CITY OF ANN ARBOR
INVITATION TO BID

Water Treatment Plant
Filter Backwash Improvements

ITB No. 4607

Due Date: December 19, 2019 at 2:00 PM (Local Time)

Public Services Area
Water Treatment Services Unit

Issued By:

City of Ann Arbor
Procurement Unit
301 E. Huron Street
Ann Arbor, MI 48104

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NOTICE OF PRE-BID CONFERENCE

A pre-bid conference for this project will be held on **December 3, 2019** at **2 PM at the Ann Arbor Water Treatment Plant at 919 Sunset Road, Ann Arbor, MI 48103**.

Attendance at this conference is highly recommended. Administrative and technical questions regarding this project will be answered at this time. The pre-bid conference is for information only. Any answers furnished will not be official until verified in writing by the Financial Service Area, Procurement Unit. Answers that change or substantially clarify the bid will be affirmed in an addendum.

A site visit will follow the pre-bid conference to allow potential bidders the opportunity to view the project site.

INSTRUCTIONS TO BIDDERS

General

Work to be done under this Contract is generally described through the detailed specifications and must be completed fully in accordance with the contract documents. All work to be done under this Contract is located in or near the City of Ann Arbor.

Any Bid which does not conform fully to these instructions may be rejected.

Preparation of Bids

Bids should be prepared providing a straight-forward, concise description of the Bidder's ability to meet the requirements of the ITB. Bids shall be written in ink or typewritten. No erasures are permitted. Mistakes may be crossed out and corrected and must be initialed and dated in ink by the person signing the Bid.

Bids must be submitted on the "Bid Forms" provided with each blank properly filled in. If forms are not fully completed it may disqualify the bid. No alternative bid will be considered unless alternative bids are specifically requested. If alternatives are requested, any deviation from the specification must be fully described, in detail on the "Alternate" section of Bid form.

Each person signing the Bid certifies that he/she is the person in the Bidder's firm/organization responsible for the decision as to the fees being offered in the Bid and has not and will not participated in any action contrary to the terms of this provision.

Questions or Clarifications / Designated City Contacts

All questions regarding this ITB shall be submitted via email. Emailed questions and inquires will be accepted from any and all prospective Bidders in accordance with the terms and conditions of the ITB.

All questions shall be due on or before **December 10, 2019 at 5:00 PM** and should be addressed as follows:

> Specification/Scope of Work questions emailed to **eric.geerlings@tetratech.com**
> Bid Process and Compliance questions emailed to cspencer@a2gov.org

Any error, omissions or discrepancies in the specification discovered by a prospective contractor and/or service provider shall be brought to the attention of **Eric Geerlings at eric.geerlings@tetratech.com** after discovery as possible. Further, the contractor and/or service provide shall not be allowed to take advantage of errors, omissions or discrepancies in the specifications.

Addenda

If it becomes necessary to revise any part of the ITB, notice of the Addendum will be posted to Michigan Inter-governmental Trade Network (MITN) www.mitn.info and/or City of Ann Arbor web site www.A2gov.org for all parties to download.

Each Bidder must in its Bid, to avoid any miscommunications, acknowledge all addenda which it has received, but the failure of a Bidder to receive, or acknowledge receipt of; any addenda shall not relieve the Bidder of the responsibility for complying with the terms thereof.

The City will not be bound by oral responses to inquiries or written responses other than written addenda.

Bid Submission

All Bids are due and must be delivered to the City of Ann Arbor Procurement Unit on or before **December 19, 2019 at 2 PM local time.** Bids submitted late or via oral, telephonic, telegraphic, electronic mail or facsimile **will not** be considered or accepted.

Each Bidder must submit one (1) original Bid and **two (2)** Bid copies in a sealed envelope clearly marked: **ITB No. 4607 Water Treatment Plant Filter Backwash Improvements.**

Bids must be addressed and delivered to:

City of Ann Arbor
Procurement Unit,
c/o Customer Services, 1st Floor
301 East Huron Street
Ann Arbor, MI 48107

All Bids received on or before the Due Date will be publicly opened and recorded immediately. No immediate decisions are rendered.

The following forms provided within this ITB Document must be included in submitted bids.

- **City of Ann Arbor Prevailing Wage Declaration of Compliance**
- **City of Ann Arbor Living Wage Ordinance Declaration of Compliance**
- **Vendor Conflict of Interest Disclosure Form**
- **City of Ann Arbor Non-Discrimination Ordinance Declaration of Compliance**

Bids that fail to provide these forms listed above upon bid opening will be rejected as non-responsive and will not be considered for award.

Hand delivered bids will be date/time stamped/signed by the Procurement Unit at the address above in order to be considered. Normal business hours are 9:00 a.m. to 3:00 p.m. Monday through Friday, excluding Holidays. The City will not be liable to any Bidder for any unforeseen circumstances, delivery or postal delays. Postmarking to the Due Date will not substitute for receipt of the Bid. Each Bidder is responsible for submission of their Bid.

Additional time for submission of bids past the stated due date and time will not be granted to a single Bidder; however, additional time may be granted to all Bidders when the City determines in its sole discretion that circumstances warrant it.

Award

The City intends to award a Contract(s) to the lowest responsible Bidder(s). On multi-divisional contracts, separate divisions may be awarded to separate Bidders. The City may also utilize alternatives offered in the Bid Forms, if any, to determine the lowest responsible Bidder on each division, and award multiple divisions to a single Bidder, so that the lowest total cost is achieved for the City. For unit price bids, the Contract will be awarded based upon the unit prices and the lump sum prices stated by the bidder for the work items specified in the bid documents, with consideration given to any alternates selected by the City. If the City determines that the unit price for any item is materially different for the work item bid than either other bidders or the general market, the City, in its sole discretion, in addition to any other right it may have, may reject the bid

as not responsible or non-conforming.

The acceptability of major subcontractors will be considered in determining if a Bidder is responsible. In comparing Bids, the City will give consideration to alternate Bids for items listed in the bid forms. All key staff and subcontractors are subject to the approval by the City.

Qualifications

The City will evaluate Proposals based on cost as well as experience. Contractors that have not included the required list of similar work experience, resumes for project manager and superintendent, and associated references in Section 5 of the Bid Form may have their bid rejected.

As part of the proposal, Bidders shall provide documentation that the Bidder's company has at least 10 years' experience performing construction of water and wastewater facilities. Bidders shall also submit for the proposed Project Manager and Superintendent, resumes documenting 7 years of professional experience for each individual in the construction industry as a full-time employee, along with 3 references for each individual from previous projects completed within the past 5 years. Bidders shall also submit the attached for, "Section 5-References", which identifies a minimum of three projects completed in the past 5 years at water or wastewater facilities with a treatment capacity of 5 million gallons per day or larger, including construction cost, contractor and subcontractor information, that demonstrate similar work experience and complexity to that included within these contract documents, specifically process mechanical equipment, electrical and instrumentation and controls work at treatment plants.

All key staff and subcontractors are subject to the approval of the City.

Official Documents

The City of Ann Arbor officially distributes bid documents from the Procurement Unit or through the Michigan Intergovernmental Trade Network (MITN). Copies of the bid documents obtained from any other source are not Official copies. Addenda and other bid information will only be posted to these official distribution sites. If you obtained City of Ann Arbor Bid documents from other sources, it is recommended that you register on www.MITN.info and obtain an official Bid. Bidders do not need to be shown on the plan holders list provided by MITN to be considered an official plan holder.

Bid Security

Each bid must be accompanied by a certified check, or Bid Bond by a surety licensed and authorized to do business within the State of Michigan, in the amount of 5% of the total of the bid price.

Withdrawal of Bids

After the time of opening, no Bid may be withdrawn for the period of 120 (120) days

Contract Time

Time is of the essence in the performance of the work under this Contract. The available time for work under this Contract is indicated on page C-1, Article III of the Contract. If these time requirements can not be met, the Bidder must stipulate on Bid Form Section 3 - Time Alternate its schedule for performance of the work. Consideration will be given to time in evaluating bids.

Liquidated Damages

A liquidated damages clause, as given on page C-2, Article III of the Contract, provides that the Contractor shall pay the City as liquidated damages, and not as a penalty, a sum certain per day for each and every day that the Contractor may be in default of completion of the specified work, within the time(s) stated in the Contract, or written extensions.

Liquidated damages clauses, as given in the General Conditions, provide further that the City shall be entitled to impose and recover liquidated damages for breach of the obligations under Chapter 112 of the City Code.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

Human Rights Information

All contractors proposing to do business with the City shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the Section 9:158 of the Ann Arbor City Code. Breach of the obligation not to discriminate as outlined in Section 5, beginning at page GC-2 shall be a material breach of the contract. Contractors are required to post a copy of Ann Arbor's Non-Discrimination Ordinance attached at all work locations where its employees provide services under a contract with the City.

Wage Requirements

Section 4, beginning at page GC-1, outlines the requirements for payment of prevailing wages and for payment of a "living wage" to employees providing service to the City under this contract. The successful bidder and its subcontractors must comply with all applicable requirements and provide proof of compliance.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

For laborers whose wage level are subject to federal, state and/or local prevailing wage law the appropriate Davis-Bacon wage rate classification is identified based upon the work including within this contract. **The wage determination(s) current on the date 10 days before bids are due shall apply to this contract.** The U.S. Department of Labor (DOL) has provided explanations to assist with classification in the following resource link: www.wdol.gov.

For the purposes of this ITB the Construction Type of Heavy will apply.

Conflict Of Interest Disclosure

The City of Ann Arbor Purchasing Policy requires that prospective Vendors complete a Conflict of Interest Disclosure form. A contract may not be awarded to the selected Vendor unless and until the Procurement Unit and the City Administrator have reviewed the Disclosure form and determined that no conflict exists under applicable federal, state, or local law or administrative regulation. Not every relationship or situation disclosed on the Disclosure Form may be a disqualifying conflict. Depending on applicable law and regulations, some contracts may awarded on the recommendation of the City Administrator after full disclosure, where such action is allowed

by law, if demonstrated competitive pricing exists and/or it is determined the award is in the best interest of the City. A copy of the Vendor Conflict of Interest Disclosure Form is attached.

Major Subcontractors

The Bidder shall identify on Bid Form Section 4 each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over $50,000, whichever is less. The Bidder also shall identify the work to be subcontracted to each major subcontractor. The Bidder shall not change or replace a subcontractor without approval by the City.

Debarment (City and Grant Requirements)

Submission of a Bid in response to this ITB is certification that the Bidder:

(1) is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal departments or agency.
(2) Has not within a three-year period preceding this Agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) transaction or contract under a public transaction, as defined in 45 CFR 1185; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

(3) Is not presently indicted or otherwise criminally or civilly charged by a government entity (federal, state, or local) with commission of any of the offenses enumerated in subsection (2).

(4) Has not within a three-year period preceding this Agreement had one or more public transactions (federal, state, or local) terminated for cause or default.

(5) Will comply with all applicable requirements of all other state or federal laws, executive orders, regulations, and policies governing this program.

Submission is also agreement that the City will be notified of any changes in this status.

Iran Sanctions Act (Grant Requirement)

By signing this Agreement, the bidder is certifying that it is not an Iran linked business, and that its subcontractors are not Iran linked businesses, as defined in MCL 129.312.

Disclosures

After bids are opened, all information in a submitter's bid is subjected to disclosure under the provisions of Michigan Public Act No. 442 of 1976, as amended (MCL 15.231 et seq.) known as the "Freedom of Information Act." The Freedom of Information Act also provides for the complete disclosure of contracts and attachments thereto except where specifically exempted.

Bid Protest

All Bid protests must be in writing and filed with the Purchasing Agent within five (5) business days of the award action. The bidder must clearly state the reasons for the protest. If a bidder contacts a City Service Area/Unit and indicates a desire to protest an award, the Service Area/Unit

shall refer the bidder to the Purchasing Agent. The Purchasing Agent will provide the bidder with the appropriate instructions for filing the protest. The protest shall be reviewed by the City Administrator or designee whose decision shall be final.

Any inquiries or requests regarding this procurement should be only submitted in writing to the Designated City Contacts provided herein. Attempts by any prospective bidder to initiate contact with anyone other than the Designated City Contacts provided herein that the bidder believes can influence the procurement decision, e.g., Elected Officials, City Administrator, Selection Committee Members, Appointed Committee Members, etc., may lead to immediate elimination from further consideration.

Cost Liability

The City of Ann Arbor assumes no responsibility or liability for costs incurred by the Bidder prior to the execution of a contract with the City. By submitting a bid, a bidder agrees to bear all costs incurred or related to the preparation, submission and selection process for the bid.

Reservation of Rights

The City of Ann Arbor reserves the right to accept any bid or alternative bid proposed in whole or in part, to reject any or all bids or alternatives bids in whole or in part and to waive irregularity and/or informalities in any bid and to make the award in any manner deemed in the best interest of the City.

Idlefree Ordinance

The City of Ann Arbor adopted an idling reduction Ordinance that goes into effect July 1, 2017. The full text of the ordinance (including exemptions) can be found at: www.a2gov.org/idlefree.

Under the ordinance, No Operator of a Commercial Vehicle shall cause or permit the Commercial Vehicle to Idle:

(a) For any period of time while the Commercial Vehicle is unoccupied; or

(b) For more than 5 minutes in any 60-minute period while the Commercial Vehicle is occupied.

In addition, generators and other internal combustion engines are covered

(1) Excluding Motor Vehicle engines, no internal combustion engine shall be operated except when it is providing power or electrical energy to equipment or a tool that is actively in use.

Environmental Commitment

The City of Ann Arbor recognizes its responsibility to minimize negative impacts on human health and the environment while supporting a vibrant community and economy. The City further recognizes that the products and services the City buys have inherent environmental and economic impacts and that the City should make procurement decisions that embody, promote, and encourage the City's commitment to the environment.

The City encourages potential vendors to bring forward emerging and progressive products and services that are best suited to the City's environmental principles.

INVITATION TO BID

City of Ann Arbor
Guy C. Larcom Municipal Building
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including City Nondiscrimination requirements and Declaration of Compliance Form, Living Wage requirements and Declaration of Compliance Form, Prevailing Wage requirements and Declaration of Compliance Form, Vendor Conflict of Interest Form, Notice of Pre-Bid Conference, Instructions to Bidders, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans (if applicable) and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered _____, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:320 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting requirements stated in the City Code provisions cited. Bidder certifies that the statements contained in the City Prevailing Wage and Living Wage Declaration of Compliance Forms are true and correct. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS _____ DAY OF _____, 201_.

_____	_____
Bidder's Name	Authorized Signature of Bidder
_____	_____
Official Address	(Print Name of Signer Above)
_____	_____
Telephone Number	Email Address for Award Notice

LEGAL STATUS OF BIDDER

(The Bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

* A corporation organized and doing business under the laws of the State of _____, for whom _____, bearing the office title of _____, whose signature is affixed to this Bid, is authorized to execute contracts.

NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority

• A limited liability company doing business under the laws of the State of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

* A partnership, organized under the laws of the state of _____ and filed in the county of _____, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):

_____

_____

_____

_____

_____

* An individual, whose signature with address, is affixed to this Bid: __ _____
(initial here)

Authorized Official

_____ **Date** _____**,** 201_

(Print) Name _____ Title _____

Company: _____

Address: _____

Contact Phone ( ) _____ Fax ( ) _____

Email _____

BID FORM

Section 1 – Schedule of Prices

Bidder's Company Name: _____

Project: **Water Treatment Plant Filter Backwash Improvements, ITB No. 4607**

Notes:
1. All bidders shall provide a Unit Price and Total Price for all bid items specified.
2. Quantities included in the bid table represent estimated quantities for different work. The CONTRACTOR shall be compensated for the actual number of items completed using the unit prices provided.
3. The City, at its sole discretion, may elect to delete any portion of the work delineated below, with no change to the unit prices provided. Work shall be determined based upon the availability of funds.
4. Any item not provided in the following list shall be considered incidental.
5. Contract shall be awarded based on the base bid or any combination of a base bid and alternate bid in any manner the City believes to be in its best interest.

FILTER BACKWASH IMPROVEMENTS
BASE BID

Item No.	Item Description	Qty	Unit	Unit Price	Total Price
1.	General Conditions (Max, 10% of Total)	1	LS	$	$
2.	Control Valves and Piping	1	LS	$	$
3.	Flow Meters	1	LS	$	$
4.	Instrumentation	1	LS	$	$
5.	Start-up, Testing and Disinfection	1	LS	$	$
6.	Final Closeout	1	LS	$	$
7.	Permit Allowance	1	LS	$ 4,000	$ 4,000
8.	Miscellaneous Allowance	1	LS	$10,000	$10,000
9.	Certified Payroll Compliance and Reporting	1	LS		
	TOTAL BASE BID (ITEMS 1 THROUGH 9)				**$**

Total Base Bid: _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.)

Alternates
Bidder shall list alternate bid item prices below.

Alternate No. 1a – Refurbish Backwash Pumps 1 and 2 (Kennedy Industries)

Add: Sixty Thousand and 00/100 Dollars ($60,000.00) (Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Alternate No. 1b – Refurbish Backwash Pumps 1 and 2 (Contractor Cost)

Add: _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Alternate No. 2 – Replace Backwash Pump Discharge Valves

Add: _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Alternate No. 3 – Replace Backwash Pump Suction Valves

Add: _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Alternate No. 4 – Replace Backwash Pump Motor Starters

Add: _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

BID FORM

Section 2 – Material, Equipment and Environmental Alternates

The Base Bid proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the Contractor wishes to quote alternate items for consideration by the City, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

If an environmental alternative is bid the City strongly encourages bidders to provide recent examples of product testing and previous successful use for the City to properly evaluate the environmental alternative. Testing data from independent accredited organizations are strongly preferred.

Item Number	Description	Add/Deduct Amount

If the Bidder does not suggest any material or equipment alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any material or equipment alternate under the Contract.

Signature of Authorized Representative of Bidder _____ Date _____

BID FORM

Section 3 - Time Alternate

If the Bidder takes exception to the time stipulated in Article III of the Contract, Time of Completion, page C-2, it is requested to stipulate below its proposed time for performance of the work. Consideration will be given to time in evaluating bids.

If the Bidder does not suggest any time alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any time alternate under the Contract.

Signature of Authorized Representative of Bidder _____ Date _____

BID FORM

Section 4 - Major Subcontractors

For purposes of this Contract, a Subcontractor is anyone (other than the Contractor) who performs work (other than or in addition to the furnishing of materials, plans or equipment) at or about the construction site, directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any individual who furnishes merely the individual's own personal labor or services.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision to Section 4 of the General Conditions covering subcontractor's employees who perform work on this contract.

For the work outlined in these documents the Bidder expects to engage the following major subcontractors to perform the work identified:

Subcontractor (Name and Address)	Work	Amount
	Mechanical/Process	
	Electrical	
	Instrumentation	
	Painting	
Kennedy Industries	Pump Refurbishment (Alternate No. 1)	

If the Bidder does not expect to engage any major subcontractor, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT expect to engage any major subcontractor to perform work under the Contract.

Signature of Authorized Representative of Bidder_____ Date _____

BID FORM

Section 5 – References

Include a minimum of 3 references from similar project completed within the past 10 years.

[Refer also to Instructions to Bidders for additional requirements, if any]

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

SAMPLE STANDARD CONTRACT

If a contract is awarded, the selected contractor will be required to adhere to a set of general contract provisions which will become a part of any formal agreement. These provisions are general principles which apply to all contractors of service to the City of Ann Arbor such as the following:

CONTRACT

THIS AGREEMENT is made on the _____ day of _____, 201_, between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and _____("Contractor")

(An individual/partnership/corporation, include state of incorporation) (Address)

Based upon the mutual promises below, the Contractor and the City agree as follows:

ARTICLE I - Scope of Work

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled [Insert Title of Bid and Bid Number] in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, which are incorporated as part of this Contract:

Non-discrimination and Living Wage Declaration of Compliance Forms (if applicable)
Vendor Conflict of Interest Form
Prevailing Wage Declaration of Compliance Form (if applicable)
Bid Forms
Contract and Exhibits
Bonds
General Conditions
Standard Specifications
Detailed Specifications
Plans
Addenda

ARTICLE II - Definitions

Administering Service Area/Unit means **Water Treatment Services Unit**

Project means **Water Treatment Plant Filter Backwash Improvements, ITB No. 4607**

ARTICLE III - Time of Completion

(A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.

(B) The project shall be substantially complete (beneficial use for its intended purpose) by November 15, 2020. The entire work for this Contract shall be completed by December 1, 2020.

(C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the

Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to $500 for each calendar day of delay in the completion of all the work. If any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

ARTICLE IV - The Contract Sum

(A) The City shall pay to the Contractor for the performance of the Contract, the unit prices as given in the Bid Form for the estimated bid total of:

_____Dollars ($_____)

(B) The amount paid shall be equitably adjusted to cover changes in the work ordered by the Supervising Professional but not required by the Contract Documents. Increases or decreases shall be determined only by written agreement between the City and Contractor.

ARTICLE V - Assignment

This Contract may not be assigned or subcontracted any portion of any right or obligation under this contract without the written consent of the City. Notwithstanding any consent by the City to any assignment, Contractor shall at all times remain bound to all warranties, certifications, indemnifications, promises and performances, however described, as are required of it under this contract unless specifically released from the requirement, in writing, by the City.

ARTICLE VI - Choice of Law

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this agreement, the Contractor and the City agree to venue in a court of appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

ARTICLE VII - Relationship of the Parties

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against

compensation awarded for services under this agreement.

ARTICLE VIII - Notice

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing. Notice will be deemed given on the date when one of the following first occur: (1) the date of actual receipt; or (2) three days after mailing certified U.S. mail.

ARTICLE IX - Indemnification

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold the City, its officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence. The provisions of this Article shall survive the expiration or earlier termination of this contract for any reason.

ARTICLE X - Entire Agreement

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations, negotiations, agreements, or understandings whether written or oral. Neither party has relied on any prior representations in entering into this Contract. No terms or conditions of either party's invoice, purchase order or other administrative document shall modify the terms and conditions of this Contract, regardless of the other party's failure to object to such form. This Contract shall be binding on and shall inure to the benefit of the parties to this Contract and their permitted successors and permitted assigns and nothing in this Contract, express or implied, is intended to or shall confer on any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever under or by reason of this Contract. This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

FOR CONTRACTOR

By_____

Its:_____

FOR THE CITY OF ANN ARBOR

By_____
Christopher Taylor, Mayor

By_____
Jacqueline Beaudry, City Clerk

Approved as to substance

By_____

Howard S. Lazarus, City Administrator

By_____

Craig Hupy, Services Area Administrator

Approved as to form and content

_____
Stephen K. Postema, City Attorney

PERFORMANCE BOND

(1) _____ of _____(referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for

$ _____, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City dated _____, 201_, for: _____ _____and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq.

(3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:

(a) complete the Contract in accordance with its terms and conditions; or

(b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.

(4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.

(5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

SIGNED AND SEALED this _____ day of _____, 201_.

_____	_____
(Name of Surety Company)	(Name of Principal)
By _____	By _____
(Signature)	(Signature)
Its _____	Its _____
(Title of Office)	(Title of Office)
Approved as to form:	Name and address of agent:
_____	_____
Stephen K. Postema, City Attorney	_____
	_____

LABOR AND MATERIAL BOND

(1) _____

of _____(referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of

$ _____, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City, dated _____, 201_, for _____

_____; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;

(3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.

(4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.

SIGNED AND SEALED this _____ day of _____, 201_

_____
(Name of Surety Company)

By _____
(Signature)

Its _____
(Title of Office)

Approved as to form:

_____
Stephen K. Postema, City Attorney

_____
(Name of Principal)

By _____
(Signature)

Its _____
(Title of Office)

Name and address of agent:

_____

_____

_____

GENERAL CONDITIONS

Section 1 - Execution, Correlation and Intent of Documents

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

Section 2 - Order of Completion

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

Section 3 - Familiarity with Work

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

Section 4 - Wage Requirements

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen,

mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. A sample Prevailing Wage Form is provided in the Appendix herein for reference as to what will be expected from contractors. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

If the Contractor is a “covered employer” as defined in Chapter 23 of the Ann Arbor City Code, the Contractor agrees to comply with the living wage provisions of Chapter 23 of the Ann Arbor City Code. The Contractor agrees to pay those employees providing Services to the City under this Agreement a “living wage,” as defined in Section 1:815 of the Ann Arbor City Code, as adjusted in accordance with Section 1:815(3); to post a notice approved by the City of the applicability of Chapter 23 in every location in which regular or contract employees providing services under this Agreement are working; to maintain records of compliance; if requested by the City, to provide documentation to verify compliance; to take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee or person contracted for employment in order to pay the living wage required by Section 1:815; and otherwise to comply with the requirements of Chapter 23.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor’s employees who perform work on this contract.

Section 5 - Non-Discrimination

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of MCL 37.2209. The Contractor further agrees to comply with the provisions of Section 9:158 of Chapter 112 of Title IX of the Ann Arbor City Code, and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity.

Section 6 - Materials, Appliances, Employees

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

Section 7 - Qualifications for Employment

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

Section 8 - Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

Section 9 - Permits and Regulations

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

Section 10 - Protection of the Public and of Work and Property

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

Section 11 - Inspection of Work

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

Section 12 - Superintendence

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

Section 13 - Changes in the Work

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

Section 14 - Extension of Time

Extension of time stipulated in the Contract for completion of the work will be made if and as the

Supervising Professional may deem proper under any of the following circumstances:

(1) When work under an extra work order is added to the work under this Contract;

(2) When the work is suspended as provided in Section 20;

(3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;

(4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;

(5) Delay due to an act of Government;

(6) Delay by the Supervising Professional in the furnishing of plans and necessary information;

(7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section l3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

(1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;

(2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same;

the cost of all material and supplies required of either temporary or permanent character; rental of all power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;

(3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;

(4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;

(5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

Section 16 - Progress Payments

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract

Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than l80 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

Section 17 - Deductions for Uncorrected Work

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

Section 18 - Correction of Work Before Final Payment

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within l0 days after written notice, the City may remove them and, if the removed material has value, may store the material at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

Section 19 - Acceptance and Final Payment

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

(1) The consent of the surety to payment of the final estimate;
(2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

(1) unsettled liens;
(2) faulty work appearing within 12 months after final payment;
(3) hidden defects in meeting the requirements of the plans and specifications;
(4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

Section 20 - Suspension of Work

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

Section 21 - Delays and the City's Right to Terminate Contract

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the
required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify

such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

Section 22 - Contractor's Right to Terminate Contract

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

Section 23 - City's Right To Do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

Section 24 - Removal of Equipment and Supplies

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

Section 25 - Responsibility for Work and Warranties

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials

furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

Section 26 - Partial Completion and Acceptance

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

Section 27 - Payments Withheld Prior to Final Acceptance of Work

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

(1) Defective work not remedied;

(2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;

(3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;

(4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

Section 28 - Contractor's Insurance

(1) The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death or

property damage that may arise under this Contract; whether the act(s) or omission(s) giving rise to the claim were made by the Contractor, any subcontractor, or anyone employed by them directly or indirectly. Prior to commencement of any work under this contract, Contractor shall provide to the City documentation satisfactory to the City, through City-approved means (currently myCOI), demonstrating it has obtained the required policies and endorsements. The certificates of insurance endorsements and/or copies of policy language shall document that the Contractor satisfies the following minimum requirements. Contractor shall add registration@mycoitracking.com to its safe sender's list so that it will receive necessary communication from myCOI. When requested, Contractor shall provide the same documentation for its subcontractor(s) (if any).

Required insurance policies include:

(a) Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

Bodily Injury by Accident - $500,000 each accident
Bodily Injury by Disease - $500,000 each employee
Bodily Injury by Disease - $500,000 each policy limit

(b) Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 04 13 or current equivalent. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements specifically for the following coverages: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further there shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. The following minimum limits of liability are required:

$1,000,000	Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.
$2,000,000	Per Project General Aggregate
$1,000,000	Personal and Advertising Injury
$2,000,000	Products and Completed Operations Aggregate

(c) Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 10 13 or current equivalent. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. Further, the limits of liability shall be $1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

(d) Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of $1,000,000.

(2) Insurance required under subsection (1)(b) and (1)(c) above shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute with this insurance. Further, the Contractor agrees to waive any right of recovery by its

insurer against the City for any insurance listed herein.

(3) Insurance companies and policy forms are subject to approval of the City Attorney, which approval shall not be unreasonably withheld. Documentation must provide and demonstrate an unconditional and un-qualified 30-day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number(s); name of insurance company(s); name and address of the agent(s) or authorized representative(s); name(s), email address(es), and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which may be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified Contractor shall furnish the City with satisfactory certificates of insurance and endorsements prior to commencement of any work. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) and all required endorsements to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies and endorsements to the Administering Service Area/Unit at least ten days prior to the expiration date.

(4) Any Insurance provider of Contractor shall be authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-authorized insurance companies are not acceptable unless approved in writing by the City.

(5) City reserves the right to require additional coverage and/or coverage amounts as may be included from time to time in the Detailed Specifications for the Project.

(6) The provisions of General Condition 28 shall survive the expiration or earlier termination of this contract for any reason.

Section 29 - Surety Bonds

Bonds will be required from the successful bidder as follows:

(1) A Performance Bond to the City of Ann Arbor for the amount of the bid(s) accepted;
(2) A Labor and Material Bond to the City of Ann Arbor for the amount of the bid(s) accepted.

Bonds shall be executed on forms supplied by the City in a manner and by a Surety Company authorized to transact business in Michigan and satisfactory to the City Attorney.

Section 30 - Damage Claims

The Contractor shall be held responsible for all damages to property of the City or others, caused by or resulting from the negligence of the Contractor, its employees, or agents during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. The Contractor must restore all property injured including sidewalks, curbing, sodding, pipes, conduit, sewers or other public or private property to not less than its original condition with new work.

Section 31 - Refusal to Obey Instructions

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

Section 32 - Assignment

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

Section 33 - Rights of Various Interests

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

Section 34 - Subcontracts

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

Section 35 - Supervising Professional's Status

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

Section 36 - Supervising Professional's Decisions

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

Section 37 - Storing Materials and Supplies

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

Section 38 - Lands for Work

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

Section 39 - Cleaning Up

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

Section 40 - Salvage

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.

Section 41 - Night, Saturday or Sunday Work

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

Section 42 - Sales Taxes

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

Section 43

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____, 20___, to _____, 20 , performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled _____, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Past due invoices, if any, are listed below.

Section 44

CONTRACTOR'S AFFIDAVIT

The undersigned Contractor,_____, represents that on _____, 20___, it was awarded a contract by the City of Ann Arbor, Michigan to_____ under the terms and conditions of a Contract titled _____. The Contractor represents that all work has now been accomplished and the Contract is complete.

The Contractor warrants and certifies that all of its indebtedness arising by reason of the Contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the project, as well as all other claims arising from the performance of the Contract, have been fully paid or satisfactorily settled. The Contractor agrees that, if any claim should hereafter arise, it shall assume responsibility for it immediately upon request to do so by the City of Ann Arbor.

The Contractor, for valuable consideration received, does further waive, release and relinquish any and all claims or right of lien which the Contractor now has or may acquire upon the subject premises for labor and material used in the project owned by the City of Ann Arbor.

This affidavit is freely and voluntarily given with full knowledge of the facts.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Subscribed and sworn to before me, on this _____ day of _____, 20__
_____ , _____ County, Michigan
Notary Public
_____ County, MI
My commission expires on:

STANDARD SPECIFICATIONS

All work under this contract shall be performed in accordance with the Public Services Department Standard Specifications in effect at the date of availability of the contract documents stipulated in the Bid. All work under this Contract which is not included in these Standard Specifications, or which is performed using modifications to these Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents.

Standard Specifications are available online:
http://www.a2gov.org/departments/engineering/Pages/Engineering-and-Contractor-Resources.aspx

DETAILED SPECIFICATIONS

SECTION 01110 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. The Project is the located at the City of Ann Arbor Water Treatment Plant (WTP) located at 919 Sunset Road, Ann Arbor, MI 48103.

B. The base bid Work consists of removal of the existing backwash control valve and flow meter and installation of a new valves, flow meters, instrumentation and all related work. Alternate bid work consists of Refurbishing backwash (BW) Pumps 1 and 2, replacing BW Pump 1 and 2 check and discharge isolation valves, replacing BW Pumps 1 and 2 suction isolation valves and replacing BW Pump 1 and 2 Motor Starters.

1.02 WORK SEQUENCE

A. CONTRACTOR shall arrange its Work so that at no time shall it cause unnecessary interruption to the operation of existing facilities. CONTRACTOR shall prepare and submit to ENGINEER for approval, a complete detailed working schedule in compliance with the OWNER's schedule, setting forth the sequence of operations CONTRACTOR proposes to follow. No work shall commence until the OWNER/ENGINEER has approved this plan.

1.03 CONTRACTOR USE OF PREMISES

A. Limit use of the premises to construction activities in areas indicated; allow for OWNER occupancy and use by the public. Confine operations to areas within Contract limits indicated. Portions of the Site beyond areas in which construction operations are indicated are not to be disturbed.

B. The CONTRACTOR shall maintain the site free from accumulations of waste, debris and rubbish, caused by the construction operations.

C. CONTRACTOR use of OWNER's utilities (power and water) is covered in Section 01 50 00. CONTRACTOR shall coordinate all connections and usage of OWNER utilities to ensure no disruption with normal facility operation.

D. CONTRACTOR shall provide his own restroom facilities, see Section 01 50 00.

1.04 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the CONTRACTOR shall be solely responsible for the care and protection of all work and materials covered by the Contract, except where a certificate of partial substantial completion has been issued by the OWNER.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the CONTRACTOR shall make good any such damage of loss at his own expense. Protection measures shall be subject to the approval of the OWNER.

1.05 CONFINED SPACE

A. The water plant backwash cistern is considered a Permitted Confined Space. The CONTRACTOR must meet all requirements of MIOSHA and the City requirements below for working in confined spaces. The CONTRACTOR must submit a confined space entry program to the City for record, before any work is started in the area.
   1. No. 1 Cistern – Permit
      a. Valve lock-out – main wash water valve
      b. Lock-out drain valves on filters 1-10
      c. Interconnect valve between cisterns
      d. Thickener overflow to cistern
      e. Cistern Pumps 1 and 2 lock-outs
      f. Atmospheric gas test
      g. Attendant
      h. Ventilation as needed
   2. No. 2 Cistern – Permit
      a. Valve lock-out of valve #CIS 1608 (north of stairs by filter 26 in pipe gallery
      b. Lock-out cistern pumps 5 and 6 (mix pump 3 and 4 can be used to drain cistern)
      c. Interconnect valve between cisterns
      d. Atmospheric gas test
      e. Attendant
      f. Ventilation as needed
      g.

1.06 SECURITY AND ACCESS

A. The City of Ann Arbor's Water Treatment Plant is a limited access facility. The CONTRACTOR must comply with the City's operational provisions for security including, but not limited to:
   1. Provide proper identification of employees.
   2. Provide and use photos IDs for all CONTRACTOR personnel.
   3. Maintain daily sign-in log of personnel and visitors.
   4. Provide a list of personnel and vehicles on site.
   5. Maintain a daily log of vehicle license plate numbers on site.
   6. Allow OWNER to conduct background checks on CONTRACTOR's personnel upon request.
   7. Notify the plant in advance of material deliveries to the site, including delivery contents.

   These procedures may be revised by the City at any time, as needed.

B. Use of OWNER's security measures does not relieve Contractor of its responsibility to secure its own working spaces and materials.

C. Access to Site, Roadways, and Parking Areas
   1. CONTRACTOR's personnel shall park in approved area on City property, Sunset Road or Pomona Road.
   2. CONTRACTOR shall keep all hallways and doorways available for use at all times.

1.07 GUARANTEE

A. The CONTRACTOR shall be present for a site inspection before the warranty expires. At this time, the OWNER will develop a punch list of deficiencies to be addressed by the CONTRACTOR. The CONTRACTOR shall address these items within 14 days of the inspection.

1.08 PERMITS

A. The CONTRACTOR will be required to follow the requirements established by all permits necessary for the construction of this project. The following is a list of all permits that must be obtained prior to the beginning of construction.
   1. EGLE Part 399 Permit Application for Water Supply Systems.
   2. City of Ann Arbor Building Permits (all trades).

   CONTRACTOR may be required to obtain a permit from the City of Ann Arbor should any part of project mobilization or project activities interfere with traffic on a City street.

B. The EGLE Permit shall be applied for by the ENGINEER. All requirements set by this permit shall be followed by the CONTRACTOR.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 CONTROL OF WATER POLLUTION

A. General Requirements
   1. The CONTRACTOR shall conduct his work in such manner as to prevent the entry of fuels, oils, bituminous materials, chemical, sewage or other harmful materials into the City's water supply or on to the soil.
   2. The CONTRACTOR shall take all necessary precautions to prevent the entry of these harmful materials including the use of tarps, planks, protective trusses or scaffolding systems, or other OWNER and ENGINEER approved methods.
   3. Any vehicles or equipment with oil, fuel, or other fluid leaks shall not be allowed on the site and shall be immediately removed upon detection.

END OF SECTION

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for processing Allowances. Selected materials and equipment, and in some cases their installation, are shown and 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. Additional requirements, if necessary, will be issued by Change Order.

B. Alternates:
   1. Alternate No. 1 Refurbish Backwash Pumps 1 and 2.

1.02 DEFINITIONS

A. Lump Sum Allowance: A monetary sum that includes, as part of the Contract Price, the associated costs and requirements to complete the specified Allowance.

1.03 SUBMITTALS

A. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the Site for use in fulfillment of each Allowance.

1.04 OWNER'S INSTRUCTIONS

A. At the earliest feasible date after Contract Award, advise ENGINEER of the date when the final selection and purchase of each product or system described by an Allowance must be completed in order to avoid delay in performance of the Work.

B. When requested by ENGINEER, obtain Bids for each Allowance for use in making final selections; include recommendations that are relevant to performance of the Work.

C. Purchase products and systems as selected by ENGINEER from the designated supplier.

D. Use Allowances only as directed for OWNER's purposes, and only by Change Orders which designate amounts to be charged to the Allowance.

E. If the actual price for the specified Allowance is more or less than the stated Allowance, the Contract Price shall be adjusted accordingly by Change Order. The adjustment in Contract Price shall be made in accordance with Section 15 of the General Conditions.

F. Change Orders authorizing use of funds from the Contingency or Provisionary Allowances will include CONTRACTOR's related costs and reasonable overhead and profit margins.

G. At Project closeout, any amounts remaining in Allowances will be credited to OWNER by Change Order.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect products and services covered by an Allowance promptly upon delivery for damage or defects.

3.02 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 construction activities.

SCHEDULE OF ALLOWANCES

1. Lump Sum Allowance for Building Permit. An Allowance of $4,000 shall be included in the Contract Price for this Work. CONTRACTOR shall make all arrangements for and shall pay for this Work under this Contract. For further information, contact:

Company	City of Ann Arbor Building Department
Address	301 E. Huron Street, Ann Arbor, MI 48104
Phone	734-794-6267

2. Lump Sum Allowance for Miscellaneous. An Allowance of $10,000 shall be included in the Contract Price for the miscellaneous Work items. CONTRACTOR shall make all arrangements for and shall pay for this work under this Contract.

3. Lump Sum Allowance to Refurbish Backwash Pumps 1 and 2. This allowance is part of Alternate No. 1. If Alternate No. 1 is accepted this Allowance will cover costs incurred by Kennedy Industries for refurbishment. An Allowance of $60,000 shall be included in the Contract Price for refurbishment of backwash pumps 1 and 2. CONTRACTOR shall make all arrangements for and shall pay for this Work under this Contract. Mark-ups and adjustments to Kennedy Industries invoices will not be allowed. In general the Work covered by this allowance, minus details of the actual shop performed refurbishment items, include:
   a. Shipping to and from the site.
   b. All pump refurbishment.
   c. Realigning the pump and motor prior to start up.
   d. Verify pump is operating properly and take vibration measurements to confirm the pump is operating within the Hydraulics Institute ANSI/HI 9.6.4 standard.

END OF SECTION

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

B. Allowances:
   1. Lump Sum Allowance to Refurbish Backwash Pumps 1 and 2

1.02 DEFINITIONS

A. Alternate: An amount proposed by Bidders and stated on Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if OWNER decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.03 OWNER'S INSTRUCTIONS

A. Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the Project.

B. OWNER will evaluate Bids from the Base Lump Sum Bid price, and add or deduct the amounts stated on Bid Form for the Alternate in the order in which the Alternates are listed on Schedule at the end of this Section. OWNER reserves the right to determine how many Alternates will be added or deducted for this Project. The cost of the Alternate shall include any appropriate amounts for general conditions, bonds, insurances, materials, labor, tools, power, transportation, construction equipment, and associated items involved with the described Alternate.

C. Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected, or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

D. A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced on the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate. Drawings referenced on the Schedule indicate the Work required to perform the Alternate.

E. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items that are included with or required for a complete installation, whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

SCHEDULE OF ALTERNATES

Alternates to the Base Bid Form are offered as follows:

Alternate No. 1a

Description: Refurbish Backwash Pumps 1 and 2. This alternative includes Contractors efforts to engage the services of Kennedy Industries to refurbish the pumps. Kennedy's portion of this Work will be paid from the Lump Sum Allowance to Refurbish Backwash Pumps 1 and 2.

Reference Drawing No. D-101, D-103 and Specification Section 01230.

Alternate No. 1b

Description: Pump removal, loading, unloading and reinstallation of the pump, reconnecting suction and discharge piping and any wiring connections that may be required for the motor associated with refurbishing Backwash Pumps 1 and 2. Pump startup and commissioning, scheduling of the Work, paperwork, overhead and profit shall also be included.

Reference Drawing No. D-101, D-103 and Specification Section 01230.

Alternate No. 2

Description: Replace Backwash Pump Discharge Valves. Replace the check valve and discharge isolation valve on each pump.

Reference Drawing No. D-101, D-103 and Specification Section 15110.

Alternate No. 3

Description: Replace Backwash Pump Suction Valves. Replace the suction isolation valve on each pump.

Reference Drawing No. D-101, D-103 and Specification Section 15110.

Alternate No. 4

Description: Replace Backwash Pump Motor Starters. Replace the combination motor starters, associated power factor correction capacitors and associated I/O programing.

Reference Drawing No. E-301, E-302, E-701, and Specification Section 16420.

END OF SECTION

SECTION 01270 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This Section specifies administrative and procedural requirements for measurement and payment. Payment for Work under this Contract will be made on a unit price or lump sum basis for Work actually completed. Final measurements of the Work will be taken by ENGINEER to determine the amount of Work completed. The method of applying the unit prices to measured quantities shall be as specified in this Section.

1.02 OWNER'S INSTRUCTIONS

A. Payment will only be made for items listed on Bid Form. The costs for other Work required for a complete Project will be included in the prices Bid for the other items of Work listed on Bid Form.

B. Payment for each item will be in accordance with Section 16 of the General Conditions, and include all applicable labor, material, equipment, and ancillary items to complete the Work specified.

C. All measurements shall be rounded to the nearest whole unit.

1.03 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by ENGINEER and paid for by OWNER.

B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

C. The date for each progress payment will be determined at the Pre-Construction Conference. The period of construction Work covered by each Application for Payment is 1 month. Actual start/end dates will be determined at the Pre-Construction Conference.

D. Use the AIA (American Institute of Architects) Application and Certification for Payment form for Applications for Payment.
   1. Complete every entry on the form, including execution by person authorized to sign legal documents on behalf of CONTRACTOR.
   2. Incomplete applications will be returned without action.

E. Initial Application for Payment: Administrative actions and submittals that must precede submittal of the first Application for Payment include the following:
   1. List of subcontractors.
   2. List of principal suppliers and fabricators.
   3. CONTRACTOR's Construction Schedule (preliminary if not final).
   4. Schedule of principal products.
   5. Submittal Schedule (preliminary if not final).

F. Application for Payment at Substantial Completion: Administrative actions and submittals that shall proceed or coincide with this application include:
   1. Warranties (guarantees) and maintenance agreements.
   2. Maintenance instructions.
   3. Start-up performance reports.
   4. Changeover information related to OWNER's occupancy, use, operation, and maintenance.
   5. Final cleaning.
   6. Application for reduction of retainage, and consent of surety.
   7. Final progress photographs.
   8. List of incomplete Work, recognized as exceptions to ENGINEER's Certificate of Substantial Completion.

G. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Assurance that unsettled claims will be settled.
   4. Assurance that Work not complete and accepted will be completed without undue delay.
   5. Transmittal of required Project construction records to OWNER.
   6. Proof that taxes, fees, and similar obligations have been paid.
   7. Removal of temporary facilities and services.
   8. Removal of surplus materials, rubbish, and similar elements.
   9. CONTRACTOR's waivers of liens for Project.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

SCHEDULE OF UNIT PRICES

Description: Demolition
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes removal and disposal of work to be demolished on the project.

Description: General Conditions, Max 10% of Total Base Bid
Payment: Lump Sum.
Measurement: Each.
Work Required: This item of work will be paid for on a pro rata basis at the time of each progress payment. Measurement will be based on the ratio between work completed during the payment period and the total contract amount. When all of the work of this Contract has been completed, the measurement of this item shall be 1.0 Lump Sum, minus any deductions incurred for inadequate performance as described herein. This amount will not be increased for any reason, including extensions of time, extras, and/or additional work.

The unit price for this item of work shall include all labor, material, and equipment costs to perform all the work specified in the Standard Specifications and as modified by this Detailed Specification. The amount for this work shall be no more than 10% of the total base bid.

Description: Control Valves and Piping
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes installation of new pipe, installation of two new control valves, installation of new actuators, and associated electrical/instrumentation equipment and all related Work. Also includes training, painting, lead paint abatement, and other work necessary for a complete job.

Description: Flow Meters
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes installation of two new flow meters and associated electrical/instrumentation/control wiring and all related Work. Also includes training associated with this equipment.

Description: Instrumentation
Payment: Unit Cost.
Measurement: Each
Work Required: Includes the installation and programming of PLC and associated control wiring and conduits and all related Work. Also includes training associated with this equipment.

Description: Start-up, Testing and Disinfection
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes all scheduling and coordination of necessary parties, disinfection, sampling, disposal of disinfected water as approved, coordination with the City of Ann Arbor for commissioning (Section 01810) and all labor, materials and equipment necessary to complete work.

Description: Final Closeout
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes work in specification 017700 and other work necessary to close-out contract.

Description: Certified Payroll Compliance and Reporting
Payment: Lump Sum.
Measurement: Each.
Work Required: The unit price for this item of work shall include all supervisory, accounting, administrative, and equipment costs needed to monitor and perform all work related to maintaining compliance with the tasks specified in this Detailed Specification, the City of Ann Arbor Code of Ordinances, its Prevailing Wage Compliance policy and the applicable Federal and State laws.
Payment for this work will be made with each progress payment, on a pro-rata basis, based on the percentage of construction completed. When all of the work of this contract has been completed, the measurement of this item shall be 1.0 times the Lump Sum bid amount. This amount will not be increased for any reason, including extensions of time, extra work, and/or adjustments to existing items of work.

Description: Refurbish Backwash Pumps 1 and 2 (Alternate No. 1)
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes refurbishment of backwash pumps 1 and 2.

Description: Replace Backwash Pump Discharge Valves (Alternate No. 2)
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes Replace the check valve and discharge isolation valve on both pumps.

Description: Replace Backwash Pump Suction Valves (Alternate No. 3)
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes Replace the suction isolation valve on both pumps.

Description: Replace Backwash Pump Motor Starters (Alternate No. 4)
Payment: Lump Sum.
Measurement: Each.
Work Required: Includes replacing the combination motor starters, associated power factor correction capacitors and associated I/O programing for both pumps.

END OF SECTION

SECTION 01290 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements governing CONTRACTOR's Applications for Payment.

B. Related Sections:
   1. CONTRACTOR's Measurement and Payment is included in Section 012700.
   2. CONTRACTOR's Construction Schedule and Submittal Schedule are included in Section 01 33 00.

1.02 OWNER'S INSTRUCTIONS

A. Schedule of Values:
   1. Coordinate preparation of Schedule of Values with preparation of CONTRACTOR's Construction Schedule.
   2. Correlate line items on Schedule of Values with other required administrative schedules and forms, including:
      a. CONTRACTOR's Construction Schedule.
      b. Application for Payment form.
      c. List of subcontractors.
      d. Schedule of Allowances.
      e. Schedule of Alternates.
      f. List of products.
      g. List of principal suppliers and fabricators.
      h. Schedule of Submittals.
   3. Submit Schedule of Values to ENGINEER at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.
   4. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for Schedule of Values.
   5. Identification: Include the following Project identification on Schedule of Values:
      a. Project name and location.
      b. Name of ENGINEER.
      c. Project number.
      d. CONTRACTOR's name and address.
      e. Date of submittal.
   6. Arrange Schedule of Values in a tabular form with separate rows for each Specification Section and separate columns for each major structure or area of Work.
   7. Provide a breakdown of the Contract Price in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
   8. Round off amounts to the nearest whole dollar; the total shall equal the Contract Price.
   9. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

10. Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually on Applications for Payment. Each item on Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
11. At CONTRACTOR's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items on Schedule of Values or distributed as general overhead expense.
12. Update and resubmit Schedule of Values when Change Orders or Work Change Directives result in a change in the Contract Price.
13. A Lump Sum payment equal to 1-1/2% of the total Bid Price (to include all bonds, insurance, etc.) will be allowed for "mobilization" as a progress payment line item. The actual cost of bonds and insurance (up to maximum payment of 1-1/2%) will be considered in the initial payment request provided that cost documentation suitable to the OWNER is furnished by the CONTRACTOR. Any outstanding balance of the mobilization line litem will be payable when the Project work is 10% complete as indicated by the approved progress payments (less costs of mobilization and stored equipment).
14. Schedule of Values should reserve no less than 5% of lump sum cost to close out Work.

B. Initial Application for Payment: Administrative actions and submittals that must precede submittal of the first Application for Payment include the following:
   1. List of subcontractors.
   2. List of principal suppliers and fabricators.
   3. Schedule of Values.
   4. CONTRACTOR's Construction Schedule (preliminary if not final).
   5. Schedule of principal products.
   6. Submittal Schedule (preliminary if not final).

C. Applications For Payment:
   1. Each Application for Payment shall be consistent with previous applications and payments as certified by ENGINEER and paid for by OWNER.
   2. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
   3. The date for each progress payment will be determined at the Pre-Construction Conference. The period of construction Work covered by each Application for Payment is 1 month. Actual start/end dates will be determined at the Pre-Construction Conference.
   4. Use the AIA (American Institute of Architects) Application and Certification for Payment form for Applications for Payment.
   5. Complete every entry on the form, including execution by person authorized to sign legal documents on behalf of CONTRACTOR. Incomplete applications will be returned without action.
   6. Entries shall match data on Schedule of Values and CONTRACTOR's Construction Schedule. Use updated Schedules if revisions have been made.
   7. Include amounts of Change Orders and Work Change Directives issued prior to the last day of the construction period covered by the application.
   8. Submit 3 executed copies of each Application for Payment to ENGINEER; Each copy shall be complete, including waivers of lien and similar attachments, when required.
   9. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to ENGINEER.

D. Application for Payment at Substantial Completion:
   1. Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for OWNER occupancy of designated portions of the Work.
   2. Administrative actions and submittals that shall proceed or coincide with this application include:
      a. Warranties (guarantees) and maintenance agreements.
      b. Maintenance instructions.
      c. Final cleaning.
      d. Application for reduction of retainage and consent of surety.
      e. Final progress photographs.
      f. List of incomplete Work, recognized as exceptions to ENGINEER'S Certificate of Substantial Completion.

E. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Transmittal of required Project construction records to OWNER.
   4. Proof that taxes, fees, and similar obligations have been paid.
   5. Removal of temporary facilities and services.
   6. Removal of surplus materials, rubbish, and similar elements.
   7. CONTRACTOR's waivers of mechanics liens for Project.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01310 - PROJECT COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
   1. Scheduling
      a. Coordination of Work under this Contract.
      b. Administrative and supervisory personnel.
   2. Pre-Construction Conference.
   3. Pre-Installation Conference.
   4. Progress meetings.
   5. Inspections
   6. Disinfection
   7. Start-Up
   8. General installation provisions.
   9. Cleaning and protection.

B. Related Sections Specified Elsewhere:
   1. Division of Work and specific construction milestones in Section 01 11 00.
   2. Requirements for CONTRACTOR's Construction Schedule are included in Section 01 33 00.
   3. Closeout procedures are included in Section 01 77 00.

1.02 SUBMITTALS

A. Within 15 days of Notice to Proceed, submit a list of CONTRACTOR's principal staff assignments, including the Superintendent and other personnel in attendance at site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

1.03 SCHEDULING

A. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair. Make adequate provisions to accommodate items scheduled for later installation.

B. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at Site in accordance with Laws or Regulations. CONTRACTOR shall train CONTRACTOR's employees on use of these sheets and shall keep a master copy on hand at Site.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

1.04 PRE-CONSTRUCTION CONFERENCE

A. ENGINEER will schedule a Pre-Construction Conference and organizational meeting at the Site or other convenient location prior to commencement of construction activities to review responsibilities and personnel assignments.

B. Attendees: OWNER, ENGINEER, CONTRACTOR and its superintendent, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:
1. Tentative Construction Schedule.
2. Critical Work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.
6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, product data, and samples.
8. Preparation of Record Documents.
9. Use of the premises.
10. Office, Work, and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures.
13. First aid.
14. Security.
15. Housekeeping.
16. Working hours.

1.05 PRE-INSTALLATION CONFERENCE

A. Where specified, CONTRACTOR, supplier, and ENGINEER shall meet on Site and discuss tools, techniques, and procedures for installation of products and equipment prior to performing the Work.

1.06 PROGRESS MEETINGS

A. Attendees: In addition to representatives of OWNER and ENGINEER, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

B. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

C. CONTRACTOR's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to CONTRACTOR's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

D. Reporting: ENGINEER will prepare and distribute copies of minutes of the meeting to each party present and to other parties who should have been present. The minutes will include a brief summary, in narrative form, of progress since the previous meeting and report.

E. Schedule Updating: CONTRACTOR shall revise Construction Schedule after each progress meeting where revisions to Schedule have been made or recognized. Issue revised Schedule no later than 3 days after the progress meeting date to ENGINEER for distribution concurrently with the progress meeting minutes.

1.07 COORDINATION WITH OTHER CONTRACTS

A. OWNER has or will engage in construction Work associate with other contracts on the site. The following projects will be conducted concurrent with the Work of this contract.
   1. WTP UV Disinfection System
   2. SCADA Modernization
   3. Filter Gallery Instrumentation Replacement Project
   4. Architectural and Structural Repairs Project (masonry and roofing)
   5. Filter Carbon Changeout to occur March 2020 and late October / early November 2020

1.08 INSPECTIONS

A. CONTRACTOR shall participate in inspections with OWNER and/or ENGINEER as needed throughout the project.

1.09 SHUTDOWN

A. CONTRACTOR shall coordinate the shutdown of the backwash system with the City. The City shall be notified not less than 14 days prior to shutdown.

B. A preshut down meeting shall be held to confirm all aspects of the shutdown and coordinate with plant operators.

1.10 LIQUIDATED DAMAGES

A. Liquidated damages will be applied independently for each key contract date set forth by this Contract.
B. Where the schedule requirements identified in this Section are not met; including repairs not fully complete, final cleaning, equipment reinstallation and all other work to make the structure suitable for Owner operation, non-quantifiable liquidated damages in the following amounts will be applied.

1.11 WORK SEQUENDING/CONSTRAINTS

A. One backwash pumping system shall be in service at all times except for one short period when proposed pipework in the cistern will take the entire backwash system out of service.

B. A plant "recovery period" is needed after one or both of the backwash pumps are taken out of service. This is required by plant operations to process the extra waste backwash water that will be required to wash the filters following each complete or partial backwash system shut down. The recovery period shall be 7 calendar days.

C. No interruption of any part of the WTP operation shall occur without the expressed prior approval of OWNER. Requests shall allow no less than 14 days for plant staff to make necessary arrangements to properly accommodate any required shutdowns. Longer periods may be required at the sole discretion of the OWNER.

D. Before taking any part of the backwash system off line the Work shall not start until all materials are on site and ready to install.

E. Pump refurbishment performed at Kennedy Industries repair facility shall not proceed until the long lead pump parts are at Kennedy's shop before starting the work.

F. In the cistern, sump pits and for sections of piping that need to be drained OWNER will drain down these areas with existing permanently installed equipment to the extent possible. All remaining debris and water shall be CONTRACTOR's responsibility to remove to the extent necessary to perform Work and provide safe working areas. No special arrangements by OWNER will be made to clean or keep areas dry during construction.
   1. It should be assumed that approximately 1.5' of water will remain in the bottom of the cistern after it has been drained by OWNER.

G. Disinfection of proposed piping and appurtenances shall be completed in accordance with Section 01310.

H. During the course of the Work, OWNER will perform all shut downs and restarts on various systems and equipment within the WTP. No equipment may be shut down or taken out of service without OWNER's prior approval. OWNER will restart equipment when related work is complete.

I. When commissioning the backwash improvements CONTRACTOR shall coordinate with the equipment manufacturers, sub-contractors, system integrators, electrical trades, and equipment field technicians to verify wire terminations, I/O signal verification and control panel communications to the greatest extent practical before initiating actual filter backwashing with new equipment.

J. Representative samples of pipe gaskets on the discharge piping of BW Pumps 1 and 2 have been tested by OWNER for asbestos. Contractors shall assume asbestos abatement is not required for this project.

K. Representative samples of BW Pumps 1 and 2 discharge pipe paint were tested by OWNER for lead. These tests were positive and CONTRACTOR is referred to section 09970 for the lead abatement service requirements of this project.

L. All painting work shall occur after 3:30 p.m. and can extend until 10:00 p.m. M thru F and on Saturday's in order to minimize fumes in the plant during peak staff working hours. Proper ventilation measures must still be taken at all times.

M. As a guide in preparing a construction sequence for the project, the CONTRACTOR shall use the following. See Table 1 for a summary of Work items, allowable shutdown durations and liquidated damages.

1. Suggested General Sequence
    a. Submit Project Schedule and CONTRACTOR's Proposed Protection of Process Water plan for review and approval.
    b. Perform walk-through of the work area and review the work scope with ENGINEER.
    c. To help ensure the cistern Work will proceed smoothly Contractor shall enter the cistern at the very beginning of the project to: 1) Visually confirm the existing joint types, take field measurements and to become familiar with the cistern layout. 2) Plan for proposed pipework in the cistern including ingress and egress of people and materials, area for scaffolding or ladders, rigging points etc. 3) The field measurements and representative pictures shall be submitted with the piping shop drawings for the Work in this area. 4) Plan for necessary temporary lighting for entering the cistern.
    d. The plant has a "recovery period".
    e. Refurbish BW Pump No. 1 (Alternate No. 1) While this pump is being refurbished the plant will backwash using BW Pump No. 2 and supplemented by East High Service (EHS) district pressure as needed.
        1) The existing pump suction isolation valve may leak. Contractor shall provide a temporary blind flange for the suction piping.
        2) If the pump suction isolation valve (Alternative 3) can be obtained quick enough it could potentially be replaced while the pump is being refurbished. 14 day's notice to the plant will be required to plan for isolation of the suction header and taking the EHS pumps out of service. If the valve cannot be obtained fast enough it will need to be replaced the next time BW Pump No. 1 is taken out of service.
    f. Install BW Pump No. 1, disinfect and place back in service.
    g. No further system shutdowns will be allowed during the summer months between June 1 and August 30.
    h. Take the part of the backwash system associated with BW Pump No. 1 down and install the pump's control valve, flow meter, check valve (Alternate 2), pump discharge isolation valve (Alternate 2), Pump suction isolation valve (Alternate 3) and motor control center starter (Alternate No. 4).
        1) The plant will isolate the EHS suction header from the reservoir on the suction side.
        2) Contractor shall proceed with the suction valve replacement first in the sequence as it may leak.
        3) After the piping valve and meter are installed they shall be pressure tested and disinfected.
    i. The entire backwash system goes back in operation with BW Pump No. 1 control valve locked wide open and using the existing backwash control valve and meter.
    j. The plant has a "recovery period".
    k. Shut down the entire backwash system and install BW Pump No. 2 header pipe isolation valve. Close and brace this valve.
        1) This work shall proceed over a 2 day period.
        2) As soon as this valve work is done, including disinfection, part of the backwash system will go back in operation using only BW Pump No. 1.
    l. Continue replacement of BW Pump No. 2 check valve (Alternate No. 2), pump discharge isolation valve (Alternate No. 2), suction isolation valve (Alternate No. 3) control valve, flow meter and motor control center starter (Alternate No. 4).
        1) The plant will isolate the transfer pump discharge header so the suction side of the pump can be isolated for suction isolation valve replacement.
        2) Contractor shall proceed with the suction valve replacement the valve may leak and should be replaced concurrent with header pipe isolation valve noted above.

3) After the piping, valve and meter are installed they shall be pressure tested and disinfected.

m. The entire backwash system goes back in operation with BW Pump No. 2 control valve locked wide open and using the existing backwash control valve and meter.

n. The plant has a “recovery period”.

o. Refurbish BW Pump No. 2 (Alternate No. 1). Reinstall, disinfect and place back in service.

p. The plant has a “recovery period”.

q. Final testing of the backwash system improvements. The system is fully commissioned, debugged and operated in auto mode using the plant SCADA system while keeping the existing control valve and flow meter automatic controls online as backup.

1) This Work shall occur during a 3-day period.

r. Cistern Work. Take entire backwash system out of service and perform work in the cistern.

1) The pipe to be installed in the cistern shall be fully painted prior to installation.

2) Piping shall be “swabbed” with chlorine solution to disinfect it. After the pipe is placed back in service Contractor shall coordinate with the plant to obtain bacteriological testing samples.

s. Clean up and project closeout.

2. Schedule

a. The schedule in Article III of the contract is fixed and non-negotiable.

b. Contractor shall be responsible for providing additional crews as required at no additional cost to the OWNER to meet the schedule.

c. The completion dates set in Article III of the contract describe the dates that the improvements, including clean up , must be completed.

Table 1. Ann Arbor WTP Filter Backwash Improvements
Milestones and Work Constraints Summary

Item	Notice to Owner	Maximum Work Duration	Dates and Deadlines	Liquidated Damages
Anticipated Notice to Proceed (Not Guaranteed)			March 1, 2020	
Cistern drained for Field Measurements and Planning	7 days	2 days		$1000/day
Recovery Week for WTP to Backwash Filters and Prepare for next Item of Work		7 days		
Remove Backwash Pump No. 1 and Coordinate Delivery to Kennedy Industries for Inspection and Refurbishment	14 days	6 weeks	Complete before May 30, 2020	$1000/day
Backwash Pump No. 1 Out of Service for associated control valve and meter installation (Base Bid), discharge valves and suction valve replacement (Alternates No. 2 and 3) and motor starter replacement (Alternate No. 4)	14 days	5 days	No sooner than September 1, 2020	$1000/day
Recovery Week for WTP to Backwash Filters and Prepare for next Item of Work		7 days		
Backwash Pump No. 2 Out of Service for associated control valve and meter installation (Base Bid), discharge valves and suction valve replacement (Alternates No. 2 and 3) and motor starter replacement (Alternate No. 4)	14 days	5 days	No sooner than September 15, 2020	$1000/day
Recovery Week for WTP to Backwash Filters and Prepare for next Item of Work		7 days		
Remove Backwash Pump No. 2 and Coordinate Delivery to Kennedy Industries for Inspection and Refurbishment	14 days	3.5 weeks	No sooner than October 1, 2020	$1000/day
Recovery Week for WTP to Backwash Filters and Prepare for next Item of Work		7 days		
Final debugging, programming and testing of backwash system using new control valves	14 days	3 days	No sooner than October 26, 2020	$1000/day
Remove existing venturi meter and control valve in cistern, install piping	14 days	3 days	No sooner than November 1, 2020	$1000/day
Substantial Completion			November 15, 2020	See Contract
Final Completion			December 15, 2020	See Contract

Notes:

1. During periods of backwash pumps out of service, Contractor shall work overtime, including Saturdays and Sundays, to complete this work as soon as possible.
2. Liquidated damages shall apply for each item in Table 1 that exceeds the assigned maximum duration or deadline. Liquidated damages in Table 1 shall be in addition to liquidated damages in the Contract for Substantial and Final Completion.

1.12 DISINFECTION

A. CONTRACTOR shall prepare and submit a disinfection plan for review and approval. The plan shall include a description of the methods to be used, injection points, sampling points and disinfection solutions to be used.

B. CONTRACTOR shall be responsible for obtaining samples and delivering same to the City of Ann Arbor WTP for laboratory analysis

C. CONTRACTOR shall disinfect the piping per the AWWA standard C651-14 Disinfecting Water Mains and the pumps per AWWA C653-13 Disinfection of Water Treatment Plants. In general, the following methods can be used:
   1. Pumps
      a. All whetted parts shall be swabbed or sprayed with chlorine solution. Alternatively, the pump internals can be filled with 100 ppm chlorine solution and allowed to sit for 3 hours.
      b. Thoroughly flush the pump with at least 3 volumes of water and sample.
   2. Pipes
      a. New pipes and valves along with the exposed ends of existing pipes shall be sprayed or swabbed with chlorine solution.
      b. Pipes shall be thoroughly flushed with at least 3 volumes of water and sampled.
   3. Test results must show a passing bacteriology test and the chlorine residual in the flush water must match the source water.

D. All disinfection shall be scheduled and coordinated with the City, providing minimum of 7 days of notice. Coordinate sampling locations with plant operations.

E. Provide all temporary piping, fitting, backflow preventers, disinfectant feeding equipment, sampling, necessary to complete the flushing and disinfection procedure. ENGINEER shall be notified of flushing and disinfection schedules, and shall witness the sampling.

F. CONTRACTOR shall pay all additional expenses if it is necessary to repeat the testing and disinfection procedure as a result of defective work or defective testing.

G. Disinfection Products:
   1. Liquid Chlorine: Liquid chlorination may be allowed subject to approval of ENGINEER, OWNER, and Fire Marshal. Liquid chlorine shall meet the requirements of AWWA B301.
   2. Sodium Hypochlorite shall meet the requirements of AWWA B300. Containers shall have an expiration date marked at time of shipment to ensure that excessive deterioration has not occurred.
   3. Calcium Hypochlorite shall meet the requirements of AWWA B300.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

END OF SECTION

SECTION 01315 – GENERAL CONDITIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies all work described and required by the Plans and Specifications at each location for which no item of work is listed in the Bid Form, including but not limited to:

1. Coordination of, and cooperation with, other contractors, agencies, departments, and utilities.
2. Protection and maintenance of utilities.
3. Storing all materials and equipment out of traveled areas or areas needed to operate the WTP.
4. Site clean-up.
5. Noise and dust control
6. Mobilization(s) and demobilization(s).
7. All miscellaneous and incidental items such as overhead, insurance, and permits.
8. Meeting all requirements relating to Debarment Certification, Davis Bacon Act, and Disadvantaged Business Enterprise, and providing the necessary documentation.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01330 - SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals, including, but not necessarily limited to, the following:
   1. CONTRACTOR's Construction Schedule.
   2. Schedule of Values
   3. Submittal Schedule.
   4. Shop Drawings.
   5. Product data.
   6. Progress photographs.
   7. Record photographs.

B. Topics covered elsewhere include, but are not limited to:
   1. Permits.
   2. Applications for payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of subcontractors.

1.02 SCHEDULE OF VALUES

A. Within fourteen (14) days after issuance of Notice to Proceed, CONTRACTOR shall submit two (2) copies of the proposed schedule of values for the ENGINEER’s review and approval.

B. Schedule of values shall meet requirements of Section 012900.

C. Schedule of values shall be revised as needed based on ENGINEER’s comments.

D. Schedule of values shall be organized according to specification divisions.

E. Schedule of values shall include sections for tracking all costs associated with each stage of the project.

1.03 SUBMITTALS

A. Bonds and Insurance Certificates shall be submitted to and approved by OWNER prior to executing the contract and prior to the initiation of any construction on Site.

B. Permits, Licenses, and Certificates: For OWNER's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents; correspondence and records established in conjunction with compliance with standards; and regulations bearing upon performance of the Work.

1.04 SUBMITTAL PROCEDURES

A. Coordination:
   1. 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.
   2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   3. 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.
   4. ENGINEER reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing:
   1. Allow sufficient review time so that installation shall not be delayed as a result of the time required to process submittals, including time for resubmittals.
   2. ENGINEER will review and return submittals with reasonable promptness, or advise CONTRACTOR when a submittal being processed must be delayed for coordination or receipt of additional information by putting the submittal "On Hold" and returning a transmittal identifying the reasons for the delay.
   3. No extension of Contract Time will be authorized because of failure to transmit submittals to ENGINEER sufficiently in advance of the Work to permit processing.

C. Submittal Preparation:
   1. Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
   2. Provide a space approximately 4 inches by 5 inches on the label or beside the title block on submittals not originating from CONTRACTOR to record CONTRACTOR's review and approval markings and the action taken.
   3. Include the following information on the label for processing and recording action taken.
      a. Project name.
      b. Date.
      c. Name and address of ENGINEER.
      d. Name and address of CONTRACTOR.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Number and title of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.
   4. Any markings done by CONTRACTOR shall be done in a color other than red. Red is reserved for ENGINEER's marking.
   5. The number of copies to be submitted will be determined at the pre-construction conference. Reproducibles may be submitted and will be marked and returned to CONTRACTOR. Blue or black line prints shall be submitted in sufficient quantity for distribution to ENGINEER and OWNER recipients.

D. Submittal Transmittal:
   1. Package each submittal appropriately for shipping and handling. This shall include an index either on the transmittal or within the submittal itself. Transmit each submittal from CONTRACTOR to ENGINEER using a transmittal form. Submittals received from sources

other than CONTRACTOR will be returned without action. Use separate transmittals for items from different specification sections. Number each submittal consecutively beginning with the specification section. Resubmittals should have the same number as the original, plus a letter designation for each resubmittal (i.e., 013300-1-A, 013300-1-B, etc.).

2. Indicate on the transmittal relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include CONTRACTOR's certification that information complies with Contract Document requirements. On resubmittal, all changes shall be clearly identified for ease of review. Resubmittals shall be reviewed for the clearly identified changes only. Any changes not clearly identified will not be reviewed and original submittal shall govern.

1.05 CONSTRUCTION SCHEDULE

A. Within fourteen (14) days after issuance of the Notice to Proceed, the CONTRACTOR shall prepare three (3) copies of the proposed schedule and submit two (2) copies to the ENGINEER for review and approval. Hard copies of project schedule shall be in color with critical path shown. CONTRACTOR shall also submit electronic copy of schedule.
   1. 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 sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
   2. Coordinate Construction Schedule with Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
   3. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on Schedule to allow time for ENGINEER's procedures necessary for certification of Substantial Completion.

B. Schedule Updating: Revise Schedule after each meeting or activity where revisions have been recognized or made within 48 hours following the meeting or activity. Updated schedule shall show all changes since previous submittal.

1.06 SUBMITTAL SCHEDULE

A. After development and acceptance of Construction Schedule, prepare a complete Schedule of Submittals. Submit Schedule within 10 days of the date required for establishment of Construction Schedule.

B. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products, as well as Construction Schedule.

C. Prepare Schedule in chronological order; include submittals required during the construction period. Provide the following information:
   1. Scheduled date for the first submittal.
   2. Related Section number.
   3. Submittal category.
   4. Name of subcontractor.
   5. Description of the part of the Work covered.
   6. Scheduled date for resubmittal.
   7. Scheduled date ENGINEER's final release or approval.

D. Following response to initial submittal, print and distribute copies to ENGINEER, OWNER, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

E. 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 portion of the Work and are no longer involved in construction activities.

F. Schedule Updating: Revise Schedule after each meeting or activity where revisions have been recognized or made within 48 hours following the meeting or activity.

1.07 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate 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 considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.

C. Nameplate data for equipment including electric motors shall be included on Shop Drawings. Electric motor data shall state the manufacturer, horsepower, service factor, voltage, enclosure type, oversize wiring box, etc.

D. Shop Drawings shall indicate shop painting requirements to include type of paint and manufacturer.

E. Standard manufactured items in the form of catalog work sheets showing illustrated cuts of the items to be furnished, scale details, sizes, dimensions, quantity, and all other pertinent information should be submitted and approved in a similar manner.

F. Measurements given on Shop Drawings or standard catalog sheets, as established from Contract Drawings and as approved by ENGINEER, shall be followed. When it is necessary to verify field measurements, they shall be checked and established by CONTRACTOR. The field measurements so established shall be followed by CONTRACTOR and by all affected trades.

G. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches but no larger than 36 inches by 48 inches.

H. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.08 PRODUCT DATA

A. 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. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as Shop Drawings.

B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   1. Manufacturer's printed recommendations.
   2. Compliance with recognized trade association standards.
   3. Compliance with recognized testing agency standards.
   4. Application of testing agency labels and seals.
   5. Notation of dimensions verified by field measurement.
   6. Notation of coordination requirements.

C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.09 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, ENGINEER will review each submittal, mark to indicate action taken, and return promptly.
   1. Compliance with specified characteristics is CONTRACTOR's responsibility.

B. Action Stamp: ENGINEER will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
   1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
   2. Final-But-Restricted Release: When submittals are marked "Furnish as Corrected," that part of the Work covered by the submittal may proceed, provided it complies with notation or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
   3. Returned for Resubmittal: When submittal is marked "Rejected" or "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
      a. Do not permit submittals marked "Rejected" or "Revise and Resubmit" to be used at Site, or elsewhere where Work is in progress.
   4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Acknowledge Receipt."
   5. The approval of ENGINEER shall not relieve CONTRACTOR of responsibility for errors on Drawings or submittals as ENGINEER's checking is intended to cover compliance with Drawings and Specifications and not enter into every detail of the shop work.

1.10 RECORD PHOTOGRAPHS

A. CONTRACTOR shall take a minimum of 36 pre-construction photographs to document the condition of the site prior to beginning work.

B. After final acceptance of the Work, 36 photographs shall be taken of each structure and major feature of the Project as directed by ENGINEER. These photographs shall be taken from points and at times directed by ENGINEER.

C. Photographs shall include condition of South Industrial Road and pavement within fenced site, both before and after project.

D. CONTRACTOR shall provide digital photos submitted on CD. File names should represent the subject matter of the photo. At the completion of the project, the CONTRACTOR shall print the photos on photographic paper (4”x6”) and bind in a 3-ring binder, two photos per 8 ½ x 11 sheet.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This Section specifies procedural and administrative requirements for temporary services and facilities.

B. Provide and maintain temporary facilities and utilities required for construction; remove on completion of work.

C. Temporary Utilities include, but are not limited to:
   1. Temporary electric power.
   2. Temporary lighting.

D. Temporary Construction and Support Facilities include, but are not limited to:
   1. CONTRACTOR's storage sheds.
   2. Sanitary facilities (temporary toilets)

E. Construction Buildings and Facilities include, but are not limited to.
   1. Temporary Project bulletin boards.
   2. Stairs.
   3. Hoists.
   4. Ongoing construction cleanup.
   5. Storage of equipment and material.

F. Security and Protection Facilities required include, but are not limited to:
   1. Temporary fire protection.
   2. Barricades, warning signs, lights.
   3. Security enclosure and lockup.
   4. Environmental protection.
   5. Control of noise.
   6. Dust control.

1.02 REFERENCES

A. Natural Resources and Environmental Protection Act, P.A. 451 (Act 451) of 1994.

B. Codes and Standards:
   1. Comply with NFPA Code 241, "Building Construction and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library, "Temporary Electrical Facilities."
   2. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," prepared jointly by AGC and ASC, for industry recommendations.
   3. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Temporary Utilities: Submit a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to OWNER, change over from use of temporary service to use of the permanent service.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to:
   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.
   6. State and Local Soil Erosion and Sedimentation Control regulations.
   7. National Fire Protection Association (NFPA):NFPA No.70-93
   8. National Electrical Code (NEC) and local amendments thereto.
   9. Comply with federal, state, and local codes and regulations, and utility company requirements.

B. Inspection: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

A. Unless otherwise provided in these Specifications, CONTRACTOR shall make CONTRACTOR's own arrangements for electricity, gas, water, and temporary toilets for use during the construction of the Work and shall pay for all temporary facilities, connections, extensions, and services.
   1. Cost or use charges for temporary facilities are not chargeable to OWNER or ENGINEER, and will not be accepted as a basis of claims for a Change Order.

B. Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do no overload facilities or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on Site.

C. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide new materials; if acceptable to ENGINEER, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Water: Potable water service will be available through OWNER. CONTRACTOR shall be responsible for coordinating connections and hose for temporary potable water service.

2.02 EQUIPMENT

A. Provide new equipment; if acceptable to ENGINEER, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.

B. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110 to 120 volt 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.

C. 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.

D. Temporary Toilet Units: Provide self-contained single-occupant toilet units, properly vented and fully enclosed with a glass fiber-reinforced polyester shell or similar nonabsorbent material. CONTRACTOR shall coordinate location of temporary toilet units with ENGINEER.

E. First Aid Supplies: Comply with governing regulations.

F. Fire Extinguishers: Provide hand-carried, portable, UL rated, Class "A" fire extinguishers for temporary offices and similar spaces.
   1. 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.
   2. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

G. Bulletin Board: Provide a weather-protected enclosed bulletin board at Site. The bulletin board shall be mounted in a conspicuous and public outside location.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they shall 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.

3.02 TEMPORARY UTILITY INSTALLATION

A. Water Service and Distribution: CONTRACTOR shall at all times provide for CONTRACTOR's employees an abundant and convenient supply of cool drinking water taken from a potable source.

B. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground fault interrupters, and main distribution switchgear.
   1. Provide, maintain, and remove temporary electric service facilities.
   2. Electrical requirements in excess of capacity of existing electrical service shall be responsibility of contractor.
   3. Coordinate with the WTP electrician.

C. Temporary Lighting: Wherever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
   1. Install and operate temporary lighting that shall fulfill security and protection requirements, without operating the entire system, and shall provide adequate illumination for construction operations and traffic conditions.
   2. Supply temporary lighting sufficient to enable contractor to safely access all work areas.

D. Facilities exposed to weather shall be weatherproof-type and electrical equipment enclosure locked to prevent access by unauthorized personnel.

E. Pay for installation of temporary service.

F. Patch affected surfaces and structures after temporary services have been removed.

G. Provide explosion proof lamps, wiring, switches, sockets, and similar equipment required for temporary lighting and small power tools.

H. Public and Private Utilities: Where any utilities, water, sewer, gas, telephone, or any other either public or private, are encountered, CONTRACTOR must provide adequate protection for them, and CONTRACTOR shall be held responsible for any damages to such utilities arising from CONTRACTOR's operations.

I. Water for Construction
   1. Owner will provide water required for cleaning and other purposes.
   2. Water use shall not exceed usage that might endanger the owner’s water system’s integrity.

3.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

A. Locate sanitary facilities, and other temporary construction and support facilities for easy access.
   1. Maintain temporary construction and 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 OWNER.

B. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities, and drinking water fixtures. Comply with regulations and health Codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best service the Project's needs.
   1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
   2. Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
   3. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

3.04 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 ENGINEER.

B. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably 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. Provide supervision of welding operations and similar sources of fire ignition.
   2. Provide and maintain in working order a minimum of two fire extinguishers and such other fire protective equipment and devices would be reasonably effective in extinguishing fires.

C. Contractor shall be responsible for loss or injury to persons or property where work is involved, and shall provide security and take precautionary measures to protect contractor’s and owner’s interests.

D. 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 which produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the Site.

E. Control of Noise: CONTRACTOR shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers, and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers.

F. Dust Control: CONTRACTOR shall take all steps necessary for the alleviation or prevention of dust nuisance caused by or resulting from CONTRACTOR's operations and shall apply water or dust palliative, or both, as required. No direct payment will be made for any such Work performed or materials used to control dust from this Contract.

3.05 FIELD QUALITY CONTROL

A. Should the local Regulatory Agency determine at any time during construction that the construction operation is in violation of the Natural Resources and Environmental Protection Act, P.A. 451

(Act 451) of 1994 and cite OWNER, CONTRACTOR or Subcontractor shall take immediate action, as directed by OWNER, to ensure compliance with the Act.

3.06 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.

C. Termination and Removal: Unless ENGINEER requires that it be maintained longer, remove each temporary facility when the need has ended, or 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 property of CONTRACTOR. OWNER reserves the right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period.

D. Damage to Existing Property:
   1. Contractor is responsible for replacing or repairing damage to existing buildings, sidewalks, roads, parking lot surfacing, and other existing assets.
   2. Owner has the options of contracting for such work and having cost deducted from contract amount if the contractor is not qualified.

E. Barriers and Enclosures: The contractor shall furnish, install, and maintain as long as necessary, and remove when no longer required adequate barriers, warning signs or lights at all dangerous points throughout the work for protection of property, workers, and the public. The contractor shall hold the owner harmless from damage or claims arising out of any injury or damage that may be sustained by any person or persons as a result of the work under the contract.

END OF SECTION

SECTION 01600 - GENERAL EQUIPMENT STIPULATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. These General Equipment Stipulations apply, in general, to all equipment provided under other Specification Sections. They shall supplement the detailed equipment specifications, but in cases of conflict the equipment specifications shall govern.

B. Related Sections: Electric and DC-driven motors are specified in Section 16220.

1.02 OPERATION AND MAINTENANCE

Refer to section 01781

1.03 QUALITY ASSURANCE

A. Compliance with OSHA: All equipment provided under this Contract shall meet all the requirements of the Federal and/or State Occupational Safety and Health Acts. Each equipment supplier shall submit to ENGINEER certification that the equipment furnished is in compliance with OSHA.

B. Electrical Codes, Ordinances, and Industrial Standards: The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from codes or local requirements shall be borne by CONTRACTOR.

1.04 SHIPPING AND HANDLING EQUIPMENT

A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment and handling.

1.05 SPARE MATERIALS

A. All V-belt driven equipment shall be furnished with a complete set of spare belts per each piece of equipment. When two or more similar pieces of equipment are furnished, replacement belt assemblies shall be furnished for every other drive assembly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Anchor Bolts: Anchor bolts, nuts, and washers shall be hot-dipped galvanized in conformity with ASTM A 385 and be supplied with sleeves.

B. Shop Painting:
   1. Non-submerged Applications: Tnemec Series 37H, Chem-Prime.
   2. Submerged, Non-potable Applications: Tnemec Series 66, Hi-Build Epoxoline.
   3. Submerged, Potable Applications: Tnemec Series 139, Pota-Pox II.
   4. Rust preventive compound shall be:
      a. Dearborn Chemical, No-Ox-ID2W.
      b. Houghton, Rust Veto 344.
      c. Rust-Oleum R-9.

2.02 MANUFACTURED UNITS

A. Wall and Slab Sleeves and Castings: Where water- or gas-tightness is essential and at other locations where indicated, wall castings and sleeves shall be provided with an intermediate flange located approximately at the center of the wall or slab.
   1. All sleeves and casting shall be flush with walls and underside of slabs but shall extend 2 inches above finished floors.

2.03 COMPONENTS

A. Lubrication: Equipment shall be adequately lubricated by systems which require attention no more often than weekly during continuous operation. Lubrication system shall not require attention during start-up or shutdown and shall not waste lubricants.
   1. Lubrication point shall be easily accessible with all points of application provided with standard fittings for greasing or placing oil.
   2. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity for all consumption prior to completion of required testing and acceptance of equipment by OWNER.

B. Safety Guards: All belt or chain drives, fan blades, couplings, vertical or horizontal drive shafts, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 gauge or heavier galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal and painted safety yellow.
   1. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be hot-dipped galvanized.
   2. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

C. Anchor Bolts: All necessary anchor bolts shall be provided as per the manufacturer's recommendations for size, strength, and location and shall meet the requirements of Standard Details on Drawings. Substantial templates and working drawings for installation shall be provided. Two nuts shall be furnished.

1. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

D. Seals: Mercury seals will not be acceptable.

E. Bearings: All antifriction bearings shall be designed per the Anti-Friction Bearing Manufacturers Association (AFBMA) recommendations with a rating life of B-10, 30,000 hours.

F. Equipment Bases: A cast iron or welded steel baseplate shall be provided for all equipment and motor assemblies. Each baseplate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have a threaded drain connection. Bases shall be fully braced to withstand shock loads and resist buckling. Necessary safety guard mounting shall be provided as part of the equipment base.

G. Motor Starters and Control Panels: Motor starters 480 volt or less shall be size one or larger and have 120 volt AC contactor coils. All control circuits and indicating lights associated with the starter shall be 120 volt. The control transformer shall be sized to have 100 VA minimum spare capacity for future use. A terminal strip shall be provided for all control wires entering the starter with spare terminals for future use. The terminal strip and wires shall be identified. One spare normally open auxiliary starter contact, wired to the terminal strip, shall be provided for future use. Indicating lights shall be 120 volt, oiltight, push-to-test type. Explosion-proof units shall meet NEC Class I, Division I, Group D requirements.
   1. Provide equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction, such as NEMA 4, 4X, 7, or 9 if it is other than NEMA 12. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.

2.04 FABRICATION

A. Shop Painting: All iron and steel surfaces shall be protected by suitable paint or coatings applied in the shop or at point of fabrication. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment.
   1. All iron and steel surfaces which will be totally or partially submerged or located in a continuously or intermittently moist atmosphere during normal operation shall be shop blast cleaned to a near-white finish, removing all dirt, rust-scale, and foreign matter by any of the recommended methods outlined in the Steel Structures Painting Council Specification SP-10.
   2. The cleaned surfaces shall be shop primed before any rust bloom forms. All other exposed surface shall be properly filed, scraped, sanded, etched, brushed, sandblasted, and/or cleaned to provide surfaces free from dirt, loose crystals, rust, scale, oil, and grease and shop primed.
   3. Shop primed surfaces shall be painted with one or more coats of a primer which meets the requirements of this Section and is compatible with the finish painting system specified in Section 09900. Minimum shop coat thickness shall be 1.5 dry mills.

B. Electric motors, speed reducers, starters, pumps, motor control centers, control panels, and other self-contained or enclosed components shall be shop finished with 2 coats of an enamel paint as per manufacturer's recommendations.

C. Where specified, steel and iron surfaces shall be hot-dipped galvanized in conformity with ASTM A 153 and A 385.

D. Machined, polished, and nonferrous surfaces which are not to be painted or galvanized shall be coated with rust preventive compound.

PART 3 - EXECUTION

3.01 EQUIPMENT BASES

A. The baseplate shall be installed on a concrete base. Baseplates shall be anchored to the concrete base with suitable anchor bolts and grouted in place.

3.02 WALL AND SLAB SLEEVES AND CASTINGS

A. Unless otherwise shown on Drawings or specified, at all points where pipes or conduit pass through walls, slabs or roofs, suitable sleeves or castings shall be furnished and installed. Sleeves and castings shall not be painted in areas to be embedded in the concrete. All loose rust, scale, grease, or oil shall be removed prior to pouring the concrete.

B. Unless otherwise shown or approved by ENGINEER, the space between the pipe and the sleeve shall be caulked. All ground buried and water or gas retaining wall or slab sleeves or castings shall be mechanical joint.

3.03 EQUIPMENT INSTALLATION CHECK

A. Refer to Section 01810.

B. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.

3.04 OPERATION AND MAINTENANCE TRAINING

A. Refer to Section 01820.

END OF SECTION

SECTION 01770 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for Contract closeout including, but not limited to:
   1. Warranties and Bonds.
   2. Requirements for Substantial Completion.
   3. Project record document submittal.
   4. Final cleaning.

B. Certifications and other commitments and agreements for continuing services to OWNER are specified elsewhere in the Contract Documents.

1.02 WARRANTY REQUIREMENTS

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve CONTRACTOR of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with CONTRACTOR.

B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.

E. OWNER's Recourse: Written warranties made to OWNER are in addition to implied warranties, and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which OWNER can enforce such other duties, obligations, rights, or remedies.

F. Rejection of Warranties: OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

G. OWNER reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.03 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products in quantities specified in individual specification sections. This may include, but is not limited to the topics in Table 01770-A.

B. All wearable items shoud be supplied to provide at least two years of operation and maintenance.

Table 01770-A – Spare Parts

Equipment	Specification Section	Parts
Paint	09900	Extra Paint
Manufacturer Paint	13410	Extra Paint
Instrumentation	13491	Relays
PLCs	13491	Various Cards
Modules	13491	Various Modules
Basic Electrical	16050	Conduit Caps

1.04 SUBSTANTIAL COMPLETION

A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Price.
   2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   3. Advise OWNER of pending insurance changeover requirements.
   4. Submit specific warranties, workmanship bonds, maintenance agreements, O&M Manuals, final certifications, and similar documents.
   5. Obtain and submit releases enabling OWNER unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates, and similar releases.
   6. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, ENGINEER will either proceed with inspection or advise CONTRACTOR of unfilled requirements.
   1. ENGINEER will prepare the Certificate of Substantial Completion following inspection, or advice CONTRACTOR of construction that must be completed or corrected before the certificate will be issued.
   2. ENGINEER will repeat inspection when requested and assured that the Work has been substantially completed.
   3. Results of the completed inspection will form the basis of requirements for final acceptance.

C. The warranty period for specific portions of the Work will begin on the date established on Component Acceptance Form or at such other date as agreed by OWNER, ENGINEER, and CONTRACTOR.

1.05 FINAL ACCEPTANCE

A. Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Submit an updated final statement, accounting for final additional changes to the Contract Price.
   3. Submit a copy of ENGINEER's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by ENGINEER.
   4. Submit consent of surety to final payment.
   5. Submit a final liquidated damages settlement statement.
   6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   7. Submit record drawings, maintenance manuals, final Project photographs, damage or settlement survey, property survey, and similar final record information.
   8. Deliver tools, spare parts, extra stock, and similar items.
   9. Make final changeover of permanent locks and transmit keys to OWNER. Advise OWNER's personnel of changeover in security provisions.
   10. Complete start-up testing of systems, and instruction of OWNER's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
   11. Meet all other conditions of the contract.

B. Reinspection Procedure: ENGINEER will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to ENGINEER.
   1. Upon completion of reinspection, ENGINEER will prepare a certificate of final acceptance as shown in the end of this Section, or advise CONTRACTOR of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, reinspection will be repeated.

1.06 SUBMITTALS

A. Submit written warranties to ENGINEER prior to the date certified for Substantial Completion. If ENGINEER's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of ENGINEER.

B. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

1.07 RECORD DOCUMENT SUBMITTALS

A. Record Drawings:
   1. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown.

2. Mark whichever Drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
3. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
4. Mark new information that is important to OWNER, but was not shown on Contract Drawings or Shop Drawings.
5. Note related Change Order numbers where applicable.
6. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.

B. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work.
1. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to ENGINEER for OWNER's records.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General cleaning during construction is required by the General Conditions and included in Section 01310 and 01500.

B. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in typical municipal water ground storage tank.

C. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion as shown at the end of this Section.
1. Remove labels that are not permanent labels.
2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances.
3. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition.
4. Clean Site, including landscape development areas, of rubbish, litter, accumulated debris, surplus materials of any kind which result from its operation, including construction equipment, tools, sheds, sanitary enclosures, etc., and foreign substances.
5. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth even-textured surface.
6. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications. In the absence of any portion of these requirements, the CONTRACTOR shall completely rehabilitate the site to a condition and appearance equal or superior to that which

existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the OWNER.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.
   1. Do not burn waste materials. Do not bury debris or excess materials on OWNER's property.
   2. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
   3. Remove waste materials from Site and dispose of in a lawful manner.

F. Where extra materials of value remaining after completion of associated Work have become OWNER's property, arrange for disposition of these materials as directed.

END OF SECTION

CERTIFICATE OF SUBSTANTIAL COMPLETION

Contract _____

Contract No. _____

Date Issued: _____

OWNER _____

CONTRACTOR _____

This Certificate of Substantial Completion applies to all Work under the Contract.

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

_____ _____
DATE OF SUBSTANTIAL COMPLETION

A tentative punch list of items to be completed or corrected is attached hereto as Attachment No. A. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR by _____, _____.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees pending final payment shall be as follows:

OWNER: Shall perform and/or maintain insurances, if any, in accordance with Article 5 of the General Conditions, and allow CONTRACTOR reasonable access to complete or correct items on the tentative list. Additional responsibilities are:

_____

_____

CONTRACTOR: Shall perform and/or maintain Site security, temporary facilities, Bonds and insurances in accordance with Article 5 of the General Conditions, and protect the Work. Additional responsibilities are:

_____

_____

The following documents are attached to and made a part of this Certificate:

Attachment A: Tentative Punch List of Items to be completed prior to Final Payment (Pages 1 to 2, inclusive).

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____
Date

_____
_____
ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on _____
Date

_____
CONTRACTOR

By: _____
(Authorized Signature)

CERTIFICATE OF FINAL COMPLETION

Contract _____

Contract No. _____

Date Issued: _____

OWNER _____

CONTRACTOR _____

This Certificate of Final Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, in accordance with Paragraph 14.06 of the General Conditions, and that Work is hereby declared to be finally complete in accordance with the Contract Documents on

_____
DATE OF FINAL COMPLETION

CONTRACTOR's general warranty and guarantee period commences on ___ __ and terminates on __ ____.

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to correct defective Work in accordance with the General Conditions of the Contract Documents.

Executed by ENGINEER on _____
Date

_____
ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Final Completion on _____
Date

_____
CONTRACTOR

By: _____
(Authorized Signature)

SECTION 01781 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Operation and maintenance data/manuals.

1.02 SUBMITTALS

A. Submit operations and maintenance data for all equipment.

B. Quantity Required and Timing of Submittals:
   1. Preliminary Submittal:
      a. Printed Copies: 4 copies, exclusive of copies required by CONTRACTOR.
      b. Electronic Copies: 1 copy.
      c. Submit to ENGINEER by the earlier of: ninety days following approval of Shop Drawings and product data submittals, or thirty days prior to starting training of operations and maintenance personnel, or ten days prior to field quality control testing at the Site.
      d. Furnish preliminary operation and maintenance data submittal in acceptable form and content, as determined by ENGINEER, before associated materials and equipment will be eligible for payment.
   2. Final Submittal: Provide final submittal prior to Substantial Completion, unless submittal is specified as required prior to an interim Milestone.
      a. Printed Copies: 4 copies.
      b. Electronic Copies (Searchable PDF): 2 copies

1.03 OPERATION AND MAINTENANCE DATA/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 required. Binders shall be minimum one-inch wide and maximum of three-inch wide. Binders for each copy of each volume shall be identical.
   2. 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 of each volume.
   3. Do not overfill binders.
   4. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
   5. Provide the following information on cover of each volume:
      a. Title: “OPERATING AND MAINTENANCE INSTRUCTIONS”.
      b. Name or type of material or equipment covered in the manual.
      c. Volume number, if more than one volume is required, listed as “Volume __ of __”, with appropriate volume-designating numbers filled in.
      d. Name of Project and, if applicable, Contract name and number.

e. Name of building or structure, as applicable.

6. Provide the following information on spine of each volume:
   a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
   b. Name or type of material or equipment covered in the manual.
   c. Volume number, if more than one volume is required, listed as "Volume __ of __", with appropriate volume-designating numbers filled in.
   d. Project name and building or structure name.
7. The manuals' cover sheets and spines shall all be matching. The CONTRACTOR shall prepare a template for use by the various subcontractors.

B. Pages:
   1. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.
   2. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.

C. Drawings:
   1. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing specified for pages.
   2. Documents larger than 11 inches by 17 inches shall be folded and inserted into clear plastic pockets bound into the manual. Mark pockets with printed text indicating content and drawing numbers. Include no more than three drawing sheets per pocket.

D. Copy Quality and Document Clarity:
   1. Contents shall be original-quality copies. Documents in the manual 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 that contain 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. Faxed copies are unacceptable.
   2. Clearly mark in 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 or cross out inapplicable content. Using highlighters to so indicate options furnished is unacceptable.

E. Organization:
   1. Table of Contents:
      a. Provide table of contents in each volume of each operations and maintenance manual.
      b. In table of contents and at least 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 identification is unacceptable.
   2. Use dividers and labeled index tabs between equipment items and between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

3. Each equipment item shall have an individual cover sheet with the following information:
    a. Name or type of material or equipment.
    b. Manufacturer's name, address, telephone number, fax number, and Internet website address.
    c. Manufacturer's local service representative's or local parts supplier's name, address, telephone number, fax number, Internet website address, and e-mail addresses, when applicable.
    d. Manufacturer's shop order and serial number(s) for materials, equipment or assembly furnished.
    e. City Equipment Number if applicable.

1.04 ELECTRONIC REQUIREMENTS

A. Electronic Copies of Operation and Maintenance Manuals:
    1. Each electronic copy shall include all information included in printed copy.
    2. Submit each electronic copy on a separate compact disc (CD), unless another electronic data transfer method or format is acceptable to ENGINEER.
    3. File Format:
        a. The O&M Manuals will be placed into the OWNER's Content Management System. All electronic files shall be compatible with this system.
        b. Files shall be in "portable document format (PDF)". Files shall be entirely electronically searchable and created from the original document. Scanned/Image PDF's will not be accepted.
        c. Submit separate file for each separate document in the printed copy.
        d. Within each file, provide bookmarks for the following:
            1) Each chapter and subsection listed in the printed copy document's table of contents.
            2) Each figure.
            3) Each table.
            4) Each appendix.
    4. Also provide drawings and figures in one of the following formats: ".bmp", ".tif", ".jpg", or ".gif". Submit files in a separate directory on the CD.
    5. Technical drawings will be provided in both AutoDesk DWG format and PDF format.

1.05 CONTENT

A. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

B. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

C. Submit complete, detailed, written preventive maintenance instructions 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 preventive maintenance task such as inspection, adjustment, lubrication, calibration, and cleaning. Include pre-startup checklists for each equipment item and maintenance requirements for long-term shutdowns.
   2. Recommended schedule for each preventive maintenance task.
   3. Lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.
   4. Table of alternative lubricants.
   5. Troubleshooting instructions.
   6. List of required maintenance tools and equipment.

D. 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:
   1. Manufacturer's name, address, telephone number, fax number, and Internet website address.
   2. Manufacturer's local service representative's or local parts supplier's name, address, telephone number, fax number, Internet website address, and e-mail addresses, when applicable.
   3. Manufacturer's shop order and serial number(s) for materials, equipment or assembly furnished.
   4. 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 operations and maintenance manual is submitted. Price list shall be dated.

E. Compete instructions for ordering replaceable parts, including reference numbers (such as shop order number or serial number) that will expedite the ordering process.

F. 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.

G. Submit manufacturer's installation and operation bulletins, 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 materials 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.

H. Submit original-quality copies of each approved and accepted Shop Drawing, product data, and other submittal, updated to indicate as-installed condition. Reduced drawings are acceptable only if reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.

I. Submit complete electrical schematics and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.

J. Programmable Logic Controllers: If programmable logic controllers are furnished
   1. Submit complete logic listings in one consistent format.
   2. Format Requirements:
      a. For ladder diagram logic, include complete cross-referencing of all logic elements. Annotate all elements with clearly understandable tags or descriptive labels.
      b. For function block diagram, label each function block with understandable tags or descriptive labels. Describe purpose and action of each function block.
      c. For sequential function chart, include extensive comments for each step to describe program step function.
      d. For instruction list and structured text, include extensive comments for each program line to describe program line function.
   3. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.
   4. Submit complete manufacturer's programming manuals.

K. Copy of warranty bond and service contract as applicable.

L. When copyrighted material is used in operations and maintenance manuals, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01800 – CERTIFIED PAYROLL COMPLIANCE AND REPORTING

PART 1 - GENERAL

1.01 SUMMARY

This specification covers all administrative requirements, payroll reporting procedures to be followed by Contractors performing work on City-sponsored public improvements projects, and all other miscellaneous and incidental costs associated with complying with the applicable sections of the City of Ann Arbor Code of Ordinances with regard to payment of prevailing wages and its Prevailing Wage Compliance policy.

This specification is **not** intended to include the actual labor costs associated with the payment of prevailing wages as required. Those costs should be properly incorporated in all other items of work bid.

1.02 GENERAL

The Contractor is expected to comply with all applicable sections of Federal and State prevailing wage laws, duly promulgated regulations, the City of Ann Arbor Code of Ordinances, and its Prevailing Wage Compliance Policy as defined within the contract documents. The Contractor shall provide the required certified payrolls, city-required declarations, and reports requested elsewhere in the contract documents within the timeline(s) stipulated therein.

The Contractor shall also provide corrected copies of any submitted documents that are found to contain errors, omissions, inconsistencies, or other defects that render the report invalid. The corrected copies shall be provided when requested by the Supervising Professional.

The Contractor shall also attend any required meetings as needed to fully discuss and ensure compliance with the contract requirements regarding prevailing wage compliance. The Contractor shall require all employees engaged in on-site work to participate in, provide the requested information to the extent practicable, and cooperate in the interview process. The City of Ann Arbor will provide the needed language interpreters in order to perform wage rate interviews or other field investigations as needed.

Certified Payrolls may be submitted on City-provided forms or forms used by the Contractor, as long as the Contractor's forms contain all required payroll information. If the Contractor elects to provide their own forms, the forms shall be approved by the Supervising Professional prior to the beginning of on-site work.

1.03 UNBALANCED BIDDING

The City of Ann Arbor will examine the submitted cost for this item of work prior to contract award. If the City determines, in its sole discretion, that the costs bid by the Contractor for complying with the contract requirements are not reasonable, accurately reported, or may contain discrepancies, the City reserves the right to request additional documentation that fully supports and justifies the price as bid. Should the submitted information not be determined to be reasonable or justify the costs, the City reserves the right to pursue award of the contract to the second low bidder without penalty or prejudice to any other remedies that it may have or may elect to exercise with respect to the original low-bidder.

The Contract Completion date will not be extended as a result of the City's investigation of the as-bid amount for this item of work, even if the anticipated contract award date must be adjusted. The only exception will be if the Contractor adequately demonstrates that their costs were appropriate and justifiable. If so, the City will adjust the contract completion date by the number of calendar days commensurate with the length of the investigation, if the published Notice to Proceed date of the work cannot be met. The contract unit prices for all other items of work will not be adjusted regardless of an adjustment of the contract completion date being made.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01810 - COMMISSIONING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Commissioning Plan

B. Functional Completion Testing

C. Startup

D. Commissioning

E. Performance Testing

F. Operational Demonstration

1.02 DEFINITIONS

A. Commissioning: Commissioning is the series of activities or processes necessary to ensure that equipment and systems are designed, installed, functionally tested, started up and capable of being operated and maintained to perform in conformity with the design intent for the facility improvements. Commissioning includes, but is not limited to factory testing, field testing, dry testing, wet testing with plant water, performance testing, Manufacturer's checkout, and operational demonstration.

B. Factory Testing: Factory testing is performance testing, operation testing, or documentation verification conducted in the production facility, specialized test facility, or by the equipment manufacturer or supplier. Such testing shall conform to the requirements of the individual sections of the Contract Documents. "Witnessed" factory testing shall mean that the testing is witnessed by the OWNER or his designated representative.

C. Field Testing: Field testing is performance testing, operation testing, or documentation verification conducted in the field after installation, to provide comparison with the results obtained in the factory testing.

D. Dry Testing: Dry testing is performed by the CONTRACTOR without introducing either process material or other test material into the component, system, or unit process.

E. Wet Testing: Wet testing is testing performed by the CONTRACTOR utilizing plant water in the component, system, or unit process. Tankage shall be filled with plant water to operating level.

F. Performance Testing: Performance Testing is testing performed by the CONTRACTOR to demonstrate the specified throughput of the equipment and unit process systems while maintaining regulatory compliance with Federal, State, and Local government regulations and minimum compliance with the equipment or unit process systems performance requirements and guarantees.

G. Manufacturer's Checkout: Manufacturer's checkout shall be performed directly by the manufacturer. Checkout by the local equipment representative or salesman is not permitted. Checkout shall include, but not be limited to, wiring and power supply, installation, tolerances, clearances, rotation, etc.

H. Startup: Startup shall be defined as the operation of equipment or unit process systems using clean water, air, or other fluids and gases as necessary to demonstrate the operation of the equipment or systems with other equipment that is a part of the Facility. Startup shall be performed by the CONTRACTOR, manufacturer, and local equipment representative.

I. System: A "system" includes all required items of equipment, devices, and appurtenances connected so that their operation or function compliments, protects, or controls the operation or function of the others.

J. Operational Demonstration: A commissioning activity performed by the CONTRACTOR wherein the CONTRACTOR operates and maintains a fully functional component system, unit process for a period of time after stable operation has been achieved. For purposes of this project, the period of time shall be 30 days, unless noted otherwise for specific pieces of equipment.

K. Commissioning Plan: The Commissioning Plan incorporates all aspects of functional completion testing, startup, commissioning, performance testing, training, and reliability tests to ensure the facility operates properly and meets design intent and performance.

1.03 QUALITY ASSURANCE

A. CONTRACTOR shall appoint a Performance Testing Manager who shall:
   1. Manage, coordinate, and supervise CONTRACTOR's start-up, testing, and commissioning activities including but not limited to field testing, dry testing, wet testing with plant water, performance testing with process liquids and solids, manufacturer's checkout and the Operational Demonstration.
   2. Assist in coordinating and documenting Site quality control Work specified in individual Specification Sections.
   3. Prepare, or review and approve, all submittals for the Work under this Section and related Work contained within the Contract Documents.
   4. Coordinate activities of subcontractors, manufacturers and suppliers relative to the start-up, testing, and commissioning activities.

B. Performance Testing Manager shall be at the Site a minimum of eight hours per day during all testing and be available at all times, 24 hours per day, seven days per week to perform these duties.

C. Performance Testing Manager shall supervise the CONTRACTOR's Operations ENGINEER and Operations Specialists who shall be dedicated to the start-up, testing, and commissioning Work.

1.04 SUBMITTALS

A. Field Installation Reports – Submit reports by Manufacturer's Representative in accordance with the Contract Documents.

B. Detailed Commissioning Plan – Submit detailed commissioning plan in accordance with the Contract Documents 90 days in advance of starting, testing and placing equipment into operation.

C. Start up and Testing Documentation: CONTRACTOR shall prepare and submit all documentation for review and approval. The documentation shall include, but not be limited to, the following:
   1. Develop blank testing forms specific to each item of equipment or system to be filled out during start-up and testing.
      a. All forms must be approved by ENGINEER and OWNER prior to use.
      b. Pump testing form shall at a minimum include VFD speed, flow, suction pressure, discharge pressure, amperage, voltage, and kW.
   2. Field testing plans, dry testing plans and wet testing plans that describe in detail the proposed testing procedures that will show the equipment and systems performance is in accordance with the requirements of the Contract Documents.
   3. Field testing, dry testing and wet testing reports including recorded test data, performance tolerances, observations, measurements taken, problems and modifications or corrective action taken for the equipment and systems to perform in accordance with the Contract Documents.
   4. Certification by the preparer that he/she is the person responsible for the data, and that the data is authentic and accurate.
   5. Certification by the CONTRACTOR or equipment or unit process systems supplier that the equipment or the unit process systems were operated continuously for the specified period and that the equipment or unit process systems operated in compliance with the specified operating conditions, parameters and performance, and that the equipment or unit process systems are suitable for Operational Demonstration.

D. Develop performance testing plans and operational demonstration plans describing in detail, coordinated, sequential testing and demonstration of each system to be tested. Performance testing plan and operational demonstration plan shall be specific to the system or equipment item to be tested, and shall identify by specific equipment or tag number each device or control station to be manipulated or observed during testing, and specific results to be observed or obtained. Subcontractors and suppliers shall be present during testing, and for the planned testing duration. Performance testing plans and operational demonstration plans shall include:
   1. Summary of results of field testing, dry testing and wet testing.
   2. Calibration of all field instruments and control devices.
   3. Description of and information on temporary systems, equipment, and devices proposed for performance Testing and Operational Demonstrations, including calibration data for temporary instrumentation and controls.
   4. Description of data reduction required, if any, and proposed time between collection of data and submittal of results to ENGINEER.
   5. Summary of criteria for acceptance of test results. Summary shall include performance tolerances (if any) included in the Contract Documents. Where performance tolerances are not included in the Contract Documents, testing plans shall include proposed performance tolerances for approval by OWNER and ENGINEER.

6. Following ENGINEER's approval of performance testing plans and operational demonstration plans, CONTRACTOR shall reproduce performance testing and operational demonstration plans in sufficient quantity for CONTRACTOR'S purposes plus five copies to ENGINEER and five copies to OWNER. Do not start performance testing or operational demonstrations until required quantity of approved plans are provided.

E. Testing Schedule: Provide a testing schedule that sets forth the planned sequence for performance testing and operational demonstration work. Testing schedule shall be part of the Progress Schedule and shall conform to requirements for Progress Schedule.
   1. Detail the equipment and systems to be tested.
   2. Show planned start date, duration, and completion of each test.
   3. Testing schedule shall submitted no later than eight weeks in advance of the date performance testing and operational demonstrations are to begin. ENGINEER will not witness performance testing and operational demonstration work until test schedule is accepted by ENGINEER.
   4. Testing schedule shall be updated weekly and resubmitted to ENGINEER. Updates shall indicate actual dates of performance testing and operational demonstration Work, indicating equipment, systems and treatment train for which testing is in progress, and that are satisfactorily completed in accordance with the Contract Documents.

F. Following a successful Operational Demonstration, a summary report containing the following, at a minimum, shall be provided by the CONTRACTOR:
   1. Equipment, systems and plant treatment trains started-up and commissioned.
   2. Start-up and commissioning dates.
   3. Equipment, systems and performance criteria tested, clearly showing requirements and field data that verifies requirements were met.
   4. Names of witnesses for start-up and commissioning.
   5. Any repairs, corrections, or modifications required for the equipment or unit process systems to successfully complete start-up and commissioning.
   6. Loop diagrams accurately depicting the installed condition of instrumentation and controls.
   7. Any other important Operational Demonstration information.
   8. Report Appendix containing the following, as a minimum:
      a. A summary of all testing data used and calculations, including source, formulas with all terms defined.
      b. Copies of all raw field data sheets, including those indicating sampling point locations, and notes.
      c. Production and operational data.
      d. Calibration sheets for equipment.
      e. Copies of calibration records for instrumentation.

1.05 COMMISSIONING PLAN

A. The CONTRACTOR shall be responsible for preparing, coordinating, and executing the Plan.
   1. The CONTRACTOR shall use the resources of the equipment and unit process systems suppliers in this work, particularly for specific equipment and unit process systems.
   2. An initial draft Plan for the Facility shall be completed and submitted by the CONTRACTOR to the ENGINEER for review at least 90 days prior to the expected commencement of commissioning. The ENGINEER will require 45 days to review the submittal and return with any exceptions noted. The CONTRACTOR shall incorporate

the ENGINEER's comments into the revised Plan within 30 days of receiving comments, and reissue the Plan to the ENGINEER and OWNER.

B. The CONTRACTOR shall provide a dedicated field staff to support the Plan activities. A full-time Startup Manager shall be responsible for day to day activities and shall be the primary contact with the ENGINEER regarding Plan activities. Support staff shall include but not be limited to designated mechanical, electrical and instrumentation and control ENGINEERs and technicians, and operating staff.
   1. The CONTRACTOR may require assistance from the OWNER's operating and maintenance staff in commissioning and performance testing activities specified herein. Activities requiring OWNER's staff shall be specifically noted in the Plan.

C. The Plan shall define:
   1. A chronological schedule of all testing and inspection activities.
   2. A checklist of all inspection and testing activities broken down by location, discipline, system, and device or item.
   3. All blank forms proposed by the CONTRACTOR for verification or recording of the functional completion testing, startup, commissioning and performance testing.
   4. An index which cross references the forms to their intended application(s).
   5. A list of all supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for retesting, in the event it is required.
   6. A list of participants in functional completion testing, startup, commissioning, and performance testing.
   7. A list of special test equipment required for functional completion testing, startup, commissioning, and performance testing.
   8. Sources of the test media (water, power, air.) for functional completion testing.
   9. The proposed method of delivery of the media to the equipment to be tested during functional completion testing, startup, commissioning, and performance testing.
   10. Temporary or interim connections for the sequencing of multiple units during functional completion testing, startup, commissioning, and performance testing.

D. The CONTRACTOR shall designate, in the Plan, a Testing and Checkout Coordinator, to coordinate and manage the activities defined in the Plan.

1.06 ROLES AND RESPONSIBILITIES

A. CONTRACTOR shall provide competent, qualified representatives of material, equipment, and system manufacturers to provide services specified, including supervising installation, adjusting, starting-up, and testing of materials and equipment.

B. The CONTRACTOR shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the Plant Testing, Startup and Commissioning specified herein. In addition, the CONTRACTOR shall arrange for and provide the participation or assistance of survey crews, quality control technicians, Supplier's representative(s), and required governmental agency representatives.

C. The CONTRACTOR shall provide the services of the Supplier's representative(s) as follows:
   1. Assistance during installation as specified in Divisions 1 through 16 and as specified herein.
   2. Field Testing as specified in Divisions 1 through 16 and as specified herein.

3. Startup as specified in Divisions 1 through 16 and as specified herein.
4. Commissioning as specified in Divisions 1 through 16 and as specified herein.

D. The Supplier's representative's activities required by this Section are in addition to the requirements for vendor training and other services specified elsewhere in the Contract Documents. Timing for the performance of these services is to be defined in the CONTRACTORS Checkout Plan, specified herein, and shall not be concurrent.

E. The ENGINEER will review and comment on the CONTRACTOR's deliverables, participate in the physical inspection activities, witness the shop and field testing, witness functional testing, maintain the permanent record of all testing results, and provide verification of conformance to the specifications. The ENGINEER's right to perform inspections, witness tests or monitor or assess the Work and activities does not relieve the CONTRACTOR of its obligation to comply with the requirements of the Contract Documents nor does it imply completion of the Work.

1.07 FUNCTIONAL COMPLETION TESTING

A. Functional Completion Testing shall be completed as construction and installation of equipment is completed to demonstrate that the equipment is ready for equipment and systems startup.

B. Functional Completion Testing shall be done in a coordinated manner based on the Plan prepared by the CONTRACTOR.

C. The OWNER's operating and maintenance staff shall be allowed to observe for the purposes of familiarization and training.

D. Functional Completion Testing procedures and documentation forms shall be developed by the CONTRACTOR. The procedures shall include a listing of items inspected for Functional Completion Testing.

E. If any equipment or unit process systems do not meet Functional Completion Testing requirements, it shall be the responsibility of the CONTRACTOR and/or equipment suppliers to make the necessary corrections or replacements and repeat the test.

F. The equipment and unit process systems shall not be started up or put into service until the Functional Completion Testing is completed as evidenced by a completed Functional Completion Testing certificate for the equipment or subsystem.

G. Modifications to the equipment and unit process systems required to meet Functional Completion Testing requirements shall be provided, and all retesting shall be performed at no additional cost to the OWNER.

H. A Functional Completion Testing Certificate shall be prepared by the CONTRACTOR for each piece of equipment or system and submitted to the ENGINEER and OWNER for review.

1.08 COMMISSIONING

A. All equipment shall be commissioned.

B. Commissioning activities for the project shall not be initiated until the requirements of Startup are completed for the equipment or unit process systems.

C. The requirements of this section shall be satisfactorily completed prior to beginning Performance Testing for equipment and unit process systems.

D. Commissioning shall be used by the CONTRACTOR and equipment or unit process suppliers to adjust, fine tune, modify and prepare the equipment or system for continuous operation and Performance Testing.

E. Equipment shall not be operated without the guidance of qualified personnel having the knowledge and experience necessary to conduct proper operation thereof and obtain valid results.

F. All required adjustments, tests, operation checks, and Startup and Commissioning activities shall be provided by qualified personnel.

G. CONTRACTOR shall be responsible for planning, supervising, and executing the Startup and Commissioning of the equipment and unit process systems with the assistance of equipment or unit process systems suppliers in accordance with the Plan.

H. The CONTRACTOR shall be responsible for commissioning under the direction of its Startup Manager.

I. The OWNER's operating and maintenance staff shall be allowed to observe for the purposes of familiarization and training.

J. For equipment or unit process systems that do not meet Commissioning requirements, it shall be the responsibility of the CONTRACTOR and/or equipment or unit process systems suppliers to make the necessary corrections or replacements and repeat Commissioning at no additional cost to the OWNER.

K. The equipment or unit process systems shall not be Performance Tested or otherwise placed into service until Commissioning is completed as evidenced by a completed Commissioning certificate for the equipment or unit process systems.

L. Commissioning Certificates for each piece of equipment or unit process shall be completed and submitted by the CONTRACTOR to the ENGINEER and OWNER for review.

1.09 PERFORMANCE TESTING AND OPERATIONAL DEMOSTRATION

A. CONTRACTOR shall demonstrate the operation of all equipment and systems. CONTRACTOR shall provide all labor, materials, services, equipment, and incidentals required for Performance Testing and Operational Demonstrations as indicated in the Contract Documents. This Performance Testing and Operational Demonstrations shall be conducted, coordinated and recorded by the CONTRACTOR in accordance with the requirements

specified herein and in cooperation with the OWNER and ENGINEER. The pump station will not be considered Substantially Complete until the completion of the performance testing and operational demonstration.

B. This Work is additional to any other installation, shop and factory testing, field testing, dry testing, wet testing, performance testing, balancing or adjustments required elsewhere in the Contract Documents.

C. Conduct Performance Testing and Operational Demonstration testing for each item of process, mechanical, instrumentation and controls, plumbing, heating, ventilating, and air conditioning (HVAC); electrical systems and equipment, and other systems and equipment, to demonstrate compliance with the performance requirements of the Contract Documents.

D. Objectives of Performance Testing and Operational Demonstrations are to:
   1. Demonstrate to the satisfaction of the OWNER and ENGINEER that structures, equipment and systems tested comply with all functional and performance requirements in the Contract Documents.
   2. Establish baseline operating conditions for OWNER's use in establishing standard operating procedures and preventative maintenance programs.
   3. The Performance Testing shall maintain conformance with performance tolerances for a period of not less than 7 days. If a testing failure occurs (whether process, mechanical, electrical, instrumentation) during the 7-day testing period, the malfunction shall be repaired, and the 7 day testing period shall restart.
   4. The Operational Demonstrations shall maintain conformance with the performance tolerances for a period of not less than 14 days. If a testing failure occurs (whether process, mechanical, electrical, instrumentation) during the 14- day testing period, the malfunction shall be repaired, and the 14-day testing period shall restart.

E. Utilities and Consumables:
   1. CONTRACTOR shall provide the following: fuel, compressed air, temporary conduit, cable and wire, piping and appurtenances, and all other items and Work required for completing Performance Testing and Operational Demonstrations.
   2. OWNER will provide the electricity, chemicals, and plant water for the initial Performance Testing and Operational Demonstrations. CONTRACTOR shall provide all temporary electrical equipment, including but not limited to conduit and cable, piping and appurtenances required to convey electricity, chemicals, and plant water to the required testing location. If re-testing is required, cost of utilities and consumables furnished by OWNER for initial testing shall be paid by CONTRACTOR at OWNER's cost or standard rates, as applicable.

F. Sequence: The following general sequence applies to Performance Testing and Operational Demonstrations:
   1. Furnish submittals required prior to Performance Testing, in accordance with the Contract Documents.
   2. Furnish acceptable operations and maintenance manuals in accordance with the Contract Documents.
   3. Complete the Work associated with starting and placing equipment and systems in operation in accordance with the Contract Documents.
   4. Training of operations and maintenance personnel in accordance with Section 01820, Demonstration and Training. Training must occur prior to the Operational Demonstration.

5. Proceed with Performance Testing in accordance with the Contract Documents, simulating the range of actual operating conditions to the greatest extent possible.
6. Complete site quality control Work specified in the Contract Documents for individual equipment items and systems. Field inspection, testing, and adjustments shall be signed off by approved representative of the Manufacturer, indicating that the equipment, components, systems, or unit processes meets the Manufacturer's requirements.
7. Following acceptance of the Performance Testing by the ENGINEER and OWNER, CONTRACTOR shall initiate a 14-day Operational Demonstrations, as described herein.
8. Successful completion of Operational Demonstration is part of the requirements to achieve Substantial Completion.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 STARTUP

A. The CONTRACTOR's Performance Testing Manager and Manufacturer's Representative shall inspect equipment and systems prior to each start-up and verify their readiness for start-up. Conditions hazardous to equipment or personnel shall be corrected by the CONTRACTOR's Performance Testing Manager prior to start-up of equipment.

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

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

D. The CONTRACTOR's Performance Testing Manager shall verify that all initial copies of the maintenance and operating instructions have received, from the ENGINEER, an acceptable disposition as defined in Section 01330, Submittal Procedures, and the only outstanding item is the field verification of the maintenance and operating instructions.

E. CONTRACTOR's Performance Testing Manager shall compare, and make adjustments to conform to; the Manufacturer's recommendations for the following minimum start up requirements:
   1. Motor Bearings and Shafting:
      a. Inspect for cleanliness, and clean and remove foreign matter.
      b. Verify alignment.
      c. Replace defective bearings and those that operate rough or noisy.
      d. Grease as necessary, in accordance with Manufacturer's recommendations.
   2. Motors:
      a. Check each motor for comparison to amperage nameplate value.
      b. Correct conditions that produce excessive current flow and conditions that exist due to equipment malfunction.

3. Pipe System:
    a. Check glands and seals for cleanliness and adjustment before running pump.
    d. Verify that piping system is free of dirt and scale before circulating liquid through system.
4. Valves:
    a. Inspect manual and automatic control valves, and clean bonnets and stems.
    b. Tighten packing glands to ensure no leakage, but allow valve stems to operate without galling.
    c. Replace packing in valves to retain maximum adjustment after system is determined to be complete.
    d. Replace packing on valves that continue to leak.
    e. Remove and repair bonnets that leak.
    f. After cleaning, coat packing gland threads and valve stems with surface preparation of “Molycote” or “Fel-Pro”.
    g. Verify that control valve seats are free from foreign matter and are properly positioned for intended service.
5. Tighten flanges and other pipe joints after system has been placed in operation.
    a. Replace gaskets that show signs of leakage after tightening.
6. Inspect all joints for leakage:
    a. Promptly remake each joint that appears to be faulty; do not wait for rust or other corrosion to form.
    b. Clean threads on both parts, and apply compound and remake joints.
7. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats, and headers in fluid system to ensure freedom from foreign matter.
8. Remove rust, scale, and foreign matter from equipment and renew defaced surfaces.
9. Inspect fan wheels for clearance and balance.
10. Check each electrical control circuit to ensure that operation complies with the Contract Documents.
11. Inspect each pressure gauge, thermometer, and other instruments for calibration.
    a. Replace items that are defaced, broken, or that read incorrectly.
12. Repair damaged insulation.
13. Vent gasses trapped in systems.
14. Verify that liquids are drained from all parts of gas or air systems.

A checklist showing the completed steps shall be submitted to OWNER upon successful start-up.

3.02 COMMISSIONING

A. On successful completion of startup, the CONTRACTOR shall begin commissioning of the equipment and systems, wherein the equipment and systems are subjected to full operation. Adjustments shall be made as necessary and the equipment and system shall be optimized and brought into compliance with design criteria in preparation for performance testing and the Operational Demonstration specified within the Contract Documents.

B. The various vendors, equipment suppliers and manufacturers shall provide on-site supervision and assistance for Commissioning services for the new facility.

C. The CONTRACTOR shall coordinate all Commissioning activities for equipment and systems in accordance with the accepted commissioning plan.

D. Commissioning shall show that the equipment and unit process systems are capable of continuous operation using process liquids and solids, chemicals, and utilities; and that the flows, operating parameters and performance requirements have been demonstrated for a minimum of seven days of continuous operation, or the period required in the equipment specifications, whichever is longer.

E. If the commissioning fails, the CONTRACTOR will be responsible for redoing the commissioning at no additional costs to the OWNER.

F. Shutdowns that occur because of power outages, acts of God, or failure of support systems not part of this contract will not be a cause of failure of continuous operation during the Operational Demonstration.

3.03 PERFORMANCE TESTING AND OPERATIONAL DEMONSTRATION

A. CONTRACTOR shall perform Operational Demonstration of the work. Unless otherwise specified, the Operational Demonstration shall be a continuous 14-day (336 hours) period during which the work is operated and maintained in a continuously on-line, fully functional process status.

B. The Operational Demonstrations shall encompass the entire work, or the portion thereof designated for Substantial Completion. The Operational Demonstrations shall include all the equipment and systems.

C. Filling, draining, cleaning, stabilizing, adjusting, or other start-up activity time shall not be counted as Operational Demonstration time.

D. During the entire 14-day Operational Demonstration period, the operation of equipment will be assumed by the OWNER's personnel, under the direction of the CONTRACTOR. The CONTRACTOR shall provide labor and sufficient material to fully operate and maintain the work 24 hours per day, 7 days per week for the entire duration of the Operational Demonstrations.

E. Prior to the Operational Demonstrations, all parts of the work designated for the operational demonstration shall have passed all required tests as specified. No testing shall be allowed during the Operational Demonstrations.

F. During the Operational Demonstration period, CONTRACTOR shall obtain baseline operating data on equipment with motors greater than one horsepower. Baseline data shall include amperage, bearing temperatures, and vibration data obtained at intervals in the approved testing plan. Methods of measurement shall be in accordance with industry standards applicable for the motors being tested.

G. All required maintenance and servicing prior to the date of Substantial Completion shall be performed by the CONTRACTOR at the specified interval and as necessary. All maintenance and servicing shall be noted in the Operational Demonstration Log.

H. All outages of equipment or system(s) should be noted in the Operational Demonstration Log. Plant outages are considered a part of normal plant operation and will not invalidate the Operational Demonstration. The CONTRACTOR is responsible for the safe and orderly shutdown and restart of equipment as necessary in the event of an outage.

I. CONTRACTOR and Performance Testing Manager shall attend Operational Demonstration coordination meetings as called by the ENGINEER to review operating conditions of equipment and systems.

J. If during the Operational Demonstration, any part of the work fails to fully conform to the requirements of the Contract Documents, the Operational Demonstration shall be considered to have failed, and the work shall not be considered to be Substantially Complete, and the ENGINEER shall so notify the CONTRACTOR in writing. The WTP Filter Backwash Improvements project will require several start/stop procedures be simulated including power failures which test the ATS and generator. The specific number will be confirmed in review of the commissioning plan. If, during the Operation Demonstration, the provisions of the General Conditions are evoked to stop the work, the Operational Demonstration will also be considered to have failed.

K. Re-testing Because of Disputed Testing Results or Procedures: In the case of an otherwise satisfactory Operational Demonstration, when there is doubt, dispute, or difference between ENGINEER and CONTRACTOR regarding testing results, methods, or equipment used in the Operational Demonstration testing, ENGINEER may order CONTRACTOR to repeat the testing. If repeat testing using such modified methods or equipment required by ENGINEER confirms the previous test, all costs of repeat test will be paid by OWNER. Otherwise all costs, including costs of the ENGINEER, labor, testing agencies, and inspections, shall be paid by CONTRACTOR.

L. Post-test Inspection: After completing Operational Demonstration testing, check equipment for proper alignment and realign, as required. Check equipment for loose connections, unusual movement, and other indication of improper operating characteristics. Disassemble and inspect equipment and devices that exhibit unusual or unacceptable operating characteristics. Repair or replace defective Work to conform to the Contract Documents at no additional cost to OWNER.

M. Upon failure of the Operational Demonstration, the CONTRACTOR shall promptly remedy any defects in the work and shall promptly reschedule and re-start the complete 14-day, (336 hours) Operational Demonstration time period. No Operational Demonstration time will be considered to have accrued to any part of the work by reason of a failed Operational Demonstration.

N. During the Operational Demonstration, the OWNER may require or permit the Operational Demonstration to be suspended:
   1. As provided in the General Conditions.
   2. Upon the written request of the CONTRACTOR, to correct or adjust the work, when in the judgment of the ENGINEER such required correction or adjustment is insufficient to deem the Operational Demonstration to have failed.
   3. If the Operational Demonstration is suspended for any reason except failure, Operational Demonstration time shall accrue to the work from the time of the beginning of the Operational Demonstration to the time of the suspension.
   4. If the Operational Demonstration is suspended at the request of the CONTRACTOR, the CONTRACTOR shall continue operation and maintenance of the work without additional charges to the OWNER, according to the extent required by the Contract Documents and the OWNER. No Operational Demonstration time shall accrue to the Work during the period of suspension.

O. Completion of the Operational Demonstration does not relieve the CONTRACTOR of its other requirements for Substantial Completion as required by the Contract Documents.

END OF SECTION

SECTION 01820 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Training

B, Instructor Manual

C. Trainee Manual

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330:
   1. Submit two copies of the outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   2. Submit resumes, including three outside references, for each instructor proposed for training program. The qualifications of the instructor shall include the type of training instructor has received for the specific equipment and previous training work experience.
   3. Submit two (2) electronic copies of each training module within seven (7) calendar days following the delivery of each training module.
   4. On each copy of the training module, provide an applied label with the following information:
      a. Name of Project.
      b. Training Session Name.
      c. Name of Engineer.
      d. Name of Construction Manager.
      e. Name of Contractor.
   5. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in a PDF electronic file. Include a table of contents with links to corresponding training components.
      a. The PDF electronic file format shall be electronically searchable.

1.03 COORDINATION

A. Contractor to coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of the Owner's personnel. Contractor shall schedule training sessions at least 60 days in advance.

B. Contractor shall provide a minimum of two (2) training sessions on the valves and flow meters. Each of the two training sessions shall cover all topics related to operating the valves to control backwash rates. Training sessions shall be on non-consecutive weeks to accommodate shift changes at the plant.

C. Training sessions shall be provided prior to the operational demonstration.

D. Contractor to coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

E. Contractor to coordinate content of training modules with content of accepted emergency, operation, and maintenance manuals. Do not submit instruction program(s) for review until the operation and maintenance data required under Section 01781 has been reviewed and accepted by Engineer.

PART 2 - PRODUCTS

2.01 INSTRUCTOR MANUAL

A. The Contractor shall prepare an Instructor Manual or each curriculum that includes all of the information specified below and written at the journeyman level for electrician specialists, mechanical specialists and instrument technicians, and for water treatment plant operators, or other disciplines, depending upon the target audience.

B. The Instructor Manual shall be consistent with the nomenclature and contents of the accepted Contractor's O&M Manuals required in Specification Section 01781. The O&M Manuals cannot be substituted for the Instructor Manual.

C. The purpose of the Instructor Manual is to define the concepts and information that will be taught to each target audience and to describe the methods and materials to be used during the training. The Instructor Manual is designed to provide specific guidance to the Instructor regarding all aspects of the training program. The Instructor Manual shall include:
   1. Description of the equipment.
   2. Parts and equipment graphics.
   3. Safety procedures.
   4. Startup checks and procedures.
   5. Overview of routine operation, including startup and shutdown and operating parameters.
   6. Routine, preventive, and corrective maintenance procedures.
   7. Lubrication (schedule and type).
   8. Assembly and disassembly procedures.
   9. Troubleshooting procedures.
   10. Parts list.
   11. Special maintenance practices.
   12. Emergency shutdown.

D. All manuals shall be presented in electronic format per the requirements of Specification Section 01330. All equipment shall be cross-referenced to the equipment tag identification numbers.

E. Each Instructor Manual shall contain:
   1. Instructor Manual cover page.
   2. Instructor Manual table of contents.
   3. Lesson Plan cover page.
   4. Lesson Plan summary.
   5. Lesson Plan text, including:
      a. Identity of the target audience (a separate Lesson Plan is required for each target audience, such as mechanical O&M personnel, electronic/electrical O&M personnel, etc.).

b. Length of the training program and each topic to be covered.
c. Performance and/or training objectives.
d. Outline of the material to be covered.
e. Training strategies to be used and interaction with the trainees.
f. Audio visual and/or support materials required, and when used or referred to during instruction.
g. A list of resource and/or reference materials.

6. A copy of all training aids, including electronic files.
7. A copy of trainee materials (handouts, reference materials, etc.) in electronic format.

F. The Contractor shall submit the equipment manufacturer's lesson plans for acceptance by the Engineer no less than ninety (90) days prior to the date that the training is to take place.

G. With the exception of cutaway models or other items expressly exempted by the Engineer, all training aids and trainee materials contained in the Instructor Manual or used in the delivery of training shall become the property of the Owner and may be duplicated by the Owner for its own use.

H. The Contractor shall provide required acceptance and/or copyright releases obtained from those who own proprietary and/or copyrighted materials provided by the Contractor so that the materials can be reproduced by the Owner.

2.02 TRAINEE MANUAL

A. Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required in the individual Specification Sections.

B. The Contractor shall submit a Trainee Manual for each curriculum that includes all of the information specified below and written at the journeyman level for electrician specialists, mechanic specialists and instrument technicians, and for water treatment plant operators, or other disciplines, depending upon the target audience.

C. The Trainee Manual shall be consistent with the nomenclature and content of the accepted Contractor O&M Manuals required in Specification Section 01781. The O&M Manual cannot be substituted for the Instructor Manual or Trainee Manual.

D. The purpose of the Trainee Manual is to provide an organized package of information for use by trainees during the training sessions and as reference Water Treatment Plant (New) material for operation and maintenance in the future. The Trainee Manual shall include:
1. Description of the equipment.
2. Parts and equipment graphics including "exploded" views.
3. Safety procedures.
4. Pre-startup checks.
5. Startup procedures.
6. Operation and monitoring procedures including normal operating parameters, and the operating limits of the equipment.
7. Shutdown procedures.
8. Troubleshooting procedures.
9. Non-routine emergency procedures.
10. Safety/Protective equipment required by Trainees.

E. All manuals shall be presented in electronic format per the requirements of Specification Section 01330. All equipment shall be cross-referenced to the equipment tag identification numbers.

F. The Contractor shall provide at least one hard copy of each Trainee Manual for each trainee. Hard copies shall be on 8.5" x 11" paper in a 3-hole D-ring binder.

PART 3 - EXECUTION

3.01 FACILITIES FOR TRAINING

A. Use Owner's designated training facilities for specified field training programs. Facilities shall include the project site, which shall be used for hands-on training programs. Coordinate use of Owner's facilities with Owner.

3.02 ON-SITE TRAINING

A. Training shall include the following:
   1. Equipment Overview (required for all types of operations and maintenance training):
      a. Describe equipment's operating (process) function and performance objectives.
      b. Describe equipment's fundamental operating principles and dynamics.
      c. Identify equipment's mechanical, electrical, and electronic components and features. Group related components into subsystems and describe function of subsystem and subsystem's interaction with other subsystems.
      d. Identify all support equipment associated with operation of subject equipment, such as air intake filters, valve actuators, motors, and other appurtenant items and equipment.
      e. Identify and describe safety precautions and potential hazards related to operation.
      f. Identify and describe in detail safety and control interlocks.
   2. Operations Training:
      a. Describe operating principles and practices.
      b. Describe routine operating, start-up, and shutdown procedures.
      c. Describe abnormal or emergency start-up, operating, and shutdown procedures that may apply.
      d. Describe alarm conditions and responses to alarms.
      e. Describe routine monitoring and recordkeeping procedures.
      f. Describe recommended housekeeping procedures.
      g. Describe how to determine if corrective maintenance or an operating parameter adjustment is required.

B. Maintenance Training:
   1. Describe preventative maintenance inspection procedures required to: inspect equipment in operation, identify potential trouble symptoms and anticipate breakdowns, and forecast maintenance requirements (predictive maintenance).
   2. Define recommended preventative maintenance intervals for each component.
   3. Describe lubricant and replacement part recommendations and limitations.
   4. Describe appropriate cleaning practices and recommend intervals.
   5. Identify and describe use of special tools required for maintenance of equipment.
   6. Describe component removal, installation, and disassembly and assembly procedures.
   7. Perform "hands-on" demonstrations of preventive maintenance procedures.

8. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
9. Define recommended torqueing, mounting, calibrating, and aligning procedures and settings, as appropriate.
10. Describe recommended procedures to check and test equipment following corrective maintenance.

C. Equipment Troubleshooting:
1. Define recommended systematic troubleshooting procedures.
2. Provide component-specific troubleshooting checklists.
3. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
4. Describe common corrective maintenance procedures with "hands on" demonstrations.

D. Instrumentation/Controls Training:
1. Instrumentation and controls training shall be provided in accordance with Section 13410 Basic Instrumentation Requirements.

E. Equipment to be covered during training shall be per the requirements of the individual sections of the Contract Documents. This may include, but is not limited to the following topics listed in Table 01820-A, Training Summary Table.

01820-A, Training Summary Table

Equipment	Specification Section
Basic Instrumentation Requirements	13410

3.03 SCHEDULE

A. The Contractor shall coordinate the manufacturer's training services with the Owner and the Engineer, providing a minimum of thirty (30) days prior notice of training, subject to the acceptance of the Engineer and the Owner.

B. Training shall occur prior to the operational demonstration.

END OF SECTION

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. It is the intent of this Section that all painting necessary to result in a complete, finished appearing facility be accomplished. As part of the work of this Section, prepare surfaces that are to be painted and furnish and apply paint materials. Paint schedules follow the text of this Section and define the surface preparation and coating systems required to paint the various types of surfaces that are to be painted. The Paint Application Table below identifies the areas to receive the paint systems specified in the paint schedules. For items or areas not listed in the Paint Application Table, consult the ENGINEER for the proper system to be used. Exclusion from the Paint Application table does not necessarily indicate that an item or area does not require painting.

B. Acceptable manufacturers shall be Tnemec and Carboline.
   1. The paint schedules that follow this specification have been developed for Tnemec products. If Carboline products are to be used, submit schedules describing Carboline's equal products and colors for review and approval.

C. Paint Application Table

Schedule M2: Interior Metal

Paint the following interior metal items: pumps (including discharge heads), piping and plumbing hangers and supports, exposed-to-view metallic electrical conduits and wiring device enclosures, all mechanical and electrical equipment except equipment with a baked-on factory finish, and all related work.

Pretreatment (Schedule M7) followed by touch-up painting of damaged galvanizing on galvanized metal items with a zinc-rich primer shall be performed before application of paint.

Painting of piping shall not occur with water moving through the piping. Painting of all piping must be approved by the ENGINEER before the piping is insulated. Any piping covered by a support or hanger shall be painted before placement on the support or in the hanger, no unpainted sections of pipe shall be allowed.

Backwash Pump 1 discharge piping shall be painted from the discharge flange of the pump to the inside face of the pump room wall. This entails approximately 55 linear feet of piping.

Backwash Pump 2 discharge piping in the basement shall be painted. This entails approximately 14 linear feet.

Cistern piping shall be completely shop painted as noted on Drawings prior to installation.

Choice of colors required. Multiple colors will be required for different items. Number of colors: Twelve (max).

Schedule PP1: Process Piping

Paint carbon steel and ductile iron piping.

Choice of color required. Number of colors: Up to six.

D. In addition to the painting indicated in the above Paint Application Table, paint all aluminum surfaces that will be in contact with concrete or dissimilar metals using two coats of the prime coat specified for Exterior Metal. Coordinate painting with the fabrication of components and with the work of other trades so as to ensure the full and correct application of paint materials.

E. In addition to the painting indicated in the above Paint Application Table, apply touch-up paint to finish defects and field cuts, welds, and penetrations of galvanized metal. Prepare and pretreat surfaces in accordance with Schedule M7 above and finish paint according to the appropriate paint schedule.

F. Prime and finish painting, regardless of the location in which the work is performed, shall conform to all requirements of this Section. Coordinate painting with the fabrication of components and with the work of other trades so as to ensure the full and correct application of paint materials.

1.02 DEFINITIONS

A. For the purposes of this Section, the following definitions apply: "Exposed to View" means all surfaces in the final work that could be seen from any vantage point from any height. "Paint" means all pretreatment, prime, intermediate and final coatings specified herein including clear, translucent and opaque materials.

1.03 QUALITY ASSURANCE

A. Applicator's Quality Assurance: Submit list of a minimum of 3 completed projects of similar size and complexity to this Work completed within the last 5 years. Projects shall demonstrate experience working on comparable structures. Include for each project:
   1. Project name and location.
   2. Name of project Owner, include a contact name and phone number.
   3. Name of General Contractor is different than Contractor holding this contract.
   4. Name of Engineer, include a contact name and phone number.
   5. Name of coating manufacturer.
   6. Approximate area of coatings applied.
   7. Date of completion.

B. Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. In the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

C. Apply paints following the recommendations in the "Applications Manual for Paint and Protective Coatings" published by McGraw-Hill.

1.04 FIELD QUALITY CONTROL

A. Inspector's Services: The Contractor shall hire Dixon Engineering or Nelson Tank (third party satisfactory to the Owner), at no additional expense to the Owner, to perform field inspections of items 1-4 below and prepare the field inspection reports described in item 5 below:
   1. Verify coatings and other materials are as specified.
   2. Verify surface preparation and applications are as specified.
   3. Visually inspect all welds prior to coating.
   4. Verify DFT of each coat and total DFT of each coating systems are as specified using wet film and dry film gauges.
   5. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
   6. Report:
      a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
      b. Report nonconforming work no corrected.
      c. Submit copies of report to Owner and Contractor.

1.05 SUBMITTALS

A. Provide submittals in accordance with Division 1 of the Specifications. Prior to ordering and delivering paint materials to the project site, submit the following:
   1. Manufacturer literature demonstrating compliance with these Specifications and indicating paint formulation, rate of coverage, recommended uses and recommended application method.
   2. Color chips for the full range of colors available in each product.

B. The paint products indicated in these Specifications establish the required standard of paint quality. Requests for substitution will not be considered.

1.06 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use. Store only the approved materials at the job site. Store them in a suitable and designated area restricted to the storage of paint materials and related equipment. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste. Store volatile solvents, rags and cleaning materials in a well ventilated area.

B. Use all means necessary to protect paint materials before, during, and after application and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the OWNER.

1.07 EXTRA STOCK

A. Upon completion of the work of this Section, deliver to the OWNER an extra stock of paint equaling approximately 2% of each color and gloss used in each coating material with all such extra stock tightly sealed in clearly labeled containers that have not been previously opened.

1.08 GUARANTEE

A. Furnish a 1-year warranty from the date of substantial completion on workmanship. Manufacturer to provide an unlimited warranty on the materials.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Provide paint materials in accordance with the paint schedules that follow the text of this Section.

B. All paint materials for each paint system shall be the products of a single manufacturer. All paint materials and equipment shall be compatible in use: finish coats shall be compatible with prime coats, prime coats shall be compatible with the surface to be coated, and all tools and equipment shall be compatible with the coating to be applied. Thinners, when used, shall be only those thinners specifically recommended for that purpose by the manufacturer of the material to be thinned.

C. Furnish finish paint in the colors selected by the OWNER from the manufacturer's standard available colors (a minimum of 12 colors must be available for each finish paint requiring color choice). Specially mixed colors may be required to achieve OSHA approved safety colors and to provide the piping and plumbing line colors to meet the OWNER’s color scheme. The City of Ann Arbor Color Coding of Piping schedule is appended to this specification for reference.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to beginning the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this application may properly commence. Verify that paint finishes may be applied in strict accordance with all pertinent codes and regulations and the requirements of these Specifications. In the event of discrepancy, immediately notify the ENGINEER. Do not proceed with application in areas of discrepancy until all such discrepancies have been fully resolved. Application of paint materials shall be deemed to indicate acceptability of the existing surface conditions.

3.02 SURFACE PREPARATION

A. General
   1. Prior to beginning surface preparation and painting operations, completely mask, remove, or otherwise adequately protect all hardware, accessories, machined surfaces, plates, equipment identification tags/nameplates, lighting fixtures, and all work of other trades that are not to receive the paint coating. Before applying paint, thoroughly clean and prepare all surfaces according to the specified surface preparation method. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
   2. Spot prime all necessary areas prior to beginning field painting.

B. Preparation of Metal Surfaces

1. Prepare metal surfaces for painting by following the method indicated on the appropriate paint schedule. Preparation methods are referenced to the Steel Structures Painting Council (SSPC) Specifications. Do not prepare metal for painting when the relative humidity is higher than 85% or the metal is less than 5°F above the dew point. After surface preparation, thoroughly clean all surfaces of any remaining dirt, oil and grease and leave it ready to receive prime paint.

3.03 PAINT APPLICATION

A. Apply paint in accordance with paint schedule requirements, the cited reference, all codes and regulations, and the recommendations of the paint manufacturer. Apply prime paint to metal surfaces within 24 hrs. after surface preparation. Do not apply paint in areas where dust is being generated.

B. Do not apply paint when the surrounding air temperature as measured in the shade is below 40°F or when the temperature of the surface to be painted is below 35°F. Do not apply paint when it is expected that the relative humidity will exceed 85% or that the air temperature will drop below 40°F within 18 hrs. after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, delay painting until certain that the surfaces can be kept above the dew point. Follow all additional environmental limitation requirements of the paint manufacturer.

C. Paint material mil thicknesses and numbers of coats that are indicated in the paint schedules are based on brush or roller application. Spray application of paint materials will be allowed in the field only for areas or surfaces that are very difficult to paint with brush or roller. Field spray application must be approved by the ENGINEER before its initiation. For areas that are spray painted, apply as many coats as necessary to achieve specified mil thicknesses.

D. Allow sufficient drying time between coats of paint. During adverse weather, extend length of drying time as recommended by the paint manufacturer.

E. Prior to applying each paint coating after the first, check mil thickness of previously applied coating(s). Correct for insufficient paint thickness by increasing the mil thickness of subsequent applications, if allowed by the paint manufacturer or by applying additional coatings to provide the specified paint thickness.

F. Spot sand between coatings to remove paint defects visible to the unaided eye from a distance of five feet.

G. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWAD 102.

H. Paint system for the concrete floors shall not be applied until all other work by other trades is complete.

3.04 CLEAN UP

A. During the progress of the work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose. Following completion of painting in each area, promptly remove all masking and temporary protection. After paint has dried, reinstall all items removed for painting. Upon completion of this portion of the work, visually inspect all surfaces and remove paint and traces of paint from surfaces not scheduled to be painted.

SCHEDULES FOLLOW

PAINT SCHEDULE M2

SERVICE: INTERIOR METAL

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Paint Manufacturer	Application	Product Name	Generic Type	No. of Coats	Dry Mils/ Coat	Sq. Ft Covered/ Gallon	Comments
Tnemec	Shop Primer	F.C. Typoxy Series 27	Polyamide Epoxy	one	4-6		
Tnemec	Field Primer	F.C. Typoxy Series 27	Polyamide Epoxy	touch-up	4-6		
Tnemec	Finish	H.B. Tneme-Tufcoat Series 114	Waterborne Acrylic Epoxy	one	4-6		Series 114 - Gloss

PAINT SCHEDULE PP1

SERVICE: PROCESS PIPING

Surface Preparation: Degreased in accordance with SSPC-SP1, SSPC-SP6 Commercial Blast Cleaning
Steel surfaces that are to be repainted shall be commercial blast cleaned in accordance with SSPC-SP6 until at least 2/3 of each element is free of all visible residues.

Paint Manufacturer	Application	Product Name	Generic Type	No. of Coats	Dry Mils/ Coat	Sq. Ft Covered/ Gallon	Comments
Tnemec	Shop Primer	F.C. Typoxy Series 27	Polyamide Epoxy	one	4-6		
Tnemec	Field Primer	F.C. Typoxy Series 27	Polyamide Epoxy	one	4-6		universal rust-inhibitive primer, with compatible with finish coat specified
Tnemec	Finish	H.B. Tneme-Tufcoat Series 114	Waterborne Acrylic Epoxy	two	2-3		Series 114 - Gloss

CITY OF ANN ARBOR WTP
STANDARD PAINT SCHEDULE

COLOR CODING OF PIPING

Potable Water: High Service, Transfer, & Wash Water (includes manhole covers)	Clear Sky en17 (tnemec)
Plant Pressure	PL12 (tnemec)

END OF SECTION

SECTION 09970 - LEAD PAINT ABATEMENT SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for working with lead-containing materials (LCM), during any of the following operations:
   1. Demolition of Lead-Containing Materials (LCM): Includes razing a building or any portion of a building or piece of equipment with LCM.
   2. Incidental Removal or Disturbance of Lead-Based Paint (LBP): This includes activities such as sanding and scraping for paint preparation activities.

B. Extent of known LCM is as follows:
   1. Backwash Pump 1 discharge piping in the Pump Room. Existing paint is Light Blue color.
   2. Backwash Pump 2 discharge piping in the Pump Room basement. Existing paint is Dark Blue color.
   3. Assume all other paints not previously tested are lead containing.

1.02 DEFINITIONS

A. The term “Lead-Based Paint” (LBP) is identified as paint or other surface coating such as varnish, sealer or stain containing lead in any detectable amount.

B. The term "Incidental Removal or Disturbance of Lead-Based Paint" indicates one or more of the following operations:
   1. Scraping, hand sanding, or otherwise removing loose LBP from existing surfaces scheduled to remain in place.

C. The term “Demolition of LCM” refers to cutting, drilling, abrading, demolishing, or otherwise disturbing building elements coated with LBP or containing lead.

D. The term “Lead-Containing Materials” (LCM) is identified as construction debris coated with lead-based paint or other materials containing lead, such as x-ray shielding.

E. The term "Critical Barrier" indicates the perimeter of the enclosure within which lead disruption/removal work takes place. Critical Barriers may include existing floor, wall, and ceiling structures, as well as constructed partitions, closures and seals.

F. The term "Project Site" indicates the limits of the Project Site as indicated on drawings or by provisions of this specification.

G. The term "Work Area" indicates the area within the Critical Barrier.

H. The term “Action Level” means exposure to an airborne concentration of lead of 30 micrograms per cubic meter of air calculated as an 8-hour time-weighted average (TWA).

I. The term “Exposure Assessment” means a determination of employee exposures for a given task measured by air monitoring. The Assessment must meet the criteria for objective data as outlined in

the MIOSHA/OSHA Lead in Construction Standard (MIOSHA Part 603, R325.51992 and 29 CFR 1926.62).

J. The term "OSHA PEL" stands for the Permissible Exposure Limit established by the Occupational Safety and Health Administration for lead exposure. The OSHA PEL refers to an airborne concentration of lead of 50 micrograms per cubic meter of air calculated as an 8-hour time-weighted average (TWA).

K. The abbreviation "TCLP" stands for Toxicity Characteristic Leaching Procedure and refers to one of the tests to determine if waste is considered a Hazardous Waste or non-hazardous solid waste.

L. The term "Hazardous Waste" refers to a listed waste or any solid or liquid waste with one or more of the following characteristics: toxic, corrosive, flammable, explosive, combustible, oxidizer, pyrophoric, unstable (reactive) or water - reactive.

M. The term "Non-Hazardous Waste" refers to any solid or liquid waste not exhibiting characteristics of Hazardous Waste.

1.03 SUBMITTALS

A. Exposure Assessment Documentation: Submit to all information used to document previous employee exposure assessments, if available. If not available, conduct an initial exposure assessment at the start of the project.

B. Written Compliance Plan: Submit a Written Compliance Plan incorporating all requirements in the MIOSHA Lead in Construction Standard. Also indicate type of containment and method of liquid waste capture to be established if water is utilized for removal.

1.04 QUALITY ASSURANCE

A. Personnel involved in the disturbance of LCM shall be trained in accordance with the requirements of the MIOSHA Lead in Construction Standard, including:
   1. The content of the MIOSHA Lead in Construction Standard and its appendices;
   2. The specific nature of the operations which could result in exposure to lead above the action level;
   3. The purpose, proper selection, fitting, use, and limitations of respirators;
   4. The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant);
   5. The engineering controls and work practices associated with the employee's job assignment including training of employees to follow relevant good work practices;
   6. The contents of any compliance plan in effect;
   7. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician; and
   8. The employee's right of access to records under 29 CFR 1910.20.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 HEALTH AND SAFETY REQUIREMENTS

A. General: Determine employee exposure to lead in air as required in MIOSHA Lead in Construction Standard.

B. Exposure Assessment: If the Contractor has made a previous Exposure Assessment that is representative of the task to be performed on-site, the Contractor may rely on this data and determine the need for personal protective equipment and work practice controls based upon this data, if approved by the City of Ann Arbor project manager.

C. Job requirements: When the Contractor does not have an Exposure Assessment or the Assessment is determined to be insufficient, the Contractor must conduct personal air monitoring in accordance with the MIOSHA Lead in Construction Standard and follow the requirements below which are outlined by job task until monitoring determines otherwise:
   1. Manual demolition, scraping, sanding, heat gun application, power tool cleaning with HEPA dust collection system, spray painting with LCM:
      a. Use of 1/2 mask respirator with HEPA filters.
      b. PPE.
      c. Medical surveillance.
      d. Use of changing room.
      e. Use of handwashing facilities.
      f. Provision of lead awareness training.
   2. Using lead mortar, lead burning, rivet busting, power tool cleaning without HEPA collection, cleaning up with dry expendable abrasives, removing or relocating enclosure:
      a. Loose fitting PAPR with HEPA or supplied air respirator.
      b. PPE.
      c. Medical surveillance.
      d. Use of changing room.
      e. Use of handwashing facilities.
      f. Provision of lead awareness training.
   3. Abrasive blasting, welding, using cutting torch, burning
      a. Supplied air respirator or SCBA.
      b. PPE
      c. Medical surveillance.
      d. Use of changing room.
      e. Use of handwashing facilities.
      f. Provision of lead awareness training.

3.02 PREPARATION

A. General: Prepare Work Areas in a manner that will protect Owner's personnel and property, and the visiting public, from contact with LCM. Prior to beginning work, confirm starting date and time with Owner. Do not begin work that will disturb LCM without Owner's approval.

B. Preparing Building Exteriors: Ensure adequate measures are in place to limit airborne lead content below the Action Level of 30 ug/m^3 (micrograms per cubic meter) adjacent to the Work Area.
   1. Erect barricades and install warning tape or signs as necessary to prevent inadvertent exposure of passersby to LCM in all forms, including, but not necessarily limited to dust, particles, and fumes.
   2. Completely cover grounds and vegetation with minimum 8-mil thick polyethylene sheets with joints between sheets lapped and taped; with one edge taped to adjacent building surfaces below area of work; and with free ends secured in position with stakes, tie-down lines or weights. Cover sufficient ground area to capture wind-blown chips, dust and particles.

C. Preparing Building Interiors: Ensure adequate measures are in place to protect building occupants from exposure to airborne lead dust, particles, fumes or other LCM exceeding the Action Level of 30 ug/m^3 (micrograms per cubic meter) lead content in air. Adequate measures shall include, but are not necessarily limited to, construction of Critical Barriers and/or establishment of negative pressure within Work Area.
   1. Seal off openings and penetrations into the Work Area. Provide temporary dust barriers consisting of at least polyethylene plastic sheet on wood studs. Lap and tape joints of plastic sheeting to prevent dust, particles, fumes, and other forms of lead debris from leaving the enclosed area.
   2. Discontinue building ventilation within the Work Area and seal off ventilation supply and return or exhaust diffusers, grilles or openings.
   3. Post warning signs at all entrances to the Work Area that state the following, as required in MIOSHA Lead in Construction Standard:
      WARNING
      LEAD WORK AREA
      POISON
      NO SMOKING OR EATING

3.03 WORK PRACTICES

A. General: Perform any removal, demolition or disturbance of LCM in compliance with the following requirements:
   1. Restrict access to Work Area to essential personnel.
   2. Use moist-removal methods and/or HEPA vacuuming where applicable. Do not over-saturate the Work Area.
   3. Any debris generated must be cleaned up immediately before it can be tracked into other areas.
   4. Remove contaminated clothing and personal protective equipment before leaving the Work Area, or Work Area enclosure, as applicable.
   5. If the Action Level is exceeded outside the Work Area, discontinue work and modify Critical Barrier, or perform other modifications of methods or materials as required to reduce the lead contamination below the Action Level.
   6. Prohibit eating, drinking, and smoking in the Work Area.

B. Incidental Removal of LBP: Remove paint from building surfaces by hand scraping and sanding; or through the use of fluid-applied chemical strippers designed to dry into a solid polymeric sheet and peel off with paint encapsulated. Hand-scraping and sanding must be used in conjunction with moist-removal methods using misted water. Leave moist paint dust and chips in place to air dry before collection.
   1. Wet methods (including power-washing) that use amounts of water that can drip, spill, or leak onto the ground, or onto or into other adjacent surfaces are prohibited unless approved by the City of Ann Arbor project manager.

2. Dry removal methods (including sand blasting, power sanding, and other methods relying on high velocity mechanical abrasion) that create airborne fine particulate waste materials are prohibited unless specifically reviewed and approved by City of Ann Arbor project manager.
3. Prior to torch-cutting building elements containing LBP, remove paint within four inches of centerline of cut in accordance with requirements of this Section.

3.04 DISPOSAL

A. Lead Painted Demolition Debris and Lead Paint Chips: In order to determine proper disposal of waste removed from the site, perform Toxicity Characteristic Leaching Procedure (TCLP) testing of LCM waste. If TCLP testing shows the waste to be nonhazardous, the waste can be disposed of as normal construction demolition debris. If waste is classified as Hazardous dispose of material as hazardous waste at an accepting landfill.
   1. When storing waste containers on-site, ensure that soil, ground water, and drains or sewers within the storage area are protected from possible contamination. Keep containers secure and tightly closed at all times, except when adding waste.
   2. Keep lead waste segregated from other waste. Do not co-mingle waste. **DO NOT MIX LIQUID AND SOLID WASTE**.
   3. Place appropriate labels on all containers. Provide all information required on the label; mark labels using indelible ink.

3.05 CLEAN UP

A. Upon completion of LCM or LBP removal and disposal operations, clean all surfaces within the Work Area before it can be tracked into other areas, including, but not necessarily limited to the following:
   1. Siding.
   2. Steel support structures.
   3. Floors and ground.
   4. Walls.
   5. Window sills.
   6. Trim.
   7. Ledges and projections.

B. For projects within building interior spaces, use a HEPA filtered vacuum for removal/elimination of dust, particulates, and debris.
   1. Brushing, brooming and other dry methods that generate airborne dust are prohibited.

C. Remove and dispose of wash water and HEPA filters as Hazardous Waste.

D. Remove and dispose of all solid waste used for protection and clean-up as Non-Hazardous Waste as indicated in Section 3.4, “Disposal of Non-Hazardous LCM from Demolition/Renovation Activities”.

E. Field Testing: The Owner may visually inspect and/or test the Project Site for evidence of remaining lead contamination. Return to Project Site and, at no additional cost to Owner, re-clean areas found to be contaminated.

END OF SECTION

SECTION 13410 - BASIC INSTRUMENTATION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative and procedural requirements for instrumentation installations. Administrative and procedural requirements are included in this Section to expand on requirements specified in Division 1.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each product specified.
   2. Wiring diagrams, both elementary and schematic, differentiating between manufacturer installed and field-installed wiring.
   3. Digital Systems: Provide the following:
      a. Digital equipment layouts of input and output racks showing complete module model number and addressing assignment. Layouts of port pin assignment, connection schematic indicating cable types and port addresses.
   4. Software Programs: One fully annotated printed copy of program prior to factory test, along with digital program files. In addition, provide required number of copies of latest revisions of program at time of acceptance by OWNER. Submittal of printouts, listings, and screen images shall be supplied on paper (hard copy). With concurrence of OWNER and ENGINEER, machine readable magnetic copies may be supplied in addition to printed copies as a matter of convenience. Format of magnetic media (CD/DVD or flash media) shall be as mutually agreed with OWNER.
   5. Programmable Logic Controllers: Submits lists of input and output assignments, data file structures used, and internal data points. Show points used to communicate with between PLCs and the operator interface and data collection segments. Include complete, fully annotated ladder logic diagrams complete with cross-reference listings.
   6. Operator Interface and Supervisory Control: Submit "screen dump" images of each proposed operator interface screen. Describe color schema, mouse button use, function key controls and communication protocol with PLCs. Provide a flow diagram showing screen navigation. Show sample event and alarm log outputs.
   7. Data Collection: Submit details of data structures, communications protocols, data exchange formats, sampling intervals, and file storage space management. Provide "screen dump" images of historical trending.

B. Record Drawings: At Project closeout, submit record drawings of installed products, in accordance with requirements of Section 01770.
   1. Where Drawings are drafted by computer equipment, CONTRACTOR shall furnish files on a disk (in PDF .pdf and AutoCAD .dwg format). These Drawings shall include changes made by Field Orders, Change Orders, Addenda, and errors discovered during start-up and acceptance.
   2. Drawings shall include terminal numbers at each wiring termination and piping termination. A complete system diagram shall be included.

C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section.
   1. Instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating equipment. Instructions shall include procedures for tests required, adjustments to be made, and safety precautions to be taken with equipment. These documents are to be submitted to ENGINEER's office.
   2. Provide 1 complete set of manufacturer's documentation covering programmable equipment supplied. Include hardware manuals and prints as manufacturer normally ships with programmable equipment.
      a. Include complete software manuals for operating system, as well as manuals for any other software. Written instructions for the operations and maintenance of software shall be provided. The instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating software.
      b. Include program listings, point/address lists, cross-reference listings, images of screens, data entry forms, and sample reports.
      c. Manuals shall include instructions for program users and instructions for maintenance programmers.
      d. Final, as-installed PLC and HMI programs upon completion of start-up

D. Warranty: Submit in accordance with requirements of Section 01770, warranties covering the items included under this Section.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. National Electric Code.
   2. Applicable State and local requirements.
   3. UL listing and labeling shall be adhered to.

C. Items covered by this Section are designated as undelivered specifically manufactured equipment for which associated progress payments will be made in accordance with this Specification.

D. Equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that equipment furnished has been manufactured in accordance with National Electric Code and OSHA requirements.

E. CONTRACTOR shall provide permits and licenses, observe and abide by applicable laws, regulations, ordinances, and rules of State, territory or political subdivision thereof, wherein the Work is done. CONTRACTOR shall pay fees for permits, inspections, licenses, and certifications when such fees are required.

F. To ensure timely performance and conformance with Specifications, Project meetings shall be held at OWNER's facility once every 3 months during course of Project. Cost of such meetings shall be included.

G. Component Requirements: For the purposes of uniformity and conformance to industry standards, signal transmission modes shall be electronic 4-20 mA DC. No other signal characteristics are acceptable, except for remote temperature detector (RTD) and thermocouple (TC) sensing circuits; 4-20 mA DC signals shall be such that devices may be wired in parallel for 1-5 volt DC as required. 1-5 volt DC mode shall be employed only within control panel enclosures.

H. Responsibility and Coordination: Drawings and Specifications are intended to include details of a complete equipment installation for purposes specified. CONTRACTOR shall be responsible for details which may be necessary to properly install, adjust, and place in operation complete installation. Any error on Drawings or in Specifications which prevents proper operation of supplied system shall be shown correct at time of Shop Drawing submittal for approval or brought to attention of ENGINEER with or prior to submittal.

I. CONTRACTOR shall be responsible for costs incurred to correct aforementioned errors brought to ENGINEER's attention. CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Manufactured material shall be adequately packed to prevent damage during shipping, handling, storage, and erection. Material shipped to Site shall be packed in a container properly marked for identification. Blocks and padding shall be used to prevent movement.

B. CONTRACTOR shall inspect the material prior to removing it from carrier. If damage is observed, CONTRACTOR shall immediately notify carrier so that a claim can be made. If no such notice is given, material shall be assumed to be in undamaged condition; any subsequent damage that occurs to the equipment shall be the responsibility of CONTRACTOR. Repair and replacement of damaged parts will be done at no expense to OWNER.

C. CONTRACTOR shall be responsible for any damage charges resulting from handling of materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPLIERS

A. Subject to compliance with specified requirements, equipment suppliers shall be the following (no "or equals"):
   1. Commerce Controls Inc.
   2. Outbound Technologies
   3. Revere Control
   4. MR Systems
   5. CEC Controls

B. References made in these Specifications to specific manufacturer’s products are intended to serve as a guide to type, construction, and materials. Listing of a manufacturer does not imply acceptance by ENGINEER of a manufacturer's particular product, product line, or latest product revision if it does not meet Specifications.

C. Equipment Supplier: Equipment specified under Sections 13413 through 13491 and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to Site, and started up by one of the qualified and approved equipment suppliers listed under this Section. Intent is for unit responsibility.
   1. Equipment supplier shall not assign any of its rights or delegate any of its obligations under these Sections without prior written acceptance by ENGINEER.
   2. Direct purchase of any items in these Sections by CONTRACTOR is not in compliance with this Specification and will not be permitted.

2.02 EQUIPMENT

A. Transmitted electronic signals to equipment of other vendors and between control panels shall be a separate isolated-floating output for each item of equipment and shall conform to ISA Standard S50.1.

B. Enclosures shall be NEMA 12, 4, 4X, or 7 as indicated on Drawings. Intrinsically safe systems, as approved by Factory Mutual, shall be furnished when called for.

C. No external power connections shall be allowed unless specifically called for in Specification. Where an external power source is called for, unit shall accept 120 VAC, plus or minus 10 percent power.

D. Current-to-current converters shall be used as power boosters to provide sufficient signal power as required. It is equipment supplier's responsibility to determine under what circumstances and locations power boosters are required, provide them, and integrate them into the instrumentation system to make system function properly.

E. Separate power supplies shall be totally enclosed with solderless terminals for connections. They shall be short circuit current limiting type that will automatically resume regulation after removal of short circuit. They shall operate from 120 volt AC, plus or minus 10 percent power. Regulated voltage shall be fixed. Units with internal trim potentiometers will be accepted.
   1. Instruments shall be panel-mounted or enclosed for wall mounting as shown on Drawings.

F. Size and style of instruments are defined in Specifications. Pneumatic panel-mounted units shall match in appearance similar electronic components.

G. Solid-state output switches, where used, shall be overvoltage transient protected and not be damaged by dI/dT or dv/dt for their design application under this Contract.

H. Instruments shall be equipped with permanently attached identification tag. Tag shall be included on field- and panel-mounted devices. Tags shall include ENGINEER's tag identification and manufacturer's tag identification if different from ENGINEER's.
   1. Tags shall be either stamped metal or laminated phenolic with black letters engraved on a white background. Field-mounted devices shall have tags fastened with screws. Devices mounted in panels will be tagged inside panel on subplates or on device itself where it can be easily read.

I. Finish on instruments and accessories shall provide protection against corrosion by elements in environment in which they are to be installed. Both the interior and exterior of enclosures shall be finished. Extra paint of each color used on material shall be provided by manufacturer for touch-up purposes.

J. Provide equipment identification nameplates complying with Section 16075. Nameplates shall contain ENGINEER's item designation and, for indicators and transmitters, design range and units of device shown.

2.03 SOURCE QUALITY CONTROL

A. Prior to performing any programming work and prior to program-related shop drawing review, Contractor shall schedule a meeting between OWNER, ENGINEER and system supplier (including PLC and HMI programmer), to review system configuration and functional intent. Meeting will be held at ENGINEER's Ann Arbor office. Topics to be discussed include the following:
   1. Sequence of operations
   2. Functional intent
   3. Alarm list
   4. Verify ranges, signals, etc.
   5. IP addresses
   6. Color schemes
   7. Schedules

B. Control and monitoring system control panels and computer equipment, if any, shall be tested at the factory and witnessed by ENGINEER prior to shipment to Site. ENGINEER shall be given 4 weeks notice before factory test date. Factory test shall include checking for conformity to Specifications, fabrication, and nomenclature. Control and monitoring system logic and terminals shall be checked line by line and function by function in total for conformity of Drawings.

C. Conduct preliminary testing prior to factory checkout by executing programs supplied for this Project. Exercise inputs to test logic for correct function and proper response of outputs. Verify correct interface with programs. Verify correct communications.

D. Detailed factory testing procedures shall be developed and transmitted to ENGINEER for review prior to testing.

E. Factory testing shall be used to validate the following:
   1. Communication interconnections. Proper communication between devices and software components shall be demonstrated.
   2. Transmission of data
   3. Process control capabilities
   4. Functional intent
   5. User adjustable features
   6. Operation under simulated malfunction conditions
   7. Alarm and Trend information storage
   8. Data Collection and Data Management Reporting shall be demonstrated.

F. Equipment supplier shall have test equipment, interconnecting cables, and accessories available at the factory for the duration of the test. A full set of annotated logic programs and wiring diagrams with the latest revisions shall be made available to ENGINEER at factory for checking purposes. Drawings shall include wire numbers and terminal numbers.

G. Control panels and programmable equipment shall not be shipped to Site until logic conforms to Contract requirements and information discussed at progress meetings, physical changes required by

testing are made, and tags conform to factory test corrections. Equipment delivered to Site without factory test or corrections will be returned to factory at CONTRACTOR's expense.

H. Major deficiencies identified by the Engineer shall be corrected and retested prior to completion of the factory test. Retesting shall be repeated as required until satisfactory results are obtained. Retesting shall be scheduled two (2) weeks in advance.

I. CONTRACTOR shall include in his Bid an amount, when the instrumentation system factory test facility in this Section is more than 80 miles from ENGINEER's Ann Arbor, Michigan office. CONTRACTOR shall pay transportation for weekly trips and lodging costs for 2 members each of ENGINEER's and Owner's staff over entire factory test.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer as approved by ENGINEER.

B. Install equipment as indicated, in accordance with manufacturer's written instruction, and in compliance with recognized industry practices to ensure that products fulfill requirements.

C. Elements that are supported by plumbing or piping, or that have only plumbing or piping connections shall be installed under those Sections.

D. Plumbing, piping, or pneumatic signal connections to elements requiring such connections shall be made under those Sections. Control panels shall be installed in accordance with Division 16 Sections, with piping connections to control panels installed under Division 15 Sections.

E. Drawings are not intended to show every detail of construction or location of piping, ductwork, or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment, air ducts, or other equipment, CONTRACTOR shall so inform ENGINEER for his approval and permission.

3.02 FIELD QUALITY CONTROL

A. Calibrate equipment in accordance with manufacturer's instructions to ranges or set points indicated on Drawings.

B. Installation and Start-up: Equipment supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than 6 hours travel time from Site.

1. Equipment supplier shall provide an experienced, factory-trained, competent, and authorized service representative for a minimum of 4 times at Site, including once during installation, once during start-up and once during acceptance to inspect, check, and calibrate any part of system. Supplier's service representative shall revisit Site for 8 hours per day as often as necessary after installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to ENGINEER.

2. Fourth trip is after equipment has been accepted and shall be used to instruct OWNER's personnel in aspects of operation and maintenance, such as fuse locations, use of controls, instruction manuals, etc. Fourth trip shall be for duration of one 8-hour day at OWNER's site.

C. Equipment supplier shall provide two, 8-hour days of training for OWNER's personnel in aspects of operation and maintenance such as fuse of controls, fuse locations, instruction manuals, etc.
   1. Training and instructions at the site shall be given by the Project Engineer assigned to the Project by the equipment supplier or other personnel as approved by ENGINEER.

D. Digital Equipment Field Training: At conclusion of field acceptance tests, CONTRACTOR shall conduct two training sessions for OWNER's personnel in use of system.
   1. Course shall be one 8 hour day in duration and shall consist of hands-on use of system as well as lectures.
   2. Written course materials shall be provided to each participant for use during instruction and to serve as a basic reference document after training.
   3. The sessions shall be separated by one week to accommodate personnel attendance scheduling.

3.03 DEMONSTRATION

A. Upon completion of installation and calibration, demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new or repaired units, and retest to demonstrate compliance.

END OF SECTION

SECTION 13421 - FLOW MEASUREMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Magnetic flow meter.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330, Shop Drawings covering the items included under this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Magnetic Flow Meter:
      a. Rosemount.

2.02 MAGNETIC FLOW METER

A. Magnetic flow meters shall be flanged.

B. Meter body shall be Schedule 10, 304 stainless steel or Schedule 40 steel with 150-pound ANSI flange or AWWA Class D flange when ANSI is not an available option.
   1. Meters 6 to 12 inches shall have polyurethane liner and Hastelloy "C" or platinum electrodes as indicated.

C. Liner material shall be suitable for the process flow indicated on Drawings.
   1. Polyurethane liner shall be furnished for meters 12 inches and larger, or if not indicated otherwise on Drawings or in the Specifications.

D. Electrodes shall be suitable for the process flow indicated on the drawings and shall be bullet nosed style made of Hastelloy "C." Exception: Platinum electrodes shall be provided for sodium hydroxide or other caustic process applications.

E. Start-up and acceptance check for flow meters shall be performed by a qualified employee of flow meter manufacturer. Service personnel of sales representative or of equipment supplier of this Section will not be accepted.

F. The sensing element shall be constructed of suitable materials to withstand submergence to 30 feet to IP 68 rating indefinitely. The tube shall be designed so that it may be buried to a depth of 15 feet where applicable. Provide evidence of ability to be buried. Directions for installation of conduit and wiring connections shall be clearly written and graphically shown for Installer’s use.

G. Magnetic flow meter signal converter shall consist of solid-state, feedback-type microprocessor circuitry. Operational parameters shall be user configurable locally via an integral push-button arrangement or via a remote intelligent terminal. Appurtenances, including hand-held programmer and/or programming software, shall be provided for local configuration of operational parameters. Converter shall change a low-level flow signal from sensor electrodes into a proportional isolated 4-20 mA DC signal. The converter shall have an extremely high input impedance and not be affected by quadrature noise. The unit shall be capable of accommodating uni-directional or bi-directional flow. Sensing of meter failure shall activate a user-configurable zero or 130 percent output signal and a failure alarm contact closure.

H. Where indicated on Drawings, a high-frequency digital proportional output shall be provided for use with high-accuracy totalizers. To eliminate errors, the converter shall incorporate an integral zero return circuit to provide a constant zero output signal in response to an external dry contact closure. An automatic empty pipe detector and low-flow cutoff shall be provided as standard.

I. Magmeter shall be electronically isolated for grounding. Where insulated or nonconductive pipe is used, only orifice plate-type grounding rings will be acceptable. Grounding electrodes which penetrate the liner will not be acceptable.

J. Unit shall be supplied with an integral or local conduit-mounted flow indicator calibrated in engineering units. Indicator shall be tagged showing design range in units being measured and shall be capable of simultaneously displaying flow rate and totalization with an alphanumeric display.

K. Zero stability shall be achieved by pulsing the sensing head magnetic field coils with a regulated direct current, first in one direction and then in opposite direction.

L. Continuous zero stability shall be obtained by signal sampling during the quiescent coil states. There shall be no zero offset or zero adjustments required. The converter shall not require calibration over its expected life under normal use.

M. Flow meter shall operate within Specifications on 120 volt AC plus 10 percent and 60 hertz plus 5 percent. Power consumption shall not exceed 25 VA for meters 24 inches and smaller, and 50 VA for meters 30 inches or greater.

N. Input span shall be adjustable between 0-1 and 0-30 feet per second and range adjustment shall be digital. Converter shall include adjustable damping circuitry. Unit shall not be affected by power line aberrations such as those produced by SCR-type motor controllers or other voltage transients.

O. System accuracy, including primary magnetic flow meter, shall be plus 0.5 percent of rate for maximum flow velocities from 1.33 to 33.33 feet per second, and plus 1 percent of rate for maximum flow velocities from 0.7 to 1.32 feet per second. Repeatability shall be plus 0.1 percent of span. Rangeability shall meet or exceed 30:1 turndown.

P. The signal converter portion of the magnetic flow meter shall include both a magnetic driver to power the magnetic coils and the signal converter electronics. The converter shall have the ability to be either integrally or remotely mounted as specified. If not specified, converter shall be remotely mounted. It shall be housed in a NEMA 4X case. When remotely mounted, the signal cable shall be provided with the proper length.

Q. Magmeter manufacturer shall comply with ISO9000 Standards and the meter shall be FM approved. Signal converters shall be interchangeable without effect of meter accuracy or the need for recalibration for all meter sizes. Provide spool-piece for meters sized 12 inches and smaller.

PART 3 - EXECUTION

3.01 GENERAL

A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

SECTION 13424 - PRESSURE MEASUREMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Diaphragm seals.
   2. Pressure to current (P/I).

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings covering the items included under this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Diaphragm Seals:
      a. Ashcroft.
      b. Trerice.
   2. Pressure to Current:
      a. ABB.

2.02 DIAPHRAGM SEALS

A. Diaphragm seals shall isolate the process measuring instruments from the process fluid. The diaphragm seal shall be of the removable type. The diaphragm seal shall be filled with liquid, compatible for the process shown to be measured on Drawings. The diaphragm seal shall be supplied with gaskets, bolts, capillary tubing, and fill fluids.

2.03 PRESSURE TO CURRENT (P/I)

A. Pressure to current signal converter shall be 2-wire, solid-state electronic, temperature-compensated, strain gauge or capacitive type. Process pressure shall be applied to sealing diaphragm in measuring section. This pressure shall be transmitted to a measuring element connected to the electronics of the transmitter. Converter shall include a repairable circuit board mounted in a NEMA 4 housing. Transmitter shall output an isolated 4-20 mA signal proportional to pressure measurement. Adjustable electronic damping shall be provided from 0 to 16 seconds in electronically adjustable increments of 0.1 second.

B. Positive overage protection shall be provided to 2,000 psig. Diaphragms and wetted parts shall be 316 stainless steel, except where other special alloys are required to prevent corrosion.

C. Accuracy shall be within plus or minus 0.1 percent of calibrated span for spans from 1:1 to 15:1 of URL. Stability shall be plus or minus 0.1 percent of URL for 6 months. Zero suppression and elevation shall be at least 500 percent of range.

D. In applications where pressure transients may occur (i.e., level for elevated and ground storage tanks, pumping pressure, etc.), CONTRACTOR shall include snubbers in pressure tap line and an electronic signal time constant which will reduce pressure transients to plus or minus 1 percent of calibrated span. Time constant is to be achieved by placing it in panel providing power to pressure transmitter.

E. Units shall be supplied with an integral digital indicator calibrated 0 to 100 percent, and in engineering units.

PART 3 - EXECUTION

3.01 GENERAL

A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

SECTION 13430 - CONTROL PANELS AND CONSOLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Control panels and consoles.
   2. Switches, push-buttons, lights.
   3. Relays.
   4. Terminal blocks.
   5. Control power transformers.
   6. Transient Voltage Surge Suppression

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings covering the items included under this Section.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.
   2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Switches, Push-Buttons, Lights:
      a. Schneider Electric (Square D). (Type K).
      b. Rockwell Automation (Type 800T/H).
   2. Relays:
      a. Potter-Brumfield (Type KUP).
      b. Rockwell Automation (Type 700HB).
      c. Schneider Electric (Square D). (Type KU).
      d. Struthers-Dunn (Type 292 Series).
      e. Omron (Type MK-S)

3. Terminal Blocks; finger safe construction:
    a. Altech (Type CTS4U-N).
    b. Rockwell Automation (Type 1492WM4 or Type 1492W4).
    c. Schneider Electric (Square D). (Type 9080GM6).
    d. Weidmueller (SAK TS35 or WDU 2.5).
    e. Phoenix Contact (UT4 Series)
4. Fusible Terminal Blocks:
    a. Altech (Type CAFL4U).
    b. Rockwell Automation (Type 1492-CE6H5 or 1492-H6).
    c. Schneider Electric (Square D). (TeSyS Type DFCC).
    d. Weidmueller (SAKS1 or ASK1).
    e. Phoenix Contact (UT4-HESILED24/HESILA250)
5. Control Power Transformers:
    a. Acme.
    b. Sola.
6. Transient Voltage Surge Suppression:
    a. Emerson.
    b. Sola.
    c. Schneider Electric (Square D).
7. Textured Polyurethane Enamel:
    a. Sherwin-Williams, Polane T and/or Polane HST.
8. Wire Markers:
    a. Brady.
    b. T&B.
    c. Westline.

2.02 CONTROL PANELS AND CONSOLES

A. Sheet Metal Construction:
    1. Panels and consoles shall be fabricated from sheet steel welded and bolted into a rigid self-supporting structure a maximum of 90 inches high and a minimum of 20 inches deep. Overall length shall be coordinated with space requirements as indicated by Drawings. Changes in length from that shown on Drawings must be brought to attention of ENGINEER within 90 days of Contract Award. Cost to modify floor plan or wall opening shall be at CONTRACTOR's expense after this 90-day period. Panel face layouts shown on Drawings are intended to indicate relative position of all components. Supplier shall fix exact locations and overall dimensions to meet requirements of its equipment.
    2. Panel and console bodies shall be 12 gauge minimum steel for panels up to 42 inches in width, and 10 gauge minimum steel for panels exceeding 42 inches in width. Panel subplates shall be same gauge as enclosure. Stiffening members shall be provided for strength and stiffness as required.
    3. A minimum of 3 inches shall be provided between edge of panel subplate and outside walls of panel body to ensure adequate wire-way space for external wires entering panel. Panel subplate shall be mounted on collar studs for easy removal. Print pockets shall be provided on each panel. Brackets welded to inside of panel, complete with lights, shall be provided on panels where indicated by Drawings.
    4. Identification plates shall be laminated phenolic with black letters engraved on a white background and mounted with screws or double-back adhesive foam tape.
    5. All components inside panel shall have identification plates. This includes instruments, relays, switches, circuit boards in plug-in racks, etc. Identification plates shall include engineering

symbols (FBQ-1, SW-3, FIC-4, CR-1, etc.). Switches and circuit breakers inside panel shall have names (Horn, Audio Tone, Panel Power, etc.) on identification plates as well as engineering symbol.

6. Identification plates shall be located on or adjacent to device they are identifying and shall be readable without looking around, under, or on top of device to find identification plate.

B. Access:
   1. Wall- and/or floor-mounted control panels shall have continuous piano-hinged doors for ease of access. Door openings shall expose a minimum of 80 percent of panel interior. Door openings shall be sealed with a 0.125-inch thick minimum cellular neoprene gasket cemented with oil-resistant adhesive and held in place with a retaining strip. Print pockets shall be provided on each door. Two door enclosures shall have a removable center post. Panel doors less than 40 inches high shall be equipped with a 2-point latching mechanism. Panel doors 40 inches high or more shall be equipped with a 3-point latching mechanism.
   2. Components and terminals shall be accessible without removing another component except covers. Swing out sections shall be used if mounting space is required that is not normally accessible.
   3. Panels shall have open bottoms except where structural members are required.

C. Finish:
   1. Panel face openings for mounting equipment shall be smoothly finished cut with counterboring and trim strips provided as required to give a neat finished appearance. Bezels shall be used on all front panel-mounted devices to cover panel cutouts. A chrome-plated or stainless steel bezel shall be used at parting line of panels that have shipping splits or at parting line of panels placed end to end.
   2. After fabrication, panel surfaces shall be given a phosphatizing treatment inside and out, and then finished with 2 coats of textured polyurethane enamel. Panel interior shall be painted white, ANSI No. 51. Exterior color will be selected by ENGINEER.
   3. Panels shall have identical exterior finishes as selected by ENGINEER. Panel finishes on matching colored panels shall be identical. It is supplier's responsibility to achieve this result, especially for panels fabricated in different shops.

D. Electrical:
   1. Internal panel wiring shall be 19 strand No. 16 AWG, 90^{O}C MTW, Class C stranded, or THHN/THWN approved as 90^{O}C MTW. All panel wiring not run in wire ducts shall be bundled and tied. Each wire shall be identified at both ends with same exclusive number. Number shall be same number shown on control schematic. Number shall not be used again for any other purpose. Wires marked differently on each end will not be accepted. Wire markers shall be provided on end of each wire at termination point.
   2. Control wiring associated with control circuits de-energized when main disconnect is opened shall be color-coded red. Control wiring associated with control circuits which remains "hot" when main disconnect is opened shall be color-coded yellow. DC control wiring shall be color-coded blue. Ground wires shall be color-coded green. Terminal blocks shall be numbered in numerical order. Yellow wiring leaving panel shall be brought to an isolated set of terminal blocks.
   3. Provide an instrument common bus 0.1 by 0.5 by 6-inch minimum in enclosure and isolated from enclosure. A separate instrument common wire shall be run from each common terminal on an instrument to instrument common bus. Instrument common wires looped from one terminal to another and then to instrument common bus will not be accepted.

4. Instrument common bus shall be connected to power supply common with a wire or wire braid strap as short as practical and of sufficient capacity to prevent troublesome voltage drop. Common terminals and common bus for instrument common shall be tagged "Instrument Common." Instrument signal wires of 4-20 mA or 1-5V shall be shielded wire. Telephone wires and telemetry equipment interconnection wires shall be shielded wires.
5. Provide a copper ground bus 0.1 by 0.5 by 6-inch minimum in enclosure to which all instrument grounds and panel enclosure are tied. Separate ground wire shall be run from instrument enclosure ground terminal directly to ground bus. Instrument ground wires looped from one instrument to another will not be accepted. Under no circumstances shall neutral side of power source or any other terminals used for grounding power circuits be used as an instrument common.
6. Wires to internal components shall be connected to inside of terminal strip. Wires to external components shall be connected to outside of terminal strip. No more than 2 wires shall be connected to one terminal point.
7. Panel wire duct shall be provided between each row of components and adjacent to each terminal strip. Wire ducts shall be a minimum of 1-inch wide and 3 inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wire ducts shall be constructed of nonmetallic materials with a voltage insulation in excess of maximum voltage carried therein.
8. Floor-standing panels and consoles shall be equipped with a flange mounted 600V rated main non-automatic trip circuit breaker or disconnect switch. Single phase, 60 hertz power at voltage shown on Drawings shall be supplied to main disconnect. Panel fabricator shall provide any additional voltages and power requirements at control panel to meet requirements of equipment contained therein.
9. Disconnect and transformer shall have enclosed protected terminations to prevent accidental shock.
10. Within each control panel a Transient Voltage Surge Suppression (TVSS) device shall be installed at the main disconnect and shall be sized for the control panel feeder size.
11. Relays, timers, etc., installed on panel subplate shall be provided with a minimum spacing between component and wire duct of 1.5 inches above and 1 inch below. Minimum spacing between adjacent components shall be 0.25 inch. Relays, timers, etc., shown in schematics are intended to show function. Additional relays may be required in conjunction with items shown to provide total number of contacts required. Where limit, pressure, float switches, etc., are used and more than SPDT contacts are indicated by schematics, provide additional contacts required by using auxiliary relays. However, if a DPDT switch is called for, using a SPDT with a relay will not be accepted. All control and pilot devices such as relays, timers, etc., shall be 120V, 3 amp rated except where noted with coil voltage as required. One N.O. spare contact shall be provided on each relay.

E. Panel/Subplate Layout:
1. Panel face-mounted equipment shall consist of pilot lights, push-buttons, selector switches, meters, indicating timer, etc. Spacing between horizontal rows of components shall be 1.5 inches minimum; spacing between vertical columns of components shall be 1.875 inches minimum. Components shall be grouped and/or located as indicated on Drawings. Distance from bottom row of components to floor shall be not less than 36 inches. Top row of recording and indicating instruments shall be centered approximately 60 inches above floor. Maximum height for annunciator windows shall be 85 inches above floor. In general, indicating lights, push-buttons, etc., shall be mounted in accordance with sequence of operation from left to right and top to bottom.
2. A minimum of 2 inches shall be provided between terminal strips and wire ducts or terminal strips and terminal strips. In general, terminal strips shall be mounted on vertical edges of

subplate. Where terminal strips are mounted side-by-side, terminals shall be elevated 1.5 inches above subplate to allow wires to pass underneath.

3. Subplates shall have a minimum of 15 percent spare mounting space, and terminal strips shall have a minimum of 20 percent spare terminal blocks.

2.03 SWITCH, PUSH BUTTONS, LIGHTS

A. Selector switches shall be 120 VAC rated, oil-tight construction with standard operator knob.

B. Start push buttons shall be 120 VAC rated, oil-tight construction with extended guard and black color insert.

C. Stop push-buttons shall have a half-guard with red color insert. Contacts shall be rated NEMA B-150 and P-150.

D. Pilot lights shall be push-to-test oil-tight construction with cap colors and voltages as required. Pilot light shall be supplied with Light Emitting Diode (LED) type light module.

E. Nameplates for each switch and light shall conform to manufacturer's series and type with engraving as called for on Drawings.

2.04 RELAYS

A. Control Relays: Switching and output relays shall be plug-in type with contacts rated 120 VAC, 3 amp with 120 VAC or 24 VDC coil, indicating light, manual operator, and plastic transparent cover. Relays shall have a retainer mechanism to prevent loosening from vibration. Relays shall not be used for switching 1-5 VDC or 4-20 mA signals associated with instruments.

2.05 TERMINAL BLOCKS

A. Terminal blocks shall be 300 or 600 volt rated, channel-mounted box lug with pressure plate type or binding head screw type with pressure plate, and shall have a white marking strip. Terminal blocks shall be color-coded according to the following coloring scheme:

Black	120V power circuits de-energized when main disconnect is opened.
White	120V neutral conductors.
Red	120V control circuits de-energized when main disconnect is opened.
Yellow	120V control circuits which remain hot when main disconnect is opened.
Blue	Terminal blocks for DC wiring.
Gray	Terminal blocks for shields in DC wiring.
Green	Ground terminal blocks.

B. For terminals associated with 120V nonisolated input cards, individually fused terminal blocks shall be used for 120V power to field devices.

C. Provide a minimum of 20 percent spare terminals for each type and color of terminal used. All terminals of a given color shall be grouped with other terminals of the same color.

2.06 CONTROL POWER TRANSFORMERS

A. Control power transformers shall be sized to handle in-rush currents and to accommodate continuous load of circuits plus 25 percent future load with 5 percent or less voltage drop. Transformer primary voltage shall be as indicated on Drawings.

2.07 Transient Voltage Surge Suppression (TVSS)

A. Transient Voltage Surge Suppression (TVSS) device shall be installed at the main disconnect. TVSS shall be sized for the control panel feeder size and shall protect equipment from a peak surge of 45kA per mode and minimum 80kA peak surge per phase. Protection modes shall include phase to phase, and phase to ground for three phase panels, and shall include phase to neutral, phase to ground and neutral to ground for single phase panels. TVSS shall have a status LED indicating that it is operating properly.

PART 3 - EXECUTION

3.01 GENERAL

A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

SECTION 13491 – INSTRUMENTATION SPARE PARTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Instrumentation system spare parts.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Spare Parts List: Submit a list of recommended spare parts for the equipment provided as part of the instrumentation system.

1.03 DELIVERY

A. Deliver spare parts to OWNER prior to final acceptance of instrumentation system and equipment.

PART 2 - PRODUCTS

2.01 SPARE PARTS

A. Equipment spare parts as required for 1 year shall be provided and stored at Site by CONTRACTOR.

B. Spares consumed during construction shall be replaced at no cost to OWNER until equipment is accepted as defined in Specification.

C. Provide the following:
   1. One spare relay of each type used, including time-delay relays.
   2. One-year supply of expendable spares such as lamps, fuses, ink, ribbons, etc.

D. Digital Systems: For digital systems, spare parts as required for a period of 1 year shall be provided and stored at Site, unless directed otherwise by OWNER.

E. Provide the following:
   1. On systems employing PLCs, provide 1 spare circuit card of each type used in delivered equipment. Circuit cards shall include the following (matching units in service):
      a. Analog input card.
      b. Analog output card.
      c. Discrete input card.
      d. Discrete output card.
   2. Provide 1 spare module of each type listed below:
      a. PLC processor of type used in delivered equipment.
      b. Communication card of type used in delivered equipment.
      c. Rack power supply

3. Provide a box of fuses for each size and type used.
4. Provide one spare 24 VDC power supply

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 15100 - PRESSURE PROCESS PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Provide all labor, materials, and equipment necessary for fabrication and production of the items specified in this Section and as shown on Drawings or listed on Schedule.
   2. Unless otherwise noted on Drawings, or in this Section, pressure process piping 4 inches in diameter and larger shall be part of this Work.
   3. Dismantling of existing piping and supports, where required or shown or noted on Drawings; piping connections to existing piping, structures, valves, gates, measuring devices, pumps and other equipment, including equipment erected under other Contracts, are included in Work of this Section. Piping shall contain necessary unions or companion flanges to allow ease of equipment removal.
   4. Complete all the demolition work and repair thereof to existing walls and slabs as required for the installation of this Work including grouting of all sleeves and castings. Provide all necessary joint and coupling materials, including bolts, nuts and gaskets, wall castings or sleeves, and standard or special fittings. Furnish hangers, supports, anchors, blocking, harnesses, and other necessary closure pipe sections and special fittings. Provide and secure in proper alignment, all sleeve and casting openings in existing walls and slabs, including repair thereof.
   5. Provide all shop-applied interior and exterior pipe linings and coatings. Provide plugs in open ends of pipe, temporary bulkheads, protection of surface and subsurface improvements, cleaning, painting, testing, and disinfection, as required to accomplish Work as specified and shown on Drawings.

B. Products Installed But Not Furnished Under This Section: Install process valves, flow meters, and other appurtenances which are furnished under other Sections and incorporated in the piping systems as shown on Drawings and specified in this Section.
   1. All exposed pipe, field-applied finish painting preparation and repair of existing painted surfaces shall be done under Division 9.

C. Products Supplied But Not Installed Under This Section:
   1. All piping, fittings, appurtenances, and shop-applied coatings shall be supplied as specified under this Section.
   2. The installation and testing of Water Distribution and Pumping Mains shall be performed as specified in this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 013300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Shop Drawings shall be fully dimensioned Drawings showing the piping in full detail with exact locations, dimensions, and schedules of all pipe, fittings, hangers, supports, and appurtenances. They shall be made in accordance with the general information shown on Drawing and special information furnished by the several manufacturers of equipment. Where special fittings are required, they shall be shown in large detail with all necessary dimensions.

2. Each pipe section, special fitting, casting, sleeve, and appurtenance shall be identified on Drawings by its respective erection mark.
3. Design details of joints and joint restraint shall be submitted to ENGINEER for ENGINEER's consideration and approval before ordering any pipe.
4. Product Data: Submit product data covering the items included under this Section.

B. Record Drawings: At Project closeout, submit record Drawings of installed products, in accordance with requirements of Section 017700.

1.03 QUALITY ASSURANCE

A. All Work under this Section shall be done in accordance with standard practices as recommended by manufacturer and AWWA.

B. Codes, Ordinances, and Standards: Manufacture, storage, and erection of equipment under this Contract shall be in accordance with current ASA (ANSI), AWWA, and ASTM Standards. Standards and Specifications referenced herein shall be the current published edition. The manufacturer of the pipe and fittings shall furnish ENGINEER a certified statement that all pipe and fittings furnished by manufacturer meet the material requirements and have been inspected and tested in accordance with the applicable Specification and Standard.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Disinfection compounds shall be stored in well-ventilated areas protected from moisture and fire.

B. Storage:
1. All pipe and related items installed under this Section shall be stored as recommended by manufacturer.
2. CONTRACTOR shall take all actions necessary to protect all items installed under this Contract including furnishing all special storage areas required by equipment manufacturers.
3. Pipe shall be stored on suitable timber skids free from contact with the ground. Gaskets shall be stored in as cool, clean, and shaded a place as practical.

C. Handling:
1. All items installed under this Contract shall at all times be handled as recommended by manufacturer and in such a manner as to avoid any damage.
2. All special handling equipment and temporary supports shall be provided by CONTRACTOR.
3. Items will be subject to inspection and approval upon delivery to the Site and after storage. No cracked, broken, or damaged pipe shall be used.
4. In the event coatings are damaged, the damaged area shall be recoated with an approved coating similar to that specified for that item.
5. During handling, hauling, and storage of pipe, each piece shall be kept from contact with adjacent pieces by means of wooden blocks or timbers.

1.05 PROJECT CONDITIONS

A. Existing Conditions: The Drawings are not intended to show every detail of construction or location of piping or equipment. Where existing conditions make it necessary or advisable to change location of piping or equipment, CONTRACTOR shall so inform ENGINEER for ENGINEER's approval.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Adapter Flange Coupling (AFC):
      a. EBAA Iron Sales, Inc. (Series 2100 Megaflange).
      b. Smith-Blair, Inc.
      c. Uni-Flange Corp.
   2. Bolted Flexible Coupling (BFC):
      a. Romac Industries, Inc.
      b. Smith-Blair, Inc.
      c. Baker Coupling, Co.
   3. Grooved Couplings (GC):
      a. Victaulic.
      b. Grinnell.
      c. Anvil.
   4. Hangers and Supports:
      a. Grinnell.
      b. Elcen.

2.02 MATERIALS

A. Disinfection Products:
   1. Liquid Chlorine: Liquid chlorination may be allowed subject to approval of ENGINEER, OWNER, and Fire Marshal. Liquid chlorine shall meet the requirements of AWWA B301.
   2. Sodium Hypochlorite shall meet the requirements of AWWA B300. Containers shall have an expiration date marked at time of shipment to ensure that excessive deterioration has not occurred.
   3. Calcium Hypochlorite shall meet the requirements of AWWA B300.

2.03 PIPE JOINTS

A. All joint material and lubricants shall be furnished with the pipe, including all joint material required for connection to equipment furnished under other Sections. All joint materials shall be assembled in accordance with standard practice and manufacturer's recommendations. All equipment connections shall be flanged, union, or grooved coupling so that equipment can be removed without disassembly of the connecting piping.

B. Bolted Flexible Couplings (BFC): Bolted flexible couplings shall consist of a steel sleeve, with centering bead removed, rubber gaskets, follower rings, and a full complement of nuts and bolts. Couplings shall allow a deflection of approximately 4 degrees per joint.
   1. Couplings shall have a minimum middle ring thickness and minimum length as follows:

Pipe Size (inches)	Middle Ring Thickness	Middle Ring Length
4	0.203-inch	5-inch
6 to 12	1/4-inch	5-inch
14 to 20	5/16-inch	7-inch
24	3/8-inch	7-inch
30 to 48	3/8-inch	10-inch
54 to 72	1/2-inch	10-inch

   2. Couplings shall have a maximum gap between pipe ends as follows:

Sleeve Length	Max. Gap Allowed
5-inch	1-inch
7-inch	2-inch
10-inch	3-inch

   3. Couplings and accessories shall be galvanized and shall be shop coated with a sealer suitable for subsequent field painting or coating.

C. Flanged Joints (FJ): Pipe flanges shall conform to American Standards: dimensions, ANSI B16.1 and threads, ANSI B2.1. Flange faces except stainless steel shall be coated with a rust inhibitor immediately after drilling.
   1. Flanges for cast or ductile iron pipe and fittings shall be ductile iron and meet the requirements of AWWA C115 (ANSI 21.15).
   2. Flanged joints shall be made up with full-face 1/8-inch rubber gaskets.
   3. Flanges shall be firmly bolted with machine, stud or tap bolts of the proper size and number meeting the requirements of ASTM A 307, Grade B. Joints made with bolts or bolt studs shall have a nut on each side. Bolt projection through nuts shall be equal, and where studs are used, bolt projection on each side of the flange shall be equal.
   4. All nuts and bolts shall be cadmium plated or hot-dip galvanized.

D. Grooved Couplings (GC): Provide rigid grooved couplings where shown or noted on Drawings or noted on Pipe Schedule. Flexible type shall only be used in applications approved by ENGINEER.
   1. Grooved couplings and fittings may be used in lieu of flanged joints.
   2. Couplings shall conform to AWWA Standard C606.
   3. Gaskets shall be molded or extruded of an elastomer that is recommended by coupling manufacturer and that will satisfy the end use. End use includes consideration for pipe material and material being transmitted by the pipe.
   4. Generally, ductile iron pipe gaskets shall be halogenated Butyl compound.
   5. Shop Drawings submitted shall identify the gasket material, pipe material, and material being transmitted in the pipe.
   6. Cast iron or ductile iron fittings shall conform to the requirements of ANSI Specifications A21.10 or AWWA C110 with end preparation of a radius cut groove configuration.
   7. Ductile iron pipe in sizes 4-inch to 24-inch shall be radius cut grooved in accordance with manufacturer's specifications.

E. Adapter Flange Coupling (AFC): Adapter flange couplings for steel or ductile iron pipe shall be provided where shown on Drawings.
   1. The coupling shall be designed to meet the test requirements of ANSI B16.1, 125-pound flanges.
   2. The coupling shall be designed to handle a 525 psi hydrostatic test and 175 psi working pressure at temperatures of -20 to 150 degrees Fahrenheit without leaking or requiring additional restraint.
   3. The coupling shall consist of a standard flange drilling (ANSI B16.1); a standard mechanical joint material (ANSI A21.11 or AWWA C111); and standard retainer gland construction (AISI 4140 steel setscrews, galvanized with ductile iron body ASTM A 536).

2.04 PIPING

A. Ductile Iron Pipe (DIP): Buried ductile iron pipe shall be either the Pressure Class indicated on Bid Form or on Schedule. If no classification is indicated, pipe shall be the highest Standard Pressure Class available. Ductile iron pipe shall be manufactured in accordance with AWWA C151 (ANSI A21.51). Pipe placed in buildings to be joined by flanges or grooved couplings for the pipe size shown shall have a minimum thickness of Special Thickness Class 53. Each pipe run shall be of the same class. Pipe sizes indicated are inside diameter (I.D.).
   1. Fittings for flanged ductile iron pipe shall be ductile iron or cast iron and shall meet the requirements of AWWA C110 (ANSI A21.10) and for 54-inch and larger sized shall meet the requirements of AWWA C153 (ANSI A21.53). Ductile iron fittings shall be rated for 350 psi, pipe sizes 24-inch diameter and less and 250 psi for pipe sizes over 24-inch diameter, except that ductile iron flanged fittings shall be rated for 250 psi for all pipe diameters.
   2. Cast iron fittings shall be rated for 250 psi, pipe sizes 12-inch diameter and less and 150 psi for pipe sizes over 12-inch diameter.
   3. Ductile iron joints shall be mechanical, bolted flexible coupling, and push-on, as specified under Pipe Joints, as shown or noted on Drawings, listed on Schedule, and approved by ENGINEER. Joints shall meet the requirements of AWWA C111 (ANSI A21.11). All joint materials shall be furnished with the pipe.
   4. Coatings and Linings: Exposed pipe and fittings shall be coated by manufacturer on the outside with a universal rust-inhibitive primer 2 mils minimum dry thickness, and cement lined, standard thickness, in accordance with AWWA C104/ANSI 21.4.

2.05 JOINT RESTRAINT

A. Where water or air pressure exerts a disjoining force, at all pipe deflections over 20 degrees, and all tees and dead ends, joints shall be restrained, tied, or harnessed in a manner approved by ENGINEER.

2.06 HANGERS AND SUPPORTS

A. Hangers and supports shall include all hanging and supporting devices of metallic construction shown, specified, or required for piping, apparatus, and equipment installed under this Section. All supports and parts shall conform to the latest requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Specification or as detailed on Drawings. Materials shall be stainless steel.

B. Hangers and supports shall be adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating conditions with due allowance for expansion and contraction, and shall have springs where necessary. Hangers and supports shall be of standard design where possible and be best suited for the service required, as approved by ENGINEER. Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Sufficient hangers and supports shall be installed to provide a working safety factor of not less than 5 for each hanger. Hangers shall have a minimum spacing in accordance with ANSI B31.1. Point loading hangers are not acceptable. Hangers shall be sling or saddle type.

C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamp, and structural attachments shall be beam clamps. All rigid hangers shall provide a means of vertical adjustment after erection. Generally, hangers shall be sized for supporting the pipe, excluding insulation. Overhead hangers shall be supported by threaded rods fastened to concrete slab by drilling and epoxy injection. Expansion anchors are not allowed. Floor mounted stands shall consist of a length of steel pipe fitted at the base with a standard threaded flange and at the top with an adjustable saddle or roll. The base flange shall be bolted to the floor, foundation, or concrete base.

D. Anchors shall be furnished and installed where specified, shown, or required for holding the pipelines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of all anchors shall be subject to approval by ENGINEER. Materials shall be stainless steel.

E. Concrete supports shall be placed wherever shown or required under Division 3. Equipment shall be supported in accordance with manufacturer's recommendations.

2.07 TAPS AND PLUGS

A. Where indicated or required, pipe or fittings shall be tapped to receive small or special fittings under this or other headings of the Work. Required taps shall be provided as part of this Work.

B. All taps shall be temporarily plugged at point of fabrication.

2.08 SOURCE QUALITY CONTROL

A. Tests, Inspections:
   1. All pipe and fittings delivered to the Project shall be accompanied by certification papers showing that the pipe and fittings have been tested in accordance with the applicable Specifications and that pipe and fittings meet the Specifications for this Project. All pipe and fittings will be inspected upon delivery to the Site by ENGINEER or OWNER's Representative. No cracked, broken, or damaged pipe or fittings will be allowed in this Work.
   2. Ductile Iron Pipe:
      a. Each pipe shall be hydrostatically tested to 500 psi at the point of manufacture.
      b. The class of nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, county where cast, year in which the pipe was produced, and the letters "DI" or "ductile" shall be cast or stamped on the pipe.
      c. Where required, other designation marks shall be painted on the pipe or fittings to indicate correct location in the pipeline in conformity to a detailed layout plan.

PART 3 - EXECUTION

3.01 ERECTION

A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operation condition in full conformity with detail Drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer approved by ENGINEER.

3.02 INSTALLATION

A. Laying and Erecting Pipe: Pipe shall be installed as recommended by manufacturers or by the applicable AWWA installation manual or specification.
   1. Pipe shall be carefully laid to line and grade as shown on Drawings. Care shall be taken to keep the interior of the pipe clean and free from dirt and other foreign materials.
   2. Bulkheads or other means shall be used at the open ends of the pipe for this purpose.

B. Field Cutting Piping: The spigot ends of all pipe lengths, which have been cut in the field, shall be ground to a smooth surface and painted with 2 coats of asphaltum metal protective paint.

C. Bolted Flexible Couplings (BFC): All bolted flexible couplings shall be harnessed with tie bolts or studs across the joint, design based on test pressures.
   1. On cast iron or ductile iron pipe, tie bolts shall be installed between flanges across the coupling unless otherwise noted on Drawings or approved by ENGINEER.
   2. Tie bolts or studs and other joint hardware shall be stainless steel.

D. Joints: All joints shall be assembled in accordance with that described in the "Pipe Joints" Article.

3.03 REPAIR

A. Repair of all damaged interior pipe coatings, ground-buried exterior pipe coatings and galvanized coatings shall be under this Section. Repair of exposed painted pipe shall be as specified under Section 09900.

B. Damaged linings, coatings, and wrapping shall be repaired under this Section and, if possible, before pipe is laid.
   1. Surfaces shall be thoroughly cleaned, dried, and free of old materials.
   2. They shall then be given a field coating of the same material as specified for the pipe.
   3. Coating shall meet the requirements of AWWA C203, AWWA C210, or AWWA C602 as approved by ENGINEER.
   4. All other pipe coatings and linings shall be as stated in "Piping" Article.

3.04 FIELD QUALITY CONTROL

A. Defective Pipe: No pipe or special casting known to be defective shall be laid in Work.
   1. Any piece found to be defective after it has been laid shall be removed by CONTRACTOR and replaced by a sound and perfect piece.
   2. If the major part of a defective pipe is sound, the good end may be cut off and used.
   3. The cutting of pipes for this and any other purpose shall be done by skilled workers, and in such manner as will not injure the pipe. Every such cut shall be square and smooth. Cut surfaces shall be recoated as specified for the pipe.

B. Tests:
   1. After completion, each run of pipe shall be tested by CONTRACTOR in the presence of ENGINEER. All appurtenances such as service connections, corporation stops, and curb stops shall be tested with the run of pipe.
      a. Any leaks shall be made tight.
      b. Under this Work, CONTRACTOR shall furnish all water or air, piping, bulkheads, pumps or compressors, gauge, and other equipment required for the test.
      c. The section of pipe to be tested shall be cleaned and isolated by valves or plugs. Such valves or plugs shall be designed to hold against the test pressure. Sections of pipe shall have an opening through which air or water can be introduced. The supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the pressure. The pressure gauge shall have a minimum diameter of 3-1/2 inches and a range compatible with the test pressure. Pipelines that cannot be closed for a direct pressure test shall be tested by filling the tanks to which they are connected to the highest operating level or installing temporary test bulkheads. After completion of tests, all pipes shall be drained. Buried pipelines shall be pressure tested with all pipe joints exposed for visual inspection unless otherwise directed by ENGINEER.
      d. If requested by ENGINEER, CONTRACTOR shall furnish proposed test procedures for approval including pipe identification, test pressure and a description of the method of testing.
      e. In the event that the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and repaired where necessary. Any pipes or special castings found to be cracked shall be removed and replaced with new pieces by CONTRACTOR. After this Work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.
   2. Test Pressures: In general, pipelines shall be tested at 1-1/2 times their working pressure or at the test pressure indicated on Piping Schedule. Adjustments for hydrotest water temperature and water column elevation differences at point of test must be made.
   3. Hydrostatic Testing: The section of pipe to be tested shall be filled with water, the entrained air within the line shall be removed, and water shall be pressurized up to test pressure at the pipe low point within 5 to 10 minutes.
      a. The test period shall start immediately after initial pressurization. The line shall be maintained under the test pressure for a continuous 2-hour period.
      b. The section of pipe to be tested shall hold the test pressure with no more than a 5 percent loss in pressure over the test period.
      c. Piping with flanged, grooved coupling, screwed, socket type, and welded joints shall be completely tight at the designated test pressure.
      d. The test pressure shall not vary by more than 5 psi throughout the entire test period.
   4. Each valve assembly shall be tested by CONTRACTOR; the test shall consist of opening and closing the valve.

3.05 DISINFECTION

A. Potable water piping and water mains shall be flushed and disinfected in accordance with AWWA C 651, continuous feed or slug method. All potable water piping shall be flushed. Disinfection may precede or follow pressure testing; however, new Work shall not be connected to existing piping or water mains until two consecutive samples taken 24 hours apart have passed bacteriological tests.

B. Provide all temporary piping, fitting, backflow preventers, disinfectant feeding equipment, sampling, and laboratory testing necessary to complete the flushing and disinfection procedure. ENGINEER shall be notified of flushing and disinfection schedules, and shall witness the sampling.

C. CONTRACTOR shall dispose of the high residual chlorine water by a method approved by ENGINEER.

END OF SECTION

SECTION 15110 - PROCESS VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, and equipment necessary for fabrication, production, installation, and erection of the items specified in this Section and as shown on Drawings or on Valve Schedule on Drawings.

B. Items furnished under this Section shall be erected under Division 15. Hanger rods, inserts and supports, flange bolts, and gaskets for valves shall be furnished and installed under Section 15100.

C. Alternates:
   1. Alternate No. 2 Backwash Pumps 1 and 2 Valves.

1.02 REFERENCES

A. ANSI:

1.	B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250, and 800.
2.	B16.3, B2.1	Threaded Valve Joint Standards.
3.	B16-104	Reinforced Teflon Steel Standard.

B. ANSI/AWWA:

1.	C110/A21.10	Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
2.	C111/A21.11	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
3.	C500	Metal Seated Gate Valves for Water Supply Service.
4.	C507	Ball Valves.
5.	C504	Rubber Seated Butterfly Valves, 3-Inch through 72-Inch.
6.	C508	Swing-Check Valves for Waterworks Service, 2-Inch Through 24-Inch
7.	C509	Resilient Seated Gate Valves for Water Supply Service.
8.	C512	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
9.	C515	Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
10.	C517	Resilient-Seated Cast-Iron Eccentric Plug Valves
11.	C530	Pilot Operated Control Valves
12.	C541	Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates
13.	C542	Electric Motor Actuators for Valves and Slide Gates
14.	C550	Protective Interior Coating for Valves and Hydrants

C. ASTM:

1.	A 48	Specification for Gray Iron Castings.
2.	A 126	Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
3.	A 182/A 183M	Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service.
4.	A 183	Specification for Carbon Steel Track Bolts and Nuts.

5. A 194/194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.
6. A 276 Specification for Stainless and Heat Resisting Steel Bars and Shapes.
7. A 436 Specification for Austenitic Gray Iron Castings.
8. A 536 Specification for Ductile Iron Castings.
9. B 148 Specification for Aluminum Bronze Castings.
10. B 584 Specification for Copper Alloy Sand Castings for General Applications.
11. B 61 Specification for Steam of Bronze Castings.

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Each valve, including accessories, shall be identified on Shop Drawings by its respective mark as noted on Valve Schedule.

B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section.

C. Warranty: Submit in accordance with requirements of Section 01770, warranties covering the items included under this Section.

1.04 QUALITY ASSURANCE

A. All Work under this Section shall be performed in accordance with standard practices as recommended by manufacturer and AWWA.

B. Valve materials of construction, coatings, linings and lubrication materials shall meet the requirements of ANSI/NSF.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Resilient Seated Gate Valves (RA):
      a. American Flow Control Valves.
      b. Clow Valve Co.
      c. Kennedy
      d. Mueller Co. (A-2360 Resilient Wedge).
   2. Double Vane Check Valves (DC):
      a. Mission Manufacturing Co. - Duo-Chek.

3. Ball Control Valves (BCV):
    a. Fischer Controls Co., (Vee-Ball).
    b. DeZurik (VPB V-Port).
4. Electric motor operators for throttling service:
    a. Limitorque Corp.
    b. Rotork.

2.02 VALVE AND GATE IDENTIFICATION

A. Each valve and gate shall be tagged with its distinguishing mark letter and number. Mark letter and number will be as listed on Valve Schedule. Identification tag shall be 1-1/2-inch in diameter, 18-gauge polished brass or aluminum with 1/2-inch-high, embossed, black-filled mark letter and number placed thereon. Tags shall be securely fastened to the valve or gate operator with No. 16 brass jack chain or plastic seals.

2.03 COMPONENTS

A. Resilient Seated Gate Valves (RA):
    1. Resilient seated gate valves shall be designed for 150 psi working pressure and shall meet the requirements of AWWA Specification C509 or C515 except as otherwise specified herein. Valves shall be cast or ductile iron body, bronze stem, O-ring stem seal, and non-rising stem. The interior and exterior surfaces of the valve body shall be coated with an epoxy coating meeting the requirements of AWWA C550. The bronze or iron or ductile iron wedge shall be fully encapsulated with molded rubber. No bare metal shall be left exposed. The valve shall seal on both sides of the wedge. Gate valves shall have a clear waterway equivalent in area, when fully open, to that of the connecting pipe. Valves shall be made to open when turned to the left, or counterclockwise. The gate valves shall have non-rising stems with operator as noted in Schedule.. Flanges shall meet the requirements of AWWA C115 (ANSI 21.15).

B. Combination Air and Vacuum Release Valves (Pipe):
    1. Combination valve shall be the compound lever type with the size as noted on Drawings and designed for 100 psi working pressure. The valve body shall be cast iron with a stainless steel float and internal parts. Valves shall be provided with isolation valves.

C. Double Vane Check Valves (DC):
    1. Valves shall match existing Duo-Check II ANSI Service150, CWP 232, Size 12”, Figure No. 615 xxx 246. Contractor to confirm model number before submitting shop drawings.

D. Ball Control Valves (BCV):
    1. Ball control valves shall be completely factory-assembled including appurtenances as listed on Valve Schedule.
    2. Valves shall be characterized, parabolic or vee, flanged body type with ANSI B16.10, Class 150 flanges. Valves shall have carbon steel body, chrome-plated 316SS ball, reinforced Teflon seal meeting ANSI B16.104 Class VI leakage minimum. Valves shall have splined and clamped shaft and lever arm, stainless steel shaft with outboard Teflon and stainless steel fabric trunnion bearing and enclosed bracket and linkage.
    3. Valve shafts shall have thrust restraint to prevent blow out.
    4. Materials of construction shall comply with NSF/ANSI Standard 61 requirements.

2.04 VALVE JOINTS

A. Flange Joint: Flanges shall meet the requirements of ANSI-B16.1 Standard Class 125, except that bolt holes at shaft hubs may be drilled and tapped on the flanges. Flange faces shall be coated with a rust inhibitor immediately after drilling.

B. Wafer joints shall be flat face or raised face for use between standard flanges.

2.05 ACCESSORIES

A. Manual Operators: Operators shall be designed with a safety factor of 5 for torsional and shear stresses. The operating mechanism shall be so located and so designed that parts subject to the maintenance shall be easily accessible.
   1. Manual operators shall be so sized that a maximum of 40 pounds of rim force/pull is required for operation.
   2. Positions of operators shall be approved by ENGINEER.
   3. Valve shall be made to open when turned to the left or counterclockwise.
   4. The direction of the operator to open position shall be indicated on the operator.
   5. Bevel gear activators shall provide vertical mounting of the handwheel. Handwheels shall be included.
   6. Chainwheels shall be cast iron and furnished complete with chain and guides. Chain shall be galvanized and shall be looped to extend to within 4 feet of the floor below the valve.
   7. Handwheels shall be fabricated steel. They shall be a maximum of 30 inches in diameter and keyed to the operating nut.
   8. Electric Motor Throttling Service:
      a. Electric motor actuator for throttling service on the valves shall meet the requirements of ANSI/AWWA C542 except as herein specified. Enclosures shall be NEMA 4x unless shown otherwise on Valve Schedule. If designated on Valve Schedule a “remote control station” shall be provided for mounting important actuator controls separate from the actuator body in an easily accessible location. Deviations from the Valve Schedule will not be accepted.
      b. Actuator materials of construction shall be selected by the manufacturer to be compatible with the environmental conditions that will be present at the valves installed location. Actuators installed in water treatment plants or other potable water applications shall have materials that comply with the Safe Water Drinking Act requirements including food grade lubricants.
      c. Actuator shall be configurable in the field using manufacturer supplied software running on a standard windows operated laptop computer or handheld instrument tool using, either USB, Infra-Red or Bluetooth to communicate to the actuator. Each unit shall be supplied with the necessary handheld tools and software to facilitate actuator programing and settings adjustment.
      d. Mechanical parts shall be designed for safety factor of at least 2. Construction of the operator shall be such that it may be mounted in any position required to facilitate manual operation. Manual operation of the valves shall be possible by a handwheel attached to the mechanism. Power to motor circuit shall be automatically disconnected to prevent accidental electric operation during manual operation. A mechanical dial position indicator shall be provided to continuously indicate valve position. Operator bearings shall be self-lubricating type or lubricated for life before operator is sealed at the factory.

e. The actuator motor shall be heavy-duty with continuous duty rating and totally enclosed and nonventilated. The motor shall be equipped with thermal overload protection. Operating voltage shall be as listed on Valve Schedule. Alternatively, actuator motor shall be variable speed type with integral motor controls that are programable for reduced speed at end of travel and full motor protection.

f. The remote-control station shall be provided by the actuator manufacturer, have a NEMA 4x rated enclosure unless noted otherwise on Schedule and be powered by the actuator. Signal and power wires shall be integrally linked to the actuator with wires landed on appropriately marked terminal strips in the actuator. Unit shall be capable of being mounted 300 feet away from the actuator and with enclosure suitable for wall, rack or pole mounting. Lockable Local-Off-Remote selector, Open-Close valve position switches, push buttons, and valve position indication shall be provided. A display shall be incorporated into the remote-control station that mimics the display on the actuator body and shall include indication of valve position, torque, valve status, motor starts per hour, and temperature.
    1) The remote station can be a separate unit or, if the actuator is specifically designed and configured, the remote station can be the main actuator controller disconnected from the actuator and mounted remotely.
    2) Actuators that can have flexible main controller mounting shall have a body that maintains its NEMA rating regardless of where the controller is located.
    3) Actuators with main controller mounted remotely shall be supplied with a spare controller, one for each size and type of actuator provided on the project.

g. Wire termination compartment shall be configured to effectively isolate actuator body from moisture that may enter the compartment from the power and control wiring conduits.

h. The winding temperature rise shall meet NEMA standard for the class of insulation used at the rated service factor load. The motor shall be for high torque variable speed duty. The motor shall be reversible. A 4-20 mA throttling signal shall be provided by others. Control interface electronics, motor controller, and appurtenances to accept this signal and position the valve between 0% and 100% based on the value of the throttling signal shall be provided with the valve operator. The controller shall be provided complete with NEMA 4 enclosure, Auto-Manual selector switch and Open, Close push-buttons. Controller shall be completely solid state; contactors are not acceptable. Motor and controller shall be suitable for 1,200 starts per hour. Controllers shall accept an isolated 4-20 mA signal for valve positioning from a remote source and shall have menus and control displays can utilize the English language. Valve operators shall be equipped to be field adjustable to fail open, fail closed, or fail in place upon loss of control signal (4-20 mA). Actuators shall be set up to fail in place unless otherwise noted on Valve Schedule.

i. The actuator motor gear train in conjunction with any gearing provided as part of the valve shall be pre-selected to have a stroking time as shown on Valve Schedule. The actuator shall develop the necessary unseating torque without the use of a lost motion device.

j. Limit switches shall be provided at the extreme open and close position of the operator travel. At least 2 independent switches at each end of motor travel shall be provided as standard for a local indicator and interlocking. An additional switch shall be provided at each end for remote use.

k. Motor circuit limit switches shall be of the direct break type. Limit switches shall be adjustable. Limit switch contacts shall be isolated. Auxiliary switches for secondary functions shall be of the cam-operated, spring leaf type or outputs shall be relay type. The operator shall be equipped with a torque switch for protection in the closing direction. An electrical or mechanical interlock shall be provided to prevent the open torque switch from tripping when unseating a torque-seated valve. In the event of power failure, the operator

shall lock in the last control position until power is restored or switched over to standby power or the manual operating handwheel is engaged.

l. Torque switches, limit switches, and motor thermal switches are to be mounted as required inside the housing and connected to the master terminal strip. Provisions shall be made for 2 internal potentiometers for feedback control operations and for remote valve position indicator. Alternatively digital encoders can be used in place of potentiometers. Wiring within operator shall be incorporated in a standard laced wiring harness using compression connectors and terminal strips. Internal wiring shall be UL approved and suitable for the actuator requirements.

m. Wires shall be tagged at each end of the wire with individual wire markers or made with plug and socket connections which shall be clearly labeled and marked. Each terminal of the terminal strips shall be numbered and identified with a marker. Schematics shall be provided with Shop Drawings showing wire numbers, terminals, field wiring, etc. Connections for remote equipment shall be wired to terminal blocks or made with plug and socket connections. Equipment shall be factory wired and tested before shipment.

B. Worm Gear: Worm gear operators shall meet the requirements of AWWA C504 operators.

PART 3 - EXECUTION

3.01 ERECTION

A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operation condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer approved by ENGINEER.

B. Equipment furnished under this Section shall be installed under Section 15100.

3.02 FIELD QUALITY CONTROL

A. Installation: Special attention shall be given by CONTRACTOR to ensure that items furnished under this Section are installed in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 16050 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.

B. The Drawings are schematic and are not intended to show every detail of construction.
   1. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.
   2. CONTRACTOR shall fully coordinate electrical Work with other trades to avoid interferences.
   3. In the event of interferences, CONTRACTOR shall request clarification from ENGINEER in writing.

C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with requirements of Section 01330, Shop Drawings covering the items included under this Section of Work. Shop Drawing submittals shall include:
   1. Submit product data covering the items included under this Section of Work.

B. Conforming to Construction Drawings: Submit a complete set of Drawings showing the locations of the piping, ductwork, etc., as actually installed. Such Drawings shall be submitted to ENGINEER in digital format.

C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section. Include following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.

1.03 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with requirements in Section 01770. In addition, CONTRACTOR shall submit, prior to final payment, Drawings conforming to construction records of systems it has installed. Vendor drawings shall be sized as manufacturers' standard.

B. Provide typewritten data sheets on motor control circuits with following information on each branch feeder: Load name, horsepower or KVA (transformer), fuse size, starter size, service factor of motor, motor nameplate currents, power factor correction capacitor size (if used), and thermal overload part number.

1.04 QUALITY ASSURANCE

A. National Electrical Code: Comply with NFPA 70, National Electrical Code.

B. UL Compliance and Labeling: Use products and components labeled by UL.

1.05 PERMITS, INSPECTIONS, AND LICENSES

A. CONTRACTOR shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules.
   1. Upon completion of Work, CONTRACTOR shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the certificates to OWNER. CONTRACTOR shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Equipment shall be packaged to prevent damage during shipment, storage, and handling. Do not install damaged units; replace, and remove damaged units from Site.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL ELECTRICAL INSTALLATION

A. Provide electrical materials and equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction such as NEMA 4, 4X, 7 or 9 if it is other than NEMA 12. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.
   1. Exception: Provide manufacturer's standard construction for indoor or outdoor application where equipment is not manufactured to NEMA specifications (e.g., switchgear, transformers, high voltage capacitors, bus duct, and light fixtures; materials and equipment used in finished areas such as offices, laboratories, etc.).

B. Provide nonmetallic electrical materials and equipment enclosures in NEMA 4X areas; watertight NEMA 4 and equipment enclosures for outdoor applications and indoor applications below grade; explosion-proof NEC Class I, Division 1, Group D equipment for NEMA 7 areas; explosion-proof NEC Class II, Division 2, Group F equipment for NEMA 9 areas.

C. Coordinate with power company high voltage and/or low voltage metering requirements. Furnish, install, and connect metering equipment not furnished, installed or connected by power company.

D. Provide chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

E. Supporting devices and sleeves shall be set in poured-in-place concrete and other structural components as they are constructed.

F. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom possible. Locate light fixtures at approximately 8 feet above floor and where fixtures may be readily serviced.

G. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

H. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by Drawings recognizing that portions of Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to ENGINEER.

I. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.

J. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

K. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Section 08310.

L. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 RACEWAY INSTALLATION

A. Outdoors, use the following materials:
   1. Exposed Conduit: PVC externally coated rigid metal conduit and fittings.
   2. Underground Concrete Encased Conduit: Rigid nonmetallic conduit.
   3. Conduit Used to Connect to Vibrating Equipment including transformers and hydraulic, pneumatic or electric solenoid or motor-driven equipment: Liquidtight flexible metal conduit.

B. Indoors, use the following wiring materials:
   1. Connection to Vibrating Equipment, including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: Liquidtight flexible metal conduit.
   2. Exposed Conduit: Rigid metal conduit or intermediate metal conduit.
      a. Exceptions:
         1) Areas indicated as NEMA 4X, use rigid Schedule 40 PVC conduit.
   3. Concealed Conduit: Rigid metal conduit or intermediate metal conduit unless indicated otherwise.

C. Minimum size conduit shall be 3/4 inch unless shown otherwise.

D. Instrument Signal Conduit Requirements: Shielded signal wires for 4-20 mA type instruments or thermocouple wires assigned to the same control panel may be run in the same conduit. Shielded instrument signal wires, thermocouple wires, and shielded 2-wire intercom wires may be run in the same conduit. No other wires will be permitted in an instrument signal/2-wire intercom conduit. Conduit shall be RMC or PVC-coated RMC.

E. Conduit Thread Paint: Make threaded conduit joints watertight by coating threaded portions with a spray-on or brush-on zinc-bearing paint. Provide paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Clean field-cut threads of oil using the recommended solvent prior to coating threads.

F. Install expansion fittings in all exposed rigid nonmetallic conduit runs of 20 feet or more.

G. Install expansion/deflection fittings where conduit passes a building expansion joint or where conduits are attached to two structures joined by a concrete expansion joint.

H. Exposed or Concealed Construction: Install conduit exposed inside buildings except for areas with finished walls (e.g., offices, laboratories, lavatories, locker rooms, etc.) unless otherwise indicated.

I. Concealed Raceways: Raceways embedded in slabs shall be installed in the middle third of the slab thickness where practical and leave at least 1-inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run 1-inch and smaller raceways with a minimum of bends in the shortest practical distance. Run larger conduit parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Where nonmetallic conduit or fiberglass-reinforced conduit is used, raceways must be converted to PVC externally coated rigid metal conduit before rising above floor.

J. Exposed Raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. Conduits shall slope away from loads to keep moisture from entering the load. Run parallel or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run, such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

K. Space raceways, fittings, and boxes 0.25 inch from mounting surface in NEMA 4 and NEMA 7 areas. Spacers shall be one-piece construction of stainless steel, galvanized steel, PVC, ABS, or other noncorrosive material.

L. Sleeves: Install in concrete floor slabs except where conduit passes through a housekeeping pad. Install in exterior walls below grade.

M. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid metal conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs with floor.

N. Flexible Connections: Use short length (maximum 6 feet for lighting fixtures; maximum 3 feet for all other equipment) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement, and all motors. Use liquidtight flexible conduit in wet locations and rated flexible connections for hazardous locations. Install separate ground conductor across flexible connections.

O. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

P. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate metal conduit, use threaded rigid metal conduit fittings. For PVC externally coated rigid metal conduit, use only factory-coated fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.

Q. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush metal box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
   1. Where required by the NEC.

R. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. Provide knockout closures to cap unused knockout holes where blanks have been removed.

S. Install device boxes at the height above the floor as follows for:
   1. Light switches, 4 feet.
   2. Receptacles, 18 inches except in NEMA 4 and 4X areas, 4 feet.
   3. Thermostats, 4'-0".

T. Avoid installing boxes back-to-back in walls. Provide not less than 6-inch (150 mm) separation.

U. Position recessed outlet boxes accurately to allow for surface finish thickness.

V. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete masonry.

W. Provide fire-retardant barriers in all pull and junction boxes containing circuits that are otherwise continuously separated in conduit. Securely fasten these barriers within box. Size barriers so that space between barrier and box wall does not exceed 0.125 inch anywhere around the perimeter of barrier.

X. Support exposed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

Y. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from building structure.

Z. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipples so no threads are exposed.

AA. Complete installation of electrical raceways before starting installation of conductors within raceways and prevent foreign matter from entering raceways by using temporary closure protection. Cap spare conduit. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

BB. Install pull wires in empty raceways: Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.03 WIRE AND CABLE INSTALLATION

A. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.

B. Keep branch circuit conductor splices to minimum. Splice feeders only where indicated. Use a standard kit. No splices are allowed for instrument and telephone cables except at indicated splice points.

C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material and are UL listed as pressure type connectors.

D. Provide adequate length of conductors within electrical enclosures and train conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at terminal.

E. Terminate power conductors at equipment using pressure-type terminals specifically designed for type of terminations to be made. Terminate no more than 2 conductors No. 8 AWG and smaller

within the same pressure-type terminal. These 2 conductors shall be no more than 4 wire gauge sizes apart. Terminate no more than 1 conductor larger than No. 8 AWG within any pressure-type terminal.

F. Seal wire and cable ends until ready to splice or terminate.

3.04 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with requirements in Section 02225. In addition, the following requirements apply.
   1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover Work to provide for installation of ill-timed Work, remove and replace Work that is either defective or does not conform to requirements of Drawings.
   2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by new Work. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
   3. Patch existing finished surfaces and building components using new materials matching existing materials.

3.05 EQUIPMENT CHECKOUT AND TESTING

A. In addition to testing recommended by equipment or material supplier and called for in equipment or material specification, perform the following.

B. Motor Testing: Motor insulation shall be tested by using a 500 VDC (minimum) megger and applying test until a constant megohm reading of the following magnitude is obtained:

$R_{min.} = 4 (KV + 1)$ at 25 degrees C winding temp.
$R_{min.} = IV + 1$ at 40 degrees C winding temp.

   1. If motors do not meet requirements of megger test, blow hot air through motors to dry out and repeat until test is passed. If desirable, drying can be done by applying an electrical potential to equipment. However, in no case, induced or direct, shall voltage or current exceed continuous rating of equipment being dried.
   2. After passing megger test, motors shall be hi-pot tested at 200 percent rated voltage for a minimum of 1 minute.

C. Equipment Testing: The following tests which are applicable for a particular item of equipment shall be performed:
   1. Megger bus work phase-to-phase and phase-to-ground. Minimum acceptable steady-state value is 100 megohms.
   2. Megger power circuit breakers and circuits supplied phase-to-phase and phase-to-ground (100 megohms minimum).
   3. Test current transformer circuits by applying current to secondary wiring at current transformer terminals until contactor trips.
   4. Test, time, and set protective relays. Relays shall be timed at various multiples (minimum of 3 points) of the pick-up value to determine agreement with published curves and adjust as

necessary to agree with coordination study required settings. Exact tests to be performed vary with type of relay. Manufacturer's instructions for relay shall be complied with.

5. After Work has been completed, demonstrate to OWNER's Representative that entire electrical installation is in proper working order and will perform functions for which it was designed by functional testing.
6. Make any specific tests required by the manufacturer's installation instructions.

D. Check-out Procedures. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:
   1. Vacuum interior of cubicles and remove foreign material.
   2. Wipe clean with a lint-free cloth insulators, bushings, bus supports, etc.
   3. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.
   4. Fill motor bearings requiring oil.
   5. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.
   6. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.
   7. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.
   8. Check exposed bolted power connections for tightness.
   9. Check operation of breakers, contactors, etc., and control and safety interlocks.
   10. Check tightness of bolted structural connections.
   11. Check leveling and alignment of enclosures.
   12. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.
   13. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.
   14. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION

SECTION 16060 - GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Electrical grounding and bonding Work as follows:
   1. Solidly grounded.

B. Applications of electrical grounding and bonding Work in this Section:
   1. Electrical power systems.
   2. Raceways.
   3. Service equipment.
   4. Enclosures.
   5. Equipment.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.
   2. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

A. Materials and Components:
   1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

2. Conductors: Electrical copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
3. Service Arrester: Electrical service arrester, 480 volts, 3-phase, 4-wire, for interior mounting.
4. Grounding Electrodes: Steel with copper welded exterior, 3/4-inch diameter by 10 feet.
5. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. Connect grounding conductors to underground grounding electrodes using mechanical compression type connectors.

B. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

C. Ground each separately derived system neutral to effectively grounded metallic water pipe, effectively grounded structural steel member, and separate grounding electrode.

D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

F. Connect grounding electrode conductors to 1-inch diameter or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

G. Connect building reinforcing steel, building steel beam, building steel roof and walls and duct bank and vault reinforcing steel to ground mat using No. 4/0 AWG bare copper grounding cable.

H. Bond bare No. 4/0 AWG grounding cable in duct banks to grounding cable in vaults and to power equipment ground bus at ends of each duct bank.

I. Bond strut and other metal inside of electrical manholes and vaults to bare No. 4/0 AWG grounding cable carried in duct bank.

J. Bond grounding cables to both ends of metal conduit or sleeves through which such cables pass.

K. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

L. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.

M. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.

N. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

3.02 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester using the 3-point fall of potential method. Testing shall be performed during normal dry weather conditions with at least 5 non-rain days elapsing prior to test. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less by driving additional ground rods; then retest to demonstrate compliance.

END OF SECTION

SECTION 16070 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each type of product specified.

1.03 QUALITY ASSURANCE

A. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Slotted Metal Angle and U-Channel Systems:
      a. Allied Tube & Conduit.
      b. American Electric.
      c. B -Line Systems, Inc.
      d. Cinch Clamp Co., Inc.
      e. GS Metals Corp.
      f. Haydon Corp.
      g. Kin-Line, Inc.
      h. Unistrut Diversified Products.
   2. Conduit Sealing Bushings:
      a. Bridgeport Fittings, Inc.
      b. Cooper Industries, Inc.
      c. Elliott Electric Mfg. Corp.
      d. GS Metals Corp.
      e. Killark Electric Mfg. Co.
      f. Madison Equipment Co.
      g. L.E. Mason Co.
      h. O-Z/Gedney.
      i. Producto Electric Corp.
      j. Raco, Inc.
      k. Red Seal Electric Corp.
      l. Spring City Electrical Mfg. Co.
      m. Thomas & Betts Corp.

2.02 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors, in NEMA 4 areas, or embedded in concrete shall be hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners. Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: Steel springhead type.
   3. Hanger Rods: 0.375-inch diameter minimum, steel.

C. Conduit Sealing Bushings: Factory fabricated, watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 12 gauge or 0.105-inch-thick steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES

A. Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide a waterstop on pipe sleeves. Provide pipe sleeves of 2 standard sizes larger than conduit/pipe passing through it and of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge metal for sleeve diameter noted:
      a. 3-inch and smaller: 20-gauge.
      b. 4-inch to 6-inch: 16-gauge.
      c. Over 6-inch: 14-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
   3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:
   1. Identification labeling for cables and conductors.
   2. Warning and caution signs.
   3. Equipment labels and signs.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product Data for each type of product specified.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS

A. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

B. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.

D. Aluminum, Wraparound Cable Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.

E. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in black letters on white face and punched for mechanical fasteners.

F. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

G. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.

H. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.

I. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.

B. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.

C. Install line marker for underground wiring, both direct buried and in raceway.

D. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification or as follows:

Phase	480/277 Volts
A	Yellow
B	Brown
C	Orange
Neutral	White
Ground	Green

E. Use conductors with color factory applied entire length of conductors except as follows:
1. The following field applied color coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
    a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

F. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.

G. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION

SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Low-Voltage Wire and Cable.
   2. Instrument Cable.
   3. Local Area Network Wiring (LAN).

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Include Shop Drawings of wires, cables, connectors, splice kits, and termination assemblies.

B. Reports of field tests prepared as noted in Section 01600.

1.03 QUALITY ASSURANCE

A. UL Compliance: Provide components which are listed and labeled by UL. For cables intended for use in air handling space comply with applicable requirements of UL Standard 710, "Test Method for Fire and Smoke characteristics of cables used in Air Handling Spaces."

B. NEMA/ICEA Compliance: Provide components which comply with following standards:
   1. NEMA WC 70-1999/ICEA S-95-658-1999, Nonshielded Power Cables Rated 2,000 Volts or Less for the Distribution of Electrical Energy.

C. IEEE Compliance: Provide components which comply with the following standard.
   1. Standard 82, Test procedures for Impulse Voltage Tests on Insulated Conductors.

D. Network Wiring Experience: CONTRACTOR must be able to prove to the satisfaction of OWNER that it has significant experience in the installation of Local Area Network cable systems. Installation must include installation of Network cable, cable termination, knowledge of interconnect equipment, and a thorough knowledge of testing procedures.

E. Labeling: Handwritten labels are not acceptable. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be of a color contrasting with the label such that is may be easily read. If labeling tape is utilized, the font color shall contrast with the background. Patch panels shall exhibit workstation numbers or some type of location identifier, in sequential order, for all workstations or devices attached. Each Network cable segment shall be labeled at each end with its respective identifier.

F. Network Wiring Interconnect Equipment (Patch Panels): Interconnect equipment shall be used in all Local Area Network cable installations. Patch panels shall be mounted in the equipment racks or panel mounted. Interconnect equipment mounted in racks shall be affixed to the rack by at least

4 screws. All interconnect devices shall be assembled and installed in accordance with the manufacturer's instructions and recommendations.

G. Patch Cords: Patch cords shall be provided for each Local Area Network port on the patch panel. Patch cords shall meet or exceed technical specifications of all installed Local Area Network cable. Patch cord connectors shall be matched with patch panel connector type and network module connector type as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Low-Voltage Wire and Cable:
      a. American Insulated Wire Corp.
      b. General Cable.
      c. The Okonite Co.
      d. Southwire Co.
   2. Connectors for Low-Voltage Wires and Cable Conductors:
      a. AMP.
      b. O-Z/Gedney Co.
      c. Square D Company.
      d. 3M Company.
   3. Instrument Cable:
      a. Belden (Trade Nos. 1120A and 1118A).
   4. Local Area Network Cable:
      a. Belden 7882A/7883A, or equal.

2.02 LOW-VOLTAGE WIRES AND CABLES

A. Conductors: Provide stranded conductors conforming to ASTM Standards for concentric stranding, Class B. Construction of wire and cable shall be single conductor (1/c) unless multiconductor cable is shown by notation in form (x/c) where x indicates the number of separate insulated conductors per cable.

B. Conductor Material: Copper. Minimum size power wire shall be No. 12 AWG.

C. Insulation: Provide XHHW insulation for power conductors used in single- and 3-phase circuits indoors.
   1. Provide XHHW insulation for grounding conductors installed in raceways.
   2. Provide THHN/THWN insulation for control conductors.

2.03 CONNECTORS FOR LOW-VOLTAGE WIRES AND CABLES

A. Provide UL listed factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types, and classes for applications and services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

2.04 INSTRUMENT CABLE

A. Instrument Cable: 600 volt minimum insulated shielded cable with two or more twisted No. 16 or No. 18AWG stranded copper conductors; PVC, nylon, or polyethylene outer jacket; and 100 percent foil shielding.

2.05 LOCAL AREA NETWORK CABLE

A. Category 6 (Ethernet) Data and Patch Cable:
   1. Paired, 4-pair, 24 AWG, solid bare copper conductors with polyethylene insulation, overall aluminum foil-polyester tape shield with 24 AWG stranded tinned copper drain wire, 100 percent shield coverage, PVC jacket.
   2. UL verified to Category 6.
   3. Provide plenum rated cable where installed exposed.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Prior to energizing, check installed 480 volt, 3-phase power circuits and higher wires and cables with a 1,000-volt megohm meter to determine insulation resistance levels to assure requirements are fulfilled. Minimum acceptable megohm meter reading is 100 megohms held at a constant value for 15 seconds. A certified copy of megohm meter tests shall be submitted to ENGINEER. Test reports shall include ambient temperature and humidity at time of testing. Notify ENGINEER 48 hours prior to test with schedule.

B. Local Area Network (LAN) Cable Tests: Testing of all cable segments shall be completed in compliance with EIA/TIA-568-B.1 Standards. Testing shall be done by CONTRACTOR with at least 5 years of experience in testing Network cabling systems.
   1. TESTING: CONTRACTOR shall test each network cable segment. **OWNER reserves the right to have representation present during all or a portion of the testing process. CONTRACTOR must notify OWNER 5 days prior to commencement of testing**. If OWNER elects to be present during testing, test results will only be acceptable when conducted in the presence of OWNER.
   2. DOCUMENTATION (Network Cable): CONTRACTOR shall provide documentation to include test results and as-built Drawings. Network Cable Results: Handwritten results are acceptable provided the test is neat and legible. Copies of test results are not acceptable. Only original signed copies will be acceptable.
      a. Each cable installed shall undergo complete testing in accordance with TIA/EIA-568-B.1 to guarantee performance to this Standard.
      b. All required documentation shall be submitted within 30 days at conclusion of the project to OWNER.

c. Test Criteria: Pass rate to conform to latest TIA/EIA-568-B.1 Standards that incorporate link performance testing through entire path, including cable, couplers, and jumpers.

3. ACCEPTANCE: Acceptance of the Data Communications System, by OWNER, shall be based on the results of testing, functionality, and receipt of documentation.

C. Reports (non-LAN cable): Testing organization shall maintain a written record of observations and tests, report defective materials and workmanship, and retest corrected defective items. Testing organization shall submit written reports to ENGINEER.

END OF SECTION

SECTION 16130 - RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:
   1. Intermediate metal conduit.
   2. Liquidtight flexible conduit.
   3. Rigid metal conduit.
   4. Conduit bodies.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for the following products:
      a. Conduit.
      b. Conduit bodies.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
   2. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:
   1. Conduit:
      a. Allied Tube.
      b. Carlon.
      c. General Electric Co.
      d. Johns Manville.
      e. Occidental Coatings.
      f. Orangeburg.
      g. Perma-Cote Industries.
      h. Republic Steel.
      i. Robroy Industries.
      j. Steelduct Co.
      k. Triangle Conduit.

l. Wheatland Tube.
m. Youngstown Sheet and Tube.

2. Liquidtight Conduit:
   a. Anamet, Inc.
   b. Carlon.
   c. Electric-Flex.
   d. Thomas and Betts.
3. Conduit Bodies:
   a. Adalet-PLM.
   b. American Electric.
   c. Appleton Electric Co.
   d. Carlon.
   e. Crouse-Hinds Division, Cooper Industries, Inc.
   f. Delta Industrial Products.
   g. Killark Electric Mfg. Co.
   h. Kraloy Products Co.
   i. O-Z/Gedney Co.
   j. Perma-Cote Industries.
   k. Robroy Industries.
   l. Spring City Electrical Mfg. Co.
4. Conduit Thread Paint:
   a. CRC Chemicals, USA.
   b. Sherwin Williams.
   c. ZRC Chemical Products Co.

2.02 METAL CONDUIT AND TUBING

A. Rigid Metal Conduit: ANSI C 80.1, hot-dip galvanized.

B. Intermediate Metal Conduit: UL 1242, hot-dip galvanized.

C. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 CONDUIT BODIES

A. Provide matching gasketed covers secured with corrosion-resistant screws. Use cast covers in NEMA 4 areas and stamped steel covers in NEMA 1 and 12 areas. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.

B. Metallic Conduit and Tubing: Use metallic conduit bodies as follows:
   1. Rigid Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.
   2. Intermediate Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.

C. NEMA 7 and NEMA 9 Areas: Use materials conforming to UL standards for the area.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16135 - CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other Sections. Types of products specified in this Section include:
   1. Pull and junction boxes.
   2. Bushings.
   3. Locknuts.
   4. Conduit hubs.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Shop Drawings for floor boxes and boxes, enclosures, and cabinets that are to be shop-fabricated, (nonstock items). For shop-fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
   2. Product data for boxes, fittings, cabinets, and enclosures.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
   2. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Junction and Pull Boxes, Concealed System:
      a. Adalet-PLM Div., Scott Fetzer Co.
      b. Appleton Electric, Emerson Electric Co.
      c. Arrow-Hart Div., Crouse-Hinds Co.
      d. Bell Electric, Square D Company.
      e. GTE Corporation.
      f. Keystone Columbia, Inc.
      g. OZ/Gedney Co.; General Signal Co.
      h. Spring City Electrical Mfg. Co.

2. Junction and Pull Boxes, Exposed Conduit System:
    a. Appleton Electric, Type FS/FD.
    b. Crouse-Hinds, Type FS/FD.
3. Bushings, Knockout Closures, Locknuts, and Connectors:
    a. Adalet-PLM Div., Scott Fetzer Co.
    b. AMP, Inc.
    c. Arrow-Hart Div., Crouse-Hinds Co.
    d. Appleton Electric Co., Emerson Electric Co.
    e. Bell Electric; Square D Co.
    f. Midland-Ross Corp.
    g. Midwest Electric, Cooper Industries, Inc.
    h. OZ/Gedney Co., General Signal Co.
    i. RACO Div., Harvey Hubbell, Inc.
    j. Thomas & Betts Co., Inc.

2.02 CABINETS, BOXES, AND FITTINGS – GENERAL

A. Junction and Pull Boxes: Suitable for the conduit system installation as follows:
    1. Exposed Conduit: For pull and junction boxes 50 cubic inches and smaller, provide cast or malleable iron, zinc electroplated boxes finished with aluminum lacquer or enamel. Provide exterior mounting lugs and cast covers with neoprene gaskets. For pull and junction boxes larger than 50 cubic inches provide watertight sheet metal boxes. Grind exposed edges smooth or roll edges to prevent scuffing of wire during installation. Provide code-gauge sheet steel construction for boxes smaller than 1,000 cubic inches. Provide 0.10-inch steel construction, hot-dip galvanized after fabrication for boxes larger than 1,000 cubic inches. Secure box covers using No. 8 or larger machine screws spaced at intervals not exceeding 6 inches. Provide a continuous neoprene or rubber gasket cemented to the box cover where it contacts the box body.
        a. Exceptions: Provide nonmetallic pull and junction boxes in NEMA 4X areas. Provide appropriate explosion-proof construction for boxes located in NEMA 7 and NEMA 9 areas. Provide factory PVC-coated boxes for areas where PVC conduit is used.
    2. Concealed Conduit: Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.

B. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications. Provide watertight hubs on conduits terminated at sheet steel enclosures in NEMA 4 areas.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16410 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each type of product specified.

B. Operation and Maintenance Manuals: Submit in accordance with requirements of Sections 01600 and 13410, operation and maintenance manuals for items included under this Section, including circuits and motor disconnects.

1.02 QUALITY ASSURANCE

A. Codes and Standards:
   1. Electrical Component Standards: Provide components which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Allen-Bradley.
   2. Appleton.
   3. Crouse-Hinds Co.
   4. General Electric Co.
   5. Siemens, Inc.
   6. Square D Company.

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Provide NEMA 4, 4X, 7, 9, or 12 enclosure to match the rating of the area in which switch is installed. For motor and motor starter disconnects through 100 horsepower, provide units with horsepower ratings suitable to loads. For motor and motor starter disconnects above 100 horsepower, clearly label switch, "DO NOT OPEN UNDER LOAD."

B. Fusible Switches: (Heavy-duty) switches, with fuses of classes and current ratings indicated. See Section "Fuses" for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Non-fusible Disconnects: (Heavy-duty) switches of classes and current ratings as indicated.

2.03 ACCESSORIES

A. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:
   1. Stainless Steel for NEMA 4 switches.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16420 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Types of motor controllers, including:
   1. Combination controllers.
   2. Fractional HP manual controllers.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and sizes.
   2. Product Data: Submit manufacturer's data and installation instructions on motor controllers.
   3. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.
   2. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Allen-Bradley Co.
   2. Crouse-Hinds Co.
   3. Cutler-Hammer Products/Eaton Corp.
   4. Emotron.
   5. Furnas Electric Co.
   6. General Electric Co.
   7. Siemens, Inc.
   8. Square D Company.

2.02 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation.

B. Combination Controllers: Consist of controller and circuit breaker or fusible disconnect switch mounted in common enclosure of types, sizes, ratings, and NEMA sizes indicated. Equip starters with block-type manual reset overload relays. Provide control and pilot devices indicated. Provide 90 degree C SIS or MTW, No. 14 AWG control wiring, tagged at each termination. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with 3 padlocks. Construct and mount controllers and disconnect switches in single NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.
   1. The 3-phase starter may be the following types:
      a. Full Voltage Non-reversing (FVNR): One 3-pole magnetic contactor with a set of 3 overload devices.

C. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in the transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of the unit requirements or provide 150VA rated transformer, whichever is greater. Provide 300 volt rated, oiltight type LED lights, push buttons with extended guard and black color insert. Equip stop push buttons with half guard and red color insert. Provide 120/6 volt transformer type push-to-test LED lights with lens color indicated. Provide machine tool type relays, each with 1 spare N.O. contact. Provide 6-digit elapsed time indicators with one-tenth hour increments. When timers are required, they shall be synchronous type.

D. Fractional HP Manual Controllers: Provide 3-phase and single-phase fractional horsepower manual motor controllers, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms, and with one-piece melting alloy type thermal units. Controller shall become inoperative when thermal unit is removed. Provide controllers with double-break silver alloy contacts, visible from both sides of controller, and switch capable of being padlocked-OFF. Enclose controller unit in NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 16748 - SOFTWARE SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, equipment, and services necessary for furnishing fabrication, production, and installation of items specified in this Section or as shown on Drawings.

B. Work includes programming, testing, and installation of software required for a complete and fully operational well site control system. Principal segments of Work include, but are not limited to, programmable logic controller ladder logic, data collection, and operator process control interfaces.

C. Alternates:
   1. Alternate No. 4 Replace Backwash Pump Motor Starters.

1.02 SYSTEM DESCRIPTION

A. Design Requirements. System consists of two (2) ball control valves and two (2) magmeters installed on the effluent piping of the two (2) backwash pumps. These valves and meters are replacing a single control valve and meter. The I/O associated with the two (2) valves and meters will be routed back to the programmable logic controller (PLC) in Panel CP-F3 located on the operations floor of the filter gallery. The panel contains a Rockwell PLC-5 processor with integral I/O racks. The PLC processor is connected to the plant SCADA system via an Ethernet connection. Contractor shall program the CP-F3 PLC system. Contractor shall coordinate with the Owner for the messaging of information to the Water Plant SCADA system. The Owner will be performing the HMI programming at the plant.

B. There is an Alternate to replace the starters for the two backwash pumps. The Contractor shall provide PLC programming to accommodate the additional I/O shown for this Alternate.

C. Performance Requirements: Programmable logic controllers (PLCs) shall complete execution of all rungs with a cycle time not to exceed 250 mS. Operator interface functions shall have a 2-second response time or better. Adjust timing and operating system parameters of PLCs and computers as necessary.

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01330 and 13410, Shop Drawings and product data for products provided under this Section.

1.04 QUALITY ASSURANCE

A. Process Control Narrative Meetings: Allow in Bid for two (2) four-hour meetings at the Water Plant in Ann Arbor, Michigan, for review and updating of the process control requirements of the affected equipment.

B. Software Progress Meetings: Allow in Bid for one (1) meeting per month at the Water Plant in Ann Arbor, Michigan, for review of PLC logic and interface to graphic operator screens. Meeting to commence at time of Contract Award and continue up to panel checkout.
   1. These meetings shall be for specific purpose of assuring that software development Work is in accordance with Project requirements and are in addition to Project progress meetings that may otherwise be required. Document and distribute to all attendees minutes of meetings

C. Discussion Items for these meetings:
   1. Sequence of Operations
   2. Functional Intent
   3. Alarm List
   4. Verify ranges, signals, etc.
   5. IP addresses
   6. Color Schemes
   7. Schedules

PART 2 - PRODUCTS

2.01 SERVICE SUPPLIER

A. Software services shall be fulfilled by the organization selected as "Equipment Supplier" under Section 13410.

2.02 SOFTWARE SERVICES

A. Software services include program development, testing, documentation, and Work necessary to implement a complete and fully operating system as shown on Drawings and/or as specified. Provide programming to implement required functions and features.

B. Work requires coordination with concurrent program development for PLCs, Operator Interface, and Data Collection. Include PLC error detection logic for communications failures, data highway faults, internal faults, and time outs. Communicate PLC error conditions to Operator Interface for logging and reporting.

C. Communication between PLCs, Operator Interface, and Data Collection shall be on an exception basis. When reportable changes in process state occur, such as alarm assertion, return to normal, or analog value out of dead band, report event to PLC that communicates with Operator Interface and Data Collection. This PLC shall maintain data tables current with all process inputs and outputs. Organize data to be transferred into contiguous blocks of information using bit-mapped and integer tables. Employ a "watchdog" timer for each remote PLC and poll that PLC if no message has been received in a reasonable amount of time. Accept Operator Interface directives for setpoint changes and hand switches.

D. Communication from CP-F3 PLC to Plant SCADA is via the existing plant ethernet network system. Contractor shall be responsible for the programming required to transmit/receive updated I/O signals between the PLC and Plant SCADA system HMIs.

2.03 PROGRAMMABLE CONTROLLER LOGIC

A. Develop programs for execution on PLC using development software supplied for that specific PLC. Logic shall perform functions required to control processes and equipment as shown on Drawings and/or as specified. Develop complete cross-references for ladder logic and complete input/output listings.

B. Process Control Narratives
   1. Backwash Pump (typical of 2, Alternate No. 4)
      a. Starter OOR switch set to On – pump will run.
      b. Starter OOR switch set to Off – Pump will stop if running and be idle.
      c. Starter OOR switch set to Remote – Pump will start and stop from the Plant SCADA System. Remote manual control is provided through the PLC when the software MANUAL is selected at the HMI, the pump's START/STOP software push buttons control the pump, using operator manual commands. Refer to automatic control scheme below.
      d. Monitored Analog Signals:
         1) Pump Flow – depict continuous flow.
         2) Provide trend for analog signals for one day. At the end of the day, the trend will start over.
      e. Monitored Digital Signals.
         1) In Remote
         2) Pump Running
         3) High Winding Temperature Alarm
   2. Ball Control Valve (typical of 2)
      a. Actuator LOR switch set to Local – The valve can be opened or closed via push buttons located on the actuator.
      b. Actuator LOR switch set to Off – The valve remains in current position and cannot be moved via local pushbuttons or SCADA system.
      c. Actuator LOR switch set to Remote – The valve position can be modulated via a 4-20mA signal from the Plant SCADA System. Remote manual control is provided through the PLC when software MANUAL is selected at the HMI, the valve's 0-100% open software control is set using operator manual entry. Refer to automatic control scheme below.
      d. Monitored Analog Signals:
         1) Valve Position Feedback – depict position.
         2) Provide trend for analog signals for one day. At the end of the day, the trend will start over.
      e. Monitored Digital Signals.
         1) In Remote
         2) Valve Fault
   3. Backwash Automatic Control Scheme:
      a. An Operator will initiate a backwash sequence either from SCADA or the associated filter control panel.
      b. The backwash pumps operate in a lead/lag set up with alternation after each backwash sequence. When a backwash sequence is initiated, the lead backwash pump will start and run the duration of the sequence.
      c. After the pump starts, the associated flow control valve will modulate to maintain the desired backwash flow. The associated flow signal will be used as the control variable for the valve position.

d. The desired backwash flow rate changes throughout the backwash sequence. Reuse the backwash flow rate logic currently used for the single control valve and flow meter.
e. When the desired flow rate exceeds the output capacity of a single pump, the lag pump will start. The two flow signals shall be added together and used as the control signal for the valve positions.
f. When the desired flow rate drops to an operator set percentage below the output capacity of a single pump, the lag pump will stop, and the control valve will adjust to maintain the desired flow.
g. When a pump is called to stop, the associated control valve will start to close. When the valve reaches 95% closed, the lag pump will stop. In the event two pumps are in operation, the other pump control valve will modulate to maintain the desired flow rate, while the other valve moves towards full closed.
h. Interlock Digital Signals.
    1) Pump In Remote (at least one is required)
    2) Control Valve In Remote (at least the one associated with Pump In Remote.
    3) Pump(s) Running
    4) High Winding Temperature Alarm (Lock pump out and issue Alarm)
i. Interlock Analog Signals.
    1) Flow(s) (at least the one associated with Pump running)
j. Alarms
    1) Sequence Failure – Pump running, valve not opening
    2) Sequence Failure – Pump not running, Valve open
    3) Pump called to Run, not running
    4) Valve position feedback does not match control signal plus/minus deadband.
    5) Desired Flow not reached

PART 3 - EXECUTION

3.01 SOURCE QUALITY CONTROL

A. Conduct preliminary testing prior to executing programs supplied for this Project. Use simulated input and output devices as necessary to verify correct interpretation. Exercise inputs to test logic for correct function and proper response of outputs. Verify correct interface of PLC logic with programs used for Operator Interface and Data Collection Activities. Verify correct PLC to PLC communications.

B. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION

APPENDIX

APPENDIX A

Water Treatment Plant

Filter Building

Asbestos Lead and Regulated Building Materials Survey

Apex # **86307**

APEX Research, Inc.

1054 Hi Tech Drive, Whitmore Lake, MI 48189. Phone: (734) 449 - 9990, Fax (734) 449 - 9991 www.ApexMI.com

Customer Name: City of Ann Arbor
Address: 301 E Huron Street
City, St., Zip: Ann Arbor MI 48107
Phone: (734) 794-6000 43110 Fax: _____
Turn Around Time: (*circle one*) ***Terms and conditions on the other side.

Date of Survey: 9/10/2019
Project: City of Ann Arbor, Water Treatment Plant
Project # Backwash Pumps
Contact Person: John Tyler
Email: jtyler@a2gov.org
Circle analyses required, indicate type and quantity

Lab Use Only
Log-In: ____
Report: ____
Fax: ____
Verbal: ____
Email: ____

Rush | 24 hour | 48 hour | 72 hour | Other: _____ | TTP yes / no (Test Till Positive)
Samples received after 3pm logged in next morning

Asbestos: Bulk X Wipe ____ Point Count ____ PCM ____
Lead / Cad / Chrome: Wipe ASTM E1792? circle YES or NO ____ Air ____ Paint ____ Bulk ____
Mold: Bulk ____ Air/Zefon/AlergencoD ____ BioSIS ____ Tape ____
TEM: Bulk/NOB ____ NIOSH 7402 ____ EPA Level II ____ Other ____

Lab ID	Customer ID #	Material/Location	Volume	Area	Results
1	WTPBW-910-1	Backwash Pump #1 - Pump Room 1 - Gasket			
2	WTPBW-910-2	" " " " " " "			
3	WTPBW-910-3	" " " " " " "			
4	WTPBW-910-4	Backwash Pump #2 - Pump Room 1 - Gasket			

RECEIVED
SEP 10 2019
APEX RESEARCH

Relinquished By: John Tyler
Date: 9/10/19
Received By: _____
Time/Date: 9-10-19 1115
Relinquished By: _____
Date: _____
Received By: _____
Time/Date: _____

Revision R5 Date: Nov/2017

Certificate of Laboratory Analysis

Test Method, Polarized Light Microscopy (PLM)

Project : City of Ann Arbor Water Treatment Plant
Backwash Pumps

Report To:
Mr. John Tyler
City of Ann Arbor
301 E. Huron St.
Ann Arbor, MI 48108

ARI Report # 19-86307
Date Collected: 09/10/19
Date Received: 09/10/19
Date Analyzed: 09/12/19
Date Reported: 09/13/19

Sample Information	Asbestos Type/Percent	Non-Asbestos Material
Lab ID #: 86307 - 01 Cust. #: WTPBW-910-1 Material: Gasket Location: Backwash Pump #1 - Pump Rm. 1 Appearance: black,fibrous,homogenous Layer: 1 of 1	Asbestos Present: **NO** No Asbestos Observed	Cellulose - 10% Other - 90%
Lab ID #: 86307 - 02 Cust. #: WTPBