspended due to frozen conditions, the permittee may temporarily reduce site inspections to monthly until thawing conditions begin to occur if all of the following are met:
 - 1) Land disturbances have been suspended; and
 - 2) All disturbed areas of the site have been stabilized in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - 3) The change shall be noted in the SWPPP.
 - (e) Any basin dewatering shall be inspected daily when discharge is occurring. The discharge shall be observed and dewatering activities shall be ceased immediately if the receiving stream is being impacted. These inspections shall be noted on a log or on the inspection report.

If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (including pictures), and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The documentation must be filed with the regular inspection reports. The corrections shall be made as soon as weather conditions or other issues allow.

12. Site Inspection Reports: A log of each inspection and/or copy of the inspection report shall be kept readily accessible and must be made available upon request by the Department. Electronic logs are acceptable as long as reports can be provided within 24 hours. If inspection reports are kept off site, the SWPPP must indicate where they are stored. The inspection report shall be signed by the environmental lead or designated inspector (electronically or otherwise).
- (a) The inspection report is to include the following minimum information:
 - 1) Inspector's name and title.
 - 2) Date and time of inspection.
 - 3) Observations relative to the effectiveness of the BMPs and stabilization measures. The following must be

documented:

- a. Whether BMPs are installed, operational, and working as intended;
 - b. Whether any new or modified stormwater controls are needed;
 - c. Facilities examined for conditions that could lead to spill or leak;
 - d. Outfalls examined for visual signs of erosion or sedimentation at outfalls. Excessive erosion or sedimentation may be due to BMP failure or insufficiency. Response to observations should be addressed in the inspection report.
- 4) Corrective actions taken or necessary to correct the observed problem.
 - 5) Listing of areas where land disturbance operations have permanently or temporarily stopped.
13. Any structural or maintenance deficiencies for BMPs or stabilization measures shall be documented and corrected as soon as possible but no more than seven (7) calendar days after the inspection.
- (a) Corrective action documentation shall be stored with the associated site inspection report.
 - (b) Immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.
 - (c) If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (this may include pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The permittee shall correct the problem as soon as weather conditions or issues allow.
 - (d) Corrective actions may be required by the Department. The permittee must comply with any corrective actions required by the Department as a result of permit violations found during an inspection.

V. BMP REQUIREMENTS

1. The information, practices, and BMP requirements in this section shall be implemented on site and, where noted, provided for in the SWPPP.
2. Existing vegetation and trees shall be preserved where practicable. The permittee is encouraged to preserve topsoil where practicable.
3. The permittee shall select appropriate BMPs for use at the site and list them in the SWPPP. When selecting effective BMPs, the permittee shall consider stormwater volume and velocity. A BMP that has demonstrated ineffectiveness in preventing or minimizing sediment or other pollutants from leaving a given site shall be replaced with a more effective BMP, or additional and sequential BMPs and treatment devices may be incorporated as site conditions allow. The permittee should consider a schedule for performing erosion control measures when selecting BMPs.
4. The SWPPP shall include a description of both structural and non-structural BMPs that will be used at the site.
 - (a) The SWPPP shall provide the following general information for each BMP which will be used one or more times at the site:
 - 1) Physical description of the BMP;
 - 2) Site conditions that must be met for effective use of the BMP;
 - 3) BMP installation/construction procedures, including typical drawings; and
 - 4) Operation and maintenance procedures and schedules for the BMP.
 - (b) The SWPPP shall provide the following information for each specific instance where a BMP is to be installed:
 - 1) Whether the BMP is temporary or permanent;
 - 2) When the BMP will be installed in relation to each phase of the land disturbance procedures to complete the project; and
 - 3) Site conditions that must be met before removal of the BMP if the BMP is not a permanent BMP.
5. Structural BMP Installation: The permittee shall ensure all BMPs are properly installed and operational at the locations and relative times specified in the SWPPP.
 - (a) Perimeter control BMPs for runoff from disturbed areas shall be installed before general site clearing is started. Note this requirement does not apply to earth disturbances related to initial site clearing and establishing entry, exit, or access of the site, which may require that stormwater controls be installed immediately after the earth

disturbance.

- (b) For phased projects, BMPs shall be properly installed as necessary prior to construction activities.
 - (c) Stormwater discharges which leave the site from disturbed areas shall pass through an appropriate impediment to sediment movement such as a sedimentation basin, sediment traps (including vegetative buffers), or silt fences prior to leaving the land disturbance site.
 - (d) A drainage course change shall be clearly marked on a site map and described in the SWPPP.
 - (e) If vegetative stabilization measures are being implemented, stabilization efforts are considered “installed” when all activities necessary to seed or plant the area are completed. Vegetative stabilization is not considered “operational” until the vegetation is established.
6. Install sediment controls along any perimeter areas of the site that are downgradient from any exposed soil or other disturbed areas. Prevent stormwater from circumventing the edge of the perimeter control. For sites where perimeter controls are infeasible, other practices shall be implemented to minimize discharges to perimeter areas of the site.
7. For surface waters of the state, defined in Section 644.016.1(27) RSMo, located on or adjacent to the site, the permittee must maintain a riparian buffer or structural equivalent in accordance with at least one of the following options. The selection and location must be described in the SWPPP.
- (a) Provide and maintain a 50-foot undisturbed natural buffer; or
 - (b) Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
 - (c) If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
 - (d) The permittee is not required to comply with (a), (b), or (c) above if one or more of the following exceptions apply and documentation is provided in the SWPPP:
 - 1) As authorized per CWA Section 404 Department of the Army permit and its associated Section 401 Water Quality Certification from the Department.
 - 2) If there is no discharge of stormwater to waters of the state through the area between the disturbed portions of the site and waters of the state located within 50 feet of the site. This includes situations where the permittee has implemented permanent control measures that will prevent such discharges, such as a berm or other barrier.
 - 3) Where no natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for the current development of the site.
 - a. Where some natural buffer exists but portions of the area within 50 feet of the waters of the state are occupied by preexisting development disturbances the permittee is required to comply with (a), (b), or (c) above.
 - 4) For linear projects where site constraints make it infeasible to implement a buffer or equivalent provided the permittee limit disturbances within 50 feet of any waters of the state and/or the permittee provides supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the water of the state. The permittee must also document in the SWPPP the rationale for why it is infeasible for the permittee to implement (a), (b), or (c) and describe any buffer width retained and supplemental BMPs installed.
 - (e) Where the permittee is retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:
 - 1) The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or
 - 2) The edge of the stream or river bank, bluff, or cliff, whichever is applicable.
8. Slopes for disturbed areas must be identified in the SWPPP. A site map or maps defining the sloped areas for all phases of the project must be included in the SWPPP. The disturbance of steep slopes shall be minimized.
9. Manage stockpiles or land clearing debris piles composed, in whole or in part, of sediment and/or soil.
- (a) Locate the piles outside of any natural buffers zones, established under the condition above, and away from any stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated;
 - (b) Install a sediment barrier along all downgradient perimeter areas;
 - (c) Divert surface flows around stockpiles to reduce and minimize erosion of the stockpile.

- (d) For piles that will be unused for 14 or more days, provide cover with appropriate temporary stabilization in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - (e) Rinsing, sweeping, or otherwise placing any soil, sediment, debris, or stockpiled product which has accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the state is prohibited.
10. The site shall include BMPs for pollution prevention measures and shall be noted in the SWPPP. At minimum such measures must be designed, installed, implemented, and maintained to:
- (a) Minimize the discharge of pollutants from equipment and vehicle rinsing; no detergents, additives, or soaps of any kind shall be discharged. Rinse waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
 - (b) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater;
 - (c) Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures, including, but not limited to, the installation of containment berms and use of drip pans at petroleum product and liquid storage tanks and containers; and
 - (d) Prevent discharges from causing or contributing to an exceedance of water quality standards including general criteria.
11. Sedimentation Basins: The SWPPP shall include a sedimentation basin for each drainage area with ten or more acres disturbed at one time.
- (a) The sedimentation basin shall be sized, at a minimum, to treat a local 2-year, 24-hour storm.
 - (b) Sediment basins shall not be constructed in any waters of the state or natural buffer zones.
 - (c) Discharges from dewatering activities shall be managed by appropriate controls. The SWPPP shall include a description of any anticipated dewatering methods and specific BMPs designed to treat dewatering water.
 - 1) Appropriate controls include, but are not limited to, sediment socks, dewatering tanks, tube settlers, weir tanks, filtration systems (e.g. bag or sand filters), and passive treatment systems that are designed to remove or retain sediment.
 - 2) Erosion controls and velocity dissipation devices (e.g., check dams, riprap, and vegetated buffers) to minimize erosion at inlets, outlets, and discharge points from shall be utilized.
 - 3) Water with an oil sheen shall not be discharged and shall be marked in SWPPP.
 - 4) Visible floating solids and foam shall not be discharged.
 - (d) Until final stabilization has been achieved, sediment basins and impoundments shall utilize outlet structures or floating skimmers that withdraw water from the surface when discharging.
 - 1) Under frozen conditions, it may be considered infeasible to withdraw water from the surface and an exception can be made for that specific period as long as discharges that may contain sediment and other pollutants are managed by appropriate controls. If determined infeasible due to frozen conditions, documentation must be provided in the SWPPP to support the determination, including the specific conditions or time period when this exception applies.
 - (e) Accumulated sediment shall not exceed 50% of total volume or as prescribed in the design, whichever is less. Note in the SWPPP the locations for disposal of the material removed from sediment basins.
 - (f) Prevent discharges to the receiving stream causing excessive visual turbidity. For the purposes of this permit, visual turbidity refers to a sediment plume or other cloudiness in the water caused by sediment that can be identified by an observer.
 - (g) The SWPPP shall require the basin be maintained until final stabilization of the disturbed area served by the basin.

Where use of a sediment basin is infeasible, the SWPPP shall evaluate and specify other similarly effective BMPs to be employed to control erosion and sediment. These similarly effective BMPs shall be selected from appropriate BMP guidance documents authorized by this permit. The BMPs must provide equivalent water quality protection to achieve compliance with this permit. The SWPPP shall require both temporary and permanent sedimentation basins to have a stabilized spillway to minimize the potential for erosion of the spillway or basin embankment.

12. Soil disturbing activities on site that have ceased either temporarily or permanently shall initiate stabilization immediately in accordance with the options below. For soil disturbing activities that have been temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days:
 - (a) The permittee shall construct BMPs to establish interim stabilization; and
 - (b) Stabilization must be initiated immediately and completed within 14 calendar days.
 - (c) For soil disturbing activities that have been permanently ceased on any portion of the site, final stabilization of disturbed areas must be initiated immediately and completed within 14 calendar days.
 - 1) Allowances to the 14-day completion period for temporary and final stabilization may be made due to weather and equipment malfunctions. The use of allowances shall be documented in the SWPPP. Allowances may be determined unnecessary after review by the Department.
 - (d) Until stabilization is complete, interim sediment control shall consist of well-established and maintained BMPs that are reasonably certain to protect waters of the state from sediment pollution over an extended period of time. This may require adding more BMPs to an area than is normally used during daily operations. The types of BMPs used must be suited to the area disturbed, taking into account the number of acres exposed and the steepness of the slopes. If the slope of the area is greater than 3:1 (three feet horizontal to one foot vertical), then the permittee shall establish interim stabilization within seven days of ceasing operations on that part of the site. The following activities would constitute the immediate initiation of stabilization:
 - 1) Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable;
 - 2) Applying mulch or other non-vegetative product to the exposed areas;
 - 3) Seeding or planting the exposed areas;
 - 4) Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.
 - (e) If vegetative stabilization measures are being implemented, stabilization is considered “installed” when all activities necessary to seed or plant the area are completed. Installed does not mean established.
 - (f) If non-vegetative stabilization measures are being implemented, stabilization is considered “installed” when all such measures are implemented or applied.
 - 1) Non-vegetative stabilization shall prevent erosion and shall be chosen for site conditions, such as slope and flow of stormwater.
 - (g) Final stabilization is not considered achieved until vegetation has grown and established to meet the requirements below.
13. Prior to removal of BMPs, ceasing site inspections, and removing from the quarterly report, final stabilization must be achieved. Final stabilization shall be achieved as soon as possible once land disturbance activities have ceased. Document in the SWPPP the type of stabilization and the date final stabilization is achieved.
 - (a) The project is considered to have achieved final stabilization when perennial vegetation (excluding volunteer vegetation), pavement, buildings, or structures using permanent materials (e.g., riprap, gravel, etc.) cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetation must be at least 70% coverage of 100% of the vegetated areas on site. Vegetation must be evenly distributed.
 - (b) Disturbed areas on agricultural land are considered to have achieved final stabilization when they are restored to their preconstruction agricultural use. If former agricultural land is changing to non-agricultural use, this is no longer considered agricultural land and shall follow condition (a).
 - (c) If the intended function of a specific area of the site necessitates that it remain disturbed, final stabilization is considered achieved if all of the following are met:
 - 1) Only the minimum area needed remains disturbed (i.e., dirt access roads, motocross tracks, utility pole pads, areas being used for storage of vehicles, equipment, materials). Other areas must meet the criteria above.

- 2) Permanent structural BMPs (e.g., rock checks, berms, grading, etc.) or non-vegetative stabilization measures are implemented and designed to prevent sediment and other pollutants from entering waters of the state.
- 3) Inspection requirements in Part IV. SWPPP MANAGEMENT REQUIREMENT, Condition 11 are met and documented in the SWPPP.
- (d) Winter weather and frozen conditions do not excuse any of the above final stabilization requirements. If vegetation is required for stabilization the permittee must maintain BMPs throughout winter weather and frozen conditions until thawing and vegetation meets final stabilization criteria above. Document stabilization attempts during frozen conditions in the SWPPP. Consider future freezing when removing vegetation and plan with temporary stabilization techniques before the ground becomes frozen.

VI. SITE FINALIZATION & PERMIT TERMINATION

1. Until a site is finalized, the permittee must comply with all conditions in the permit, including continuation of site inspections and reporting quarterly to the Department. To finalize the site and remove from this permit coverage, the site shall meet the following requirements:
 - (a) For any areas that (1) were disturbed during construction, (2) are not covered over by permanent structures, and (3) over which the permittee had control during the construction activities, the requirements for final vegetative or non-vegetative stabilization in Part V. BMP REQUIREMENTS, Condition 13;
 - (b) The permittee has removed and properly disposed of all construction materials, waste, and waste handling devices and has removed all equipment and vehicles that were used during construction, unless intended for long-term beyond construction phase;
 - (c) The permittee has removed all temporary BMPs that were installed and maintained during construction, except those that are intended for long-term use or those that are biodegradable; and
 - (d) The permittee has removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following the construction activities.
2. The permit may be terminated if;
 - (a) There has been a transfer of control of all areas of the site for which the current permittee is responsible under this permit to another operator, and that operator has obtained coverage under this permit;
 - (b) Active sites obtain coverage under an individual or alternative general NPDES permit, with land disturbance conditions; or
 - (c) This permit may be terminated when all projects covered under this permit are finalized. In order to terminate the permit, the permittee shall notify the Department by submitting a Request for Termination along with the final quarterly report for the current calendar quarter.

VII. REPORTING AND SAMPLING REQUIREMENTS

1. The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns, or evidence of off-site impacts from activities at a site. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.
2. Electronic Discharge Monitoring Report (eDMR) Submission System. The NPDES Electronic Reporting Rule, 40 CFR Part 127, reporting of any report required by the permit shall be submitted via an electronic system to ensure timely, complete, accurate, and nationally consistent set of data for the NPDES program. The eDMR system is currently the only Department-approved reporting method for this permit unless specified elsewhere in this permit, or a waiver is granted by the Department. The facility must register in the Department's eDMR system through the Missouri Gateway for Environmental Management (MoGEM) before the first report is due.
3. Permittees shall prepare a quarterly report with a list of active land disturbance sites including any off-site borrow or depositional areas associated with the construction project and submit the following information electronically as an

attachment to the eDMR system until such a time when the current or a new system is available to allow direct input of the data:

- (a) The name of the project;
- (b) The location of the project (including the county);
- (c) The name of the primary receiving water(s) for each project;
- (d) A description of the project;
- (e) The number of acres disturbed;
- (f) The percent of completion of the project; and
- (g) The projected date of completion.

The quarterly report(s) shall be maintained by the permittee and readily available for review by the Department at the address provided on the application as well as submitted quarterly via the Department’s eDMR system. The permittee shall submit quarterly reports according to Table A.

Table A	Schedule for Quarterly Reporting
Activity for the months of:	Report is due:
January, February, March (1st Quarter)	April 28
April, May, June (2nd Quarter)	July 28
July, August, September (3rd Quarter)	October 28
October, November, December (4th Quarter)	January 28

VIII. STANDARD PERMIT CONDITIONS

1. Records: The permittee shall retain copies of this general permit, the SWPPP and all amendments for the site named in the State Operating Permit, results of any monitoring and analysis, and all site inspection records required by this general permit.
 - (a) The records shall be accessible during normal business hours and retained for a period of at least three (3) years from the date of termination.
 - (b) The permittee shall provide a copy (electronic or otherwise) of the SWPPP to the Department, USEPA, or any local agency or government representative if they request a copy in the performance of their official duties within 24 hours of the request (or next working day), unless given more time by the representative.
 - (c) The permittee shall provide a copy of the SWPPP to those who are responsible for installation, operation, or maintenance of any BMP. The permittee, their representative, and/or the contractor(s) responsible for installation, operation and maintenance of the BMPs shall have a current copy of the SWPPP with them when on the project site.

2. Land Ownership and Change of Ownership: Federal and Missouri stormwater regulations [10 CSR 20-6.200(1) (B)] require a stormwater permit and erosion control measures for all land disturbances of one or more acres. These regulations also require a permit for less than one acre lots if the lot is part of a larger common plan of development or sale where that plan is at least one acre in size.
 - (a) If the permittee sells any portion of a permitted site to a developer for commercial, industrial, or residential use, this land remains a part of the common sale and the new owner must obtain a permit prior to conducting any land disturbance activity. Therefore, the original permittee must amend the SWPPP to show that the property has been sold and, therefore, no longer under the original permit coverage.
 - (b) Property of any size which is part of a larger common plan of development where the property has achieved final stabilization and the original permit terminated will require application of a new land disturbance permit for any future land disturbance activity unless the activity is by an individual residential building lot owner on a site less than one acre.
 - (c) If a portion of a larger common plan of development is sold to an individual for the purpose of building his or her own private residence, a permit is required if the portion of land sold is equal to or greater than one acre. No permit is required, however, for less than one acre of land sold.

3. Permit Transfer: This permit may not be transferred to a new owner.

4. Termination: This permit may be terminated when the project has achieved final stabilization, defined in Part VI. **SITE FINALIZATION & PERMIT TERMINATION.**
 - (a) In order to terminate the permit, the permittee shall notify the Department by submitting the form Request for Termination of Operating Permit Form MO 780-2814. The form should be submitted to the appropriate regional office or through an approved electronic system if it should become available.
 - (b) The Cover Page (Certificate Page) of the Master General Permit for Land Disturbance specifies the “effective date” and the “expiration date” of the Master General Permit. The “issued date” along with the “expiration date” will appear on the State Operating Permit issued to the applicant. **This permit does not continue administratively beyond the expiration date.**
5. Duty to Reapply: If the project or development completion date will be after the expiration date of this general permit, then the permittee must reapply to the Department for a new permit. This permit may be applied for and issued electronically in accordance with Section 644.051.10, RSMo.
 - (a) Due to the nature of the electronic permitting system, a period of time may be granted at the discretion of the Department in order to apply for a new permit after the new version is effective. Applicants must maintain appropriate best management practices and inspections during the discretionary period.
6. Duty to Comply: The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Missouri Clean Water Law and Federal Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.
7. Modification, Revocation, and Reopening:
 - (a) If at any time the Department determines that the quality of waters of the state may be better protected by reopening this permit, or revoking this permit and requiring the owner/operator of the permitted site to apply for a site-specific permit, the Department may revoke a general permit and require any person to obtain such an operating permit as authorized by 10 CSR20-6.010(13) and 10 CSR 20-6.200(1)(B).
 - (b) If this permit is reopened, modified, or revoked pursuant to this Section, the permittee retains all rights under Chapter 536 and 644 Revised Statutes of Missouri upon the Department’s reissuance of the permit as well as all other forms of administrative, judicial, and equitable relief available under law.
8. Other Information: Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.
9. Duty to Provide Information: The permittee shall furnish to the Department, within 24 hours unless explicitly granted more time in writing, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.
10. Inspection and Entry: The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:
 - (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of the permit;
 - (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 - (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
 - (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Federal Clean Water Act or Missouri Clean Water Law, any substances or parameters at any location.

11. Signatory Requirement:

- (a) All permit applications, reports required by the permit, or information requested by the Department shall be signed and certified. (See 40 CFR 122.22 and 10 CSR 20-6.010)
- (b) The Federal Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit (including monitoring reports or reports of compliance or non-compliance) shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six (6) months per violation, or by both.
- (c) The Missouri Clean Water Law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for not more than six months, or by both.

12. Property Rights: This permit does not convey any property rights of any sort or any exclusive privilege.

13. Notice of Right to Appeal: If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: <https://ahc.mo.gov>



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

STORMWATER DISCHARGES FROM
THIS LAND DISTURBANCE SITE ARE
AUTHORIZED BY THE MISSOURI
STATE OPERATING PERMIT NUMBER:

ANYONE WITH QUESTIONS OR
CONCERNS ABOUT STORMWATER
DISCHARGES FROM THIS SITE,
PLEASE CONTACT THE MISSOURI
DEPARTMENT OF NATURAL
RESOURCES AT

1-800-361-4827

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET FOR MASTER GENERAL PERMIT
MO-R100xxx

The Federal Water Pollution Control Act [Clean Water Act (CWA)] Section 402 of Public Law 92-500 (as amended) established the National Pollution Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the CWA). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (MSOPs) are issued by the Missouri Department of Natural Resources (Department) under an approved program operated in accordance with federal and state laws (Federal CWA and Missouri Clean Water Law Section 644 as amended). Permits are issued for a period of five (5) years unless otherwise specified.

Per 40 CFR 124.56, 40 CFR 124.8, and 10 CSR 20-6.020(1)(A)2, a Fact Sheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the permit. A Fact Sheet is not an enforceable part of an MSOP.

DEFINITIONS FOR THE PURPOSES OF THIS PERMIT:

Common Promotional Plan: A plan undertaken by one (1) or more persons to offer lots for sale or lease; where land is offered for sale by a person or group of persons acting in concert, and the land is contiguous or is known, designated, or advertised as a common unit or by a common name or similar names, the land is presumed, without regard to the number of lots covered by each individual offering, as being offered for sale or lease as part of a common promotional plan.

Dewatering: The act of draining rainwater and/or groundwater from basins, building foundations, vaults, and trenches.

Effective Operating Condition: For the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Emergency-Related Project: A project initiated in response to a public emergency (e.g. earthquakes, extreme flooding conditions, tornado, disruptions in essential public services, pandemic) for which the related work requires immediate authorization to avoid imminent endangerment to human health/safety or the environment or to reestablish essential public services.

Exposed Soils: For the purposes of this permit, soils that as a result of earth-disturbing activities are left open to the elements.

Immediately: For the purposes of this permit, immediately should be defined as within 24 hours.

Impervious Surface: For the purpose of this permit, any land surface with a low or no capacity for soil infiltration including, but not limited to, pavement, sidewalks, parking areas and driveways, packed gravel or soil, or rooftops.

Infeasible: Infeasible means not technologically possible or not economically practicable and achievable in light of best industry practices.

Install or Installation: When used in connection with stormwater controls, to connect or set in position stormwater controls to make them operational.

Land Disturbance Site or Site: The land or water area where land disturbance activities will occur and where stormwater controls will be installed and maintained. The land disturbance site includes construction support activities, which may be located at a different part of the property from where the primary land disturbance activity will take place or on a different piece of property altogether. Off-site borrow areas directly and exclusively related to the land disturbance activity are part of the site and must be permitted.

Larger Common Plan of Development or Sale: A continuous area where multiple separate and distinct construction activities are occurring under one plan, including any off-site borrow areas that are directly and exclusively related to the land disturbance activity. Off-site borrow areas utilized for multiple different land disturbance projects are considered their own entity and are not part of the larger common plan of development or sale. See definition of Common Promotional Plan to understand what a 'common plan' is.

Minimize: To reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

Non-structural Best Management Practices (BMPs): Institutional, educational, or pollution prevention practices designed to limit the amount of stormwater runoff or pollutants that are generated in the landscape. Examples of non-structural BMPs include picking up trash and debris, sweeping up nearby sidewalks and streets, maintaining equipment, and training site staff on stormwater control practices.

Operational: for the purposes of this permit, stormwater controls are made "operational" when they have been installed and implemented, are functioning as designed, and are properly maintained.

Ordinary High Water Mark: The line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris.

Peripheral: For the purposes of this permit, peripheral should be defined as the outermost boundary of the area that will be disturbed.

Permanently: For the purposes of this permit, permanently is defined as any activity that has been ceased without any intentions of future disturbance.

Pollution Prevention Controls (or Measures): Stormwater controls designed to reduce or eliminate the addition of pollutants to construction site discharges through analysis of pollutant sources, implementation of proper handling/disposal practices, employee education, and other actions.

Qualified Person (inspections): A person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Stormwater Control (also referred to as sediment/erosion controls): refers to any temporary or permanent BMP or other method used to prevent or reduce the discharge of pollutants to waters of the state.

Structural BMP: Physical sediment/erosion controls working individually or as a group (treatment train) appropriate to the source, location, and area climate for the pollutant to be controlled. Examples of structural BMPs include silt fences, sedimentation ponds, erosion control blankets, and seeding.

Temporary Stabilization: A condition where exposed soils or disturbed areas are provided temporary vegetation and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb this area.

Treatment Train: A multi-BMP approach to managing the stormwater volume and velocity and often includes erosion prevention and sediment control practices often applied when the use of a single BMP is inadequate in preventing the erosion and transport of sediment. A good option to utilize as a corrective action.

Volunteer Vegetation: A volunteer plant is a plant that grows on its own, rather than being deliberately planted for stabilization purposes. Volunteers often grow from seeds that float in on the wind, are dropped by birds, or are inadvertently mixed into soils. Commonly, volunteer vegetation is referred to as 'weeds'. This does not meet the requirements for final stabilization.

Waters of the State: Section 644.016.1(27) RSMo. defines waters of the state as, "All waters within the jurisdiction of this state, including all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common."

PART I – BASIC PERMIT INFORMATION

Facility Type: Industrial Stormwater; Land Disturbance
Facility SIC Code(s): 1629
Facility Description: Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling, and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit establishes a Stormwater Pollution Prevention Plan (SWPPP) requirement for pollutants of concern from this type of facility or for all facilities and sites covered under this permit. 10 CSR 20-6.200(7) specifies "general permits shall contain BMP requirements and/or monitoring and reporting requirements to keep the stormwater from becoming contaminated".

Land disturbance activities include clearing, grubbing, excavating, grading, filling and other activities that result in the destruction of the root zone and/or other activities that are reasonably certain to cause pollution to waters of the state. A Missouri State Operating Permit for land disturbance permit is required for construction disturbance activities of one or more acres or for construction activities that disturb less than one acre when they are part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project.

The primary requirement of a land disturbance permit is the development of a SWPPP which incorporates site-specific BMPs to minimize soil exposure, soil erosion, and the discharge of pollutants. The SWPPP ensures the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants from leaving the site.

When it precipitates, stormwater washes over the loose soil on a construction site and various other materials and products being stored outside. As stormwater flows over the site, it can pick up pollutants like sediment, debris, and chemicals from the loose soil and transport them to nearby storm sewer systems or directly into rivers, lakes, or coastal waters.

The Missouri Department of Natural Resources is responsible for ensuring that construction site operators have the proper stormwater controls in place so that construction can proceed in a way that protects your community's clean water and the surrounding environment. One way the department helps protect water quality is by issuing land disturbance permits.

Local conditions are not considered when developing conditions for a general permit. A facility may apply for a site-specific permit if they desire a review of site-specific conditions.

PART II – RECEIVING STREAM INFORMATION

APPLICABLE DESIGNATIONS OF WATERS OF THE STATE:

Per Missouri Effluent Regulations (10 CSR 20-7.015), the waters of the state are divided into seven (7) categories. This permit applies to facilities discharging to the following water body categories:

- ✓ Missouri or Mississippi River [10 CSR 20-7.015(2)]
- ✓ Lakes or Reservoirs [10 CSR 20-7.015(3)]
- ✓ Losing Streams [10 CSR 20-7.015(4)]
- ✓ Metropolitan No-Discharge Streams [10 CSR 20-7.015(5)]
- ✓ Special Streams [10 CSR 20-7.015(6)]
- ✓ Subsurface Waters [10 CSR 20-7.015(7)]
- ✓ All Other Waters [10 CSR 20-7.015(8)]

Missouri Water Quality Standards (10 CSR 20-7.031) defines the Clean Water Commission water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and/or 1st classified receiving stream's designated water uses shall be maintained in accordance with 10 CSR 20-7.031(24). A general permit does not take into consideration site-specific conditions.

MIXING CONSIDERATIONS:

This permit applies to receiving streams of varying low flow conditions. Therefore, the effluent limitations must be based on the smallest low flow streams considered, which includes waters without designated uses. As such, no mixing is allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)]. No Zone of Initial Dilution is allowed. [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

RECEIVING STREAM MONITORING REQUIREMENTS:

There are no receiving water monitoring requirements recommended at this time.

PART III – RATIONALE AND DERIVATION OF EFFLUENT LIMITATIONS & PERMIT CONDITIONS

305(B) REPORT, 303(d) LIST, & TOTAL MAXIMUM DAILY LOAD (TMDL):

Section 305(b) of the Federal CWA requires each state identify waters not meeting Water Quality Standards and for which adequate water pollution controls have not been required. Water Quality Standards protect such beneficial uses of water as whole body contact, maintaining fish and other aquatic life, and providing drinking water for people, livestock, and wildlife. The 303(d) list helps state and federal agencies keep track of waters which are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed which shall include the TMDL calculation. For facilities with an existing general permit before a TMDL is written on their receiving stream, the Department will evaluate the permit and may require any facility authorized by this general permit to apply for and obtain a site-specific operating permit.

ANTI-BACKSLIDING:

A provision in the Federal Regulations [CWA Section 303(d)(4); CWA Section 402(c); 40 CFR Part 122.44(I)] requires a reissued permit to be as stringent as the previous permit with some exceptions.

- ✓ Not Applicable: All effluent limitations in this permit are at least as protective as those previously established.

ANTIDEGRADATION:

Antidegradation policies ensure protection of water quality for a particular water body on a pollutant by pollutant basis to ensure Water Quality Standards are maintained to support beneficial uses such as fish and wildlife propagation and recreation on and in the water. This also includes special protection of waters designated as an Outstanding National Resource Water or Outstanding State Resource Water [10 CSR 20-7.031(3)(C)]. Antidegradation policies are adopted to minimize adverse effects on water.

The Department has determined the best avenue forward for implementing the Antidegradation requirements into general stormwater permits is by requiring the appropriate development and maintenance of a SWPPP. The SWPPP must identify all reasonable and effective BMPs, taking into account environmental impacts and costs. This analysis must document why no discharge or no exposure options are not feasible at the facility. This selection and documentation of appropriate control measures will then serve as the analysis of alternatives and fulfill the requirements of the Antidegradation Rule and Implementation Procedure 10 CSR 20-7.031(3) and 10 CSR 20-7.015(9)(A)5.

Any facility seeking coverage under this permit which undergoes expansion or discharges a new pollutant of concern must update their SWPPP and select reasonable and cost effective new BMPs. New facilities seeking coverage under this permit are required to develop a SWPPP including this analysis and documentation of appropriate BMPs. Renewal of coverage for a facility requires a review of the SWPPP to ensure the selected BMPs continue to be appropriate.

- ✓ Applicable; the facility must review and maintain stormwater BMPs as appropriate.

BENCHMARKS:

When a permitted feature or outfall consists of only stormwater, a benchmark may be implemented at the discretion of the permit writer. Benchmarks require the facility to monitor and, if necessary, replace and update stormwater control measures. Benchmark concentrations are not effluent limitations. A benchmark exceedance, therefore, is not a permit violation; however, failure to take corrective action is a violation of the permit. Benchmark monitoring data is used to determine the overall effectiveness of control measures and to assist the permittee in knowing when additional corrective actions may be necessary to comply with the limitations of the permit.

- ✓ Not applicable; this permit does not contain numeric benchmarks.

BEST MANAGEMENT PRACTICES (BMPs):

Minimum site-wide BMPs are established in this permit to ensure all permittees are managing their sites equally to protect waters of the state from certain activities which could cause negative effects in receiving water bodies. While not all sites require a SWPPP because the SIC codes are specifically exempted in 40 CFR 122.26(b)(14), these BMPs are not specifically included for stormwater purposes. These practices are minimum requirements for all industrial sites to protect waters of the state. If the minimum BMPs are not followed, the facility may violate general criteria [10 CSR 20-7.031(4)]. Statutes are applicable to all permitted facilities in the state; therefore, pollutants cannot be released unless in accordance with RSMo 644.011 and 644.016 (17).

CHANGES IN DISCHARGES OF TOXIC POLLUTANT:

This special condition reiterates the federal rules found in 40 CFR 122.44(f) and 122.42(a)(1). In these rules, the facility is required to report changes in amounts of toxic substances discharged. Toxic substances are defined in 40 CFR 122.2 as "...any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA." Section 307 of the CWA then refers to those parameters found in 40 CFR 401.15.

The permittee should also consider any other toxic pollutant in the discharge as reportable under this condition.

EFFLUENT LIMITATION GUIDELINE:

Effluent Limitation Guidelines, or ELGs, are found at 40 CFR 400-499. These are limitations established by the EPA based on the SIC code and the type of work a facility is conducting. Most ELGs are for process wastewater and some address stormwater. All are technology based limitations which must be met by the applicable facility at all times.

- ✓ The industries covered under this permit have an associated Effluent Limit Guideline (ELG) which is applicable to the stormwater discharges in this permit and is applied under 40 CFR 125.3(a).

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:

The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize CWA reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. The final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online.

- ✓ Applicable; this permit requires quarterly reports.

GENERAL CRITERIA CONSIDERATIONS:

In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into permits for pollutants determined to cause, have reasonable potential to cause, or to contribute to, an excursion above any water quality standard, including narrative water quality criteria. In order to comply with this regulation, the permit writer has completed a reasonable potential determination on whether discharges have reasonable potential to cause or contribute to an excursion of the general criteria listed in 10 CSR 20-7.031(4). In instances where reasonable potential exists, the permit includes limitations within the permit to address the reasonable potential. In discharges where reasonable potential does not exist, the permit may include monitoring to later determine the discharge's potential to impact the narrative criteria. Additionally, RSMo 644.076.1, as well as Standard Permit Conditions Part VIII of this permit state it shall be unlawful for any person to cause or allow any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule, or regulation promulgated by the commission.

LAND APPLICATION:

Land application, or surficial dispersion of wastewater and/or sludge, is performed by facilities to maintain a basin as no-discharge. Requirements for these types of operations are found in 10 CSR 20-6.015; authority to regulate these activities is from RSMo 644.026.

- ✓ Not applicable; this permit does not authorize operation of a surficial land application system to disperse wastewater or sludge.

LAND DISTURBANCE:

Land disturbance, sometimes called construction activities, are actions which cause disturbance of the root layer or soil; these include clearing, grading, and excavating of the land. 40 CFR 122.26(b)(14) and 10 CSR 20-6.200(3) requires permit coverage for these activities. Coverage is not required for facilities when only providing maintenance of original line and grade, hydraulic capacity, or to continue the original purpose of the facility.

- ✓ Applicable; this permit provides coverage for land disturbance activities. These activities have SWPPP requirements and may be combined with the standard site SWPPP. Land disturbance BMPs should be designed to control the expected peak discharges. The University of Missouri has design storm events for the 25 year 24 hour storm; these can be found at: http://ag3.agebb.missouri.edu/design_storm/comparison_reports/20191117_25yr_24hr_comparison_able.htm; to calculate peak discharges, the website <https://www.lmnoeng.com/Hydrology/rational.php> has the rational equation to calculate expected discharge volume from the peak storm events.

NUTRIENT MONITORING:

Nutrient monitoring is required for facilities characteristically or expected to discharge nutrients (nitrogenous compounds and/or phosphorus) when the design flow is equal to or greater than 0.1 MGD per 10 CSR 20-7.015(9)(D)8.

- ✓ This is a stormwater only permit; therefore, it is not subject to provisions found in 10 CSR 20-7.015 per 10 CSR 20-7.015(1)(C).

OIL/WATER SEPARATORS:

Oil water separator (OWS) tank systems are frequently found at industrial sites where process water and stormwater may contain oils and greases, oily wastewaters, or other immiscible liquids requiring separation. Food industry discharges typically require pretreatment prior to discharge to municipally owned treatment works. Per 10 CSR 26-2.010(2)(B), all oil water separator tanks must be operated according to manufacturer's specifications and authorized in NPDES permits per 10 CSR 26-2.010(2) or may be regulated as a petroleum tank.

- ✓ Not applicable; this permit does not authorize the operation of OWS. The facility must obtain a separate permit to cover operation of and discharge from these devices.

PERMIT SHIELD:

The permit shield provision of the CWA (Section 402(k)) and Missouri Clean Water Law (644.051.16 RSMo) provides that when a permit holder is in compliance with its NPDES permit or MSOP, they are effectively in compliance with certain sections of the CWA and equivalent sections of the Missouri Clean Water Law. In general, the permit shield is a legal defense against certain enforcement actions but is only available when the facility is in compliance with its permit and satisfies other specific conditions, including having completely disclosed all discharges and all facility processes and activities to the Department at time of application. It is the facility's responsibility to ensure that all potential pollutants, waste streams, discharges, and activities, as well as wastewater land application, storage, and treatment areas, are all fully disclosed to the Department at the time of application or during the draft permit review process. Subsequent requests for authorization to discharge additional pollutants or expanded or newly disclosed flows, or for authorization for previously unpermitted and undisclosed activities or discharges, will likely require permit modification or may require the facility be covered under a site specific permit.

PRETREATMENT PROGRAM:

This permit does not regulate pretreatment requirements for facilities discharging to an accepting permitted wastewater treatment facility. If applicable, the receiving entity (the publicly owned treatment works - POTW) must ensure compliance with any effluent limitation guidelines for pretreatment listed in 40 CFR Subchapter N per 10 CSR 20-6.100. Pretreatment regulations per RSMo 644.016 are limitations on the introduction of pollutants or water contaminants into publicly owned treatment works or facilities.

- ✓ Not Applicable; the facilities covered under this permit are not required to meet pretreatment requirements under an ELG.

PUBLIC NOTICE OF COVERAGE FOR AN INDIVIDUAL FACILITY:

Public Notice of reissuance of coverage is not required unless the facility is a specific type of facility as defined in 10 CSR 20-6.200(1). The need for an individual public notification process shall be determined and identified in the permit [10 CSR 20-6.020(1)(C)5.].

- ✓ Not applicable; public notice is not required for coverage under this permit to individual facilities. The MGP is public noticed in lieu of individual permit PN requirements.

REASONABLE POTENTIAL ANALYSIS (RPA):

Federal regulation 40 CFR Part 122.44(d)(1)(i) requires effluent limitations for all pollutants which are or may be discharged at a level which will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard. In accordance with 40 CFR Part 122.44(d)(iii) if the permit writer determines any given pollutant has the reasonable potential to cause or contribute to an in-stream excursion above the water quality standard, the permit must contain effluent limits for the pollutant.

- ✓ The permit writer reviewed industry materials, available past inspections, and other documents and research to evaluate general and narrative water quality reasonable potential for this permit. Permit writers also use the Department's permit writer's manual, the EPA's permit writer's manual (<https://www.epa.gov/npdes/npdes-permit-writers-manual>), program policies, and best professional judgment. For each parameter in each permit, the permit writer carefully considers all applicable information regarding technology based effluent limitations, effluent limitation guidelines, and water quality standards. Best professional judgment is based on the experience of the permit writer, cohorts in the Department and resources at the EPA, research, and maintaining continuity of permits if necessary. For stormwater permits, the permit writer is required per 10 CSR 6.200(6)(B)2 to consider: A. application and other information supplied by the permittee; B. effluent guidelines; C. best professional judgment of the permit writer; D. water quality; and E. BMPs.

SCHEDULE OF COMPLIANCE (SOC):

Per § 644.051, RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement or if prohibited by other statute or regulation. An SOC includes an enforceable sequence of interim requirements (e.g. actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the CWA, and 40 CFR 122.2. For new effluent limitations, the permit may include interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR 122.47(a)(1) and 10 CSR 20-7.031(11), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, an SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

- ✓ Not Applicable: This permit does not contain a SOC.

SETBACKS:

Setbacks, sometimes called separation distances, are common elements of permits and are established to provide a margin of safety in order to protect the receiving water and other features from accidents, spills, unusual events, etc. Specific separation distances are included in 10 CSR 20-8 for minimum design standards of wastewater structures. While wastewater is considered separately from stormwater under this permit, the guides and Chapter 8 distances may remain relevant to requirements under this permit if deemed appropriate by the permittee.

- ✓ Discharge to the watersheds of a Metropolitan No-Discharge Stream (10 CSR 20-7.031 Table F) is authorized by this permit if the discharges are in compliance with 10 CSR 20-7.015(5) and 10 CSR 20-7.031(7). Discharges to these watersheds are authorized for uncontaminated stormwater discharges only.
- ✓ This permit authorizes stormwater discharges which are located in a way to allow water to be released into sinkholes, caves, fissures, or other openings in the ground which could drain into aquifers (except losing streams) per 10 CSR 20-7.015(7). It is the best professional judgment of the permit writer to allow discharges to losing streams as the effluent is stormwater only.
- ✓ This permit authorizes stormwater discharge in the watersheds of Outstanding state Resource Waters (OSRW); Outstanding National Resources Waters (ONRW), which includes the Ozark National Riverways and the National Wild and Scenic Rivers System; and impaired waters as designated in the 305(b) Report provided no degradation of water quality occurs in the OSRW and ONRW due to discharges from the permitted facility per 10 CSR 20-7.015(6)(B) and 10 CSR 20-7.031(3)(C). Additionally, if the facility is found to be causing degradation or contributing to an impairment by discharging a pollutant of concern during an inspection or through complaint investigations, they will be required to become a no discharge facility or obtain a site specific permit with more stringent monitoring and SWPPP requirements. Missouri's impaired waters can be found at <https://dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/impaired-waters>. Sites within 1000 feet of a OSRW, ONRW, or water impaired for sediment must operate as a no-discharge facility. These additional protections are borrowed from the USEPA 2021 draft Construction General Permit.

SLUDGE – DOMESTIC BIOSOLIDS:

Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for beneficial use (i.e. fertilizer). Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including, but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works.

- ✓ This permit does not authorize discharge or land application of biosolids. Sludge/biosolids is not generated by this industry.

SLUDGE – INDUSTRIAL:

Industrial sludge is solid, semi-solid, or liquid residue generated during the treatment of industrial process wastewater in a treatment works; including, but not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment process; scum and solids filtered from water supplies and backwashed; and a material derived from industrial sludge.

- ✓ Not applicable; sludge is not generated by this industry.

SPILL REPORTING:

Any emergency involving a hazardous substance must be reported to the Department's 24 hour Environmental Emergency Response hotline at (573) 634-2436 at the earliest practicable moment after discovery. The Department may require the submittal of a written report detailing measures taken to clean up a spill. These reporting requirements apply when the spill results in chemicals or materials leaving the permitted property or reaching waters of the state. This requirement is in addition to the noncompliance reporting requirement found in Standard Conditions Part I. <https://dnr.mo.gov/waste-recycling/investigations-cleanups/environmental-emergency-response>.

Underground and above ground storage devices for petroleum products, vegetable oils, and animal fats may be subject to control under federal Spill Prevention, Control, and Countermeasure Regulation and are expected to be managed under those provisions, if applicable. Substances regulated by federal law under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which are transported, stored, or used for maintenance, cleaning or repair shall be managed according to the provisions of RCRA and CERCLA.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):

In accordance with 40 CFR 122.44(k), BMPs must be used to control or abate the discharge of pollutants when: 1) Authorized under section 304(e) of the CWA for the control of toxic pollutants and hazardous substances from ancillary industrial activities; 2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; 3) Numeric effluent limitations are infeasible; or 4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA. In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites*, (Document number EPA 833-R-06-004) published by the EPA in 2007 https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf, BMPs are measures or practices used to reduce the amount of pollution entering waters of the state from a permitted facility. BMPs may take the form of a process, activity, or physical structure. Additionally, in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to 1) identify sources of pollution or contamination, and 2) select and carry out actions which prevent or control the pollution of storm water discharges. Additional information can be found in *Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices* (EPA 832-R-92-006; September 1992).

A SWPPP must be prepared if the SIC code for the facility is found in 40 CFR 122.26(b)(14) and/or 10 CSR 20-6.200(2). A SWPPP may be required of other facilities where stormwater has been identified as necessitating better management.

The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff. Developing a SWPPP provides opportunities to employ appropriate BMPs to minimize the risk of pollutants being discharged during storm events. The following paragraph outlines the general steps the permittee should take to determine which BMPs will work to achieve the benchmark values or limits in the permit. This section is not intended to be all encompassing or restrict the use of any physical BMP or operational and maintenance procedure assisting in pollution control. Additional steps or revisions to the SWPPP may be required to meet the requirements of the permit.

Areas which should be included in the SWPPP are identified in 40 CFR 122.26(b)(14). Once the potential sources of stormwater pollution have been identified, a plan should be formulated to best control the amount of pollutant being released and discharged by each activity or source. This should include, but is not limited to, minimizing exposure to stormwater, good housekeeping measures, proper facility and equipment maintenance, spill prevention and response, vehicle traffic control, and proper materials handling. Once a plan has been developed, the facility will employ the control measures determined to be adequate to prevent pollution from entering waters of the state. The facility will conduct inspections of the BMPs to ensure they are working properly and re-evaluate any BMP not achieving compliance with permitting requirements. For example if the BMP being employed is deficient in controlling stormwater pollution, corrective action should be taken to repair, improve, or replace the failing BMP. If failures do occur, continue this trial and error process until appropriate BMPs have been established.

The EPA has developed factsheets on the pollutants of concern for specific industries along with the BMPs to control and minimize stormwater (<https://www.epa.gov/npdes/stormwater-discharges-industrial-activities>). Along with EPA's factsheets, the International Stormwater BMP database (<https://bmpdatabase.org/>) may provide guidance on BMPs appropriate for specific industries.

For new, altered, or expanded stormwater discharges, the SWPPP shall identify reasonable and effective BMPs while accounting for environmental impacts of varying control methods. The antidegradation analysis must document why no discharge or no exposure options are not feasible. The selection and documentation of appropriate control measures shall serve as an alternative analysis of technology and fulfill the requirements of antidegradation [10 CSR 20-7.031(3)].

Alternative analysis evaluation of the BMPs is a structured evaluation of BMPs which are reasonable and cost effective. The alternative analysis evaluation should include practices designed to be: 1) non-degrading; 2) less degrading; or 3) degrading water quality. The glossary of the *Antidegradation Implementation Procedure* defines these three terms. The chosen BMP will be the most reasonable and effective management strategy while ensuring the highest statutory and regulatory requirements are achieved and the highest quality water attainable for the facility is discharged. The alternative analysis evaluation must demonstrate why "no discharge" or "no exposure" is not a feasible alternative at the facility. This structured analysis of BMPs serves as the antidegradation review, fulfilling the requirements of 10 CSR 20-7.031(3) Water Quality Standards and *Antidegradation Implementation Procedure*, Section II.B.

- ✓ Applicable: A SWPPP shall be developed and implemented for each site and shall incorporate required practices identified by the Department with jurisdiction, incorporate control practices specific to site conditions, and provide for maintenance and adherence to the plan.

UNDERGROUND INJECTION CONTROL (UIC):

The UIC program for all classes of wells in the State of Missouri is administered by the Missouri Department of Natural Resources and approved by EPA pursuant to section 1422 and 1425 of the Safe Drinking Water Act (SDWA) and 40 CFR 147 Subpart AA. Injection wells are classified based on the liquids which are being injected. Class I wells are hazardous waste wells which are banned by RSMo 577.155; Class II wells are established for oil and natural gas production; Class III wells are used to inject fluids to extract minerals; Class IV wells are also banned by Missouri in RSMo 577.155; Class V wells are shallow injection wells; some examples are heat pump wells and groundwater remediation wells. Domestic wastewater being disposed of sub-surface is also considered a Class V well.

In accordance with 40 CFR 144.82, construction, operation, maintenance, conversion, plugging, or closure of injection wells shall not cause movement of fluids containing any contaminant into Underground Sources of Drinking Water (USDW) if the presence of any contaminant may cause a violation of drinking water standards or groundwater standards under 10 CSR 20-7.031 or other health-based standards or may otherwise adversely affect human health. If the Department finds the injection activity may endanger USDWs, the Department may require closure of the injection wells or other actions listed in 40 CFR 144.12(c), (d), or (e). In accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes, to the Missouri Department of Natural Resources, Geological Survey Program, P.O. Box 250, Rolla, Missouri 65402. Single family residential septic systems and non-residential septic systems used solely for sanitary waste and having the capacity to serve fewer than 20 persons a day are excluded from the UIC requirements (40 CFR 144.81(9)).

- ✓ Not applicable; this permit does not authorize subsurface wastewater systems or other underground injection. These activities must be assessed under an application for a site specific permit. Certain discharges of stormwater into sinkholes may qualify as UIC. It is important the permittee evaluate all stormwater basins, even those holding water; as sinkholes have varying seepage rates. This permit does not allow stormwater discharges into sinkholes. The facility must ensure sinkholes are avoided in the construction process. The State's online mapping resource <https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=87ebef4af15d438ca658ce0b2bbc862e> has a sinkhole layer.

VARIANCE:

Per the Missouri Clean Water Law Section 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law Section 644.006 to 644.141 or any standard, rule, or regulation promulgated pursuant to Missouri Clean Water Law Section 644.006 to 644.141.

- ✓ Not Applicable: This permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITATIONS:

Per 10 CSR 20-2.010(78), the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant which may be discharged into the stream without endangering its water quality. Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's Technical Support Document For Water Quality-based Toxics Control (TSD) (EPA/505/2-90-001).

- ✓ Not applicable; water quality limitations were not applied in this permit.

WATER QUALITY STANDARDS:

Per 10 CSR 20-7.031(4), General Criteria shall be applicable to all waters of the state at all times, including mixing zones. Additionally, 40 CFR 122.44(d)(1) directs the Department to include in each NPDES permit conditions to achieve water quality established under Section 303 of the CWA, including state narrative criteria for water quality.

WHOLE EFFLUENT TOXICITY (WET) TEST:

Per 10 CSR 20-7.031(1)(FF), a toxicity test conducted under specified laboratory conditions on specific indicator organism; and per 40 CFR 122.2, the aggregate toxic effect of an effluent measured directly by a toxicity test. A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with, or through synergistic responses when mixed with receiving water.

- ✓ Not applicable: At this time, permittees are not required to conduct a WET test. This permit is for stormwater only.

PART IV – EFFLUENT LIMITATIONS DETERMINATION

EPA Construction General Permit (CGP)

The CGP was used to research and support best professional judgment decisions made in establishing technology-based conditions for this general permit which are consistent with national standards. The permit writer determined the standards established by the CGP are achievable and consistent with federal regulations. Additionally, the conditions reflecting the best practicable technology currently available are utilized to implement the ELG.

In this general permit, technology-based effluent conditions are established through the SWPPP and BMP requirements. Effective BMPs should be designed on a site-specific basis. The implementation of inspections provides a tool for each facility to evaluate the effectiveness of BMPs to ensure protection of water quality. Any flow through an outfall is considered a discharge. Future permit action due to permit modification may contain new operating permit terms and conditions which supersede the terms and conditions, including effluent limitations, of this operating permit.

PART V–REPORTING REQUIREMENTS

SAMPLING:

The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities at the facility. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

REPORTING:

There are quarterly reporting requirements for MO-R100xxx land disturbance permits. Project specific information is required to be report to the Department through the eDMR system.

PART VI – RAINFALL VALUES FOR MISSOURI & SURFACE WATER BUFFER ZONES

Knowledge of the 2-year, 24-hour storm event is used in this permit for two main reasons:

- 1) The design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants.
- 2) If the seven-day inspection frequency is utilized, an inspection must occur within 48 hours after any storm event equal to or greater than a 2-year, 24 hour storm has ceased.

For site-specific 2-year, 24-hour storm event information utilize the National Oceanic and Atmospheric Administration’s National Weather Service Atlas 14 (NOAA Atlas 14) which is located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. For more information visit; https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume8.pdf.

Surface Water Buffer Zones: In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of natural buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, steepness, and the types of erosion and sediment controls used to reduce the discharge of sediment prior to the buffer. For additional information;

https://www.epa.gov/sites/default/files/2017-02/documents/2017_cgp_final_appendix_g_-_buffer_reqs_508.pdf

PART VII – ADMINISTRATIVE REQUIREMENTS

On the basis of preliminary staff review and applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the permit. The proposed determinations are tentative pending public comment.

PUBLIC MEETING:

The department hosted three public meetings for this permit. The meetings were held on January 27, February 17, and March 9, 2021.

PUBLIC NOTICE:

The Department shall give public notice when a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest or because of water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and facility must be notified of the denial in writing.

The Department must give public notice of a pending permit or of a new or reissued Missouri State Operating Permit. The public comment period is a length of time not less than thirty (30) days following the date of the public notice, during which interested persons may submit written comments about the proposed permit.

For persons wanting to submit comments regarding this proposed permit, please refer to the Public Notice page located at the front of this draft permit. The Public Notice page gives direction on how and where to submit appropriate comments.

- ✓ The Public Notice period for this permit is started March 25, 2022 and ended April 25, 2022. Two comment letters were received.

DATE OF FACT SHEET: 03/2/2022

COMPLETED BY:

SARAH WRIGHT

MS4 & LAND DISTURBANCE PERMITTING COORDINATOR

MISSOURI DEPARTMENT OF NATURAL RESOURCES

WATER PROTECTION PROGRAM

OPERATING PERMITS SECTION - STORMWATER AND CERTIFICATION UNIT

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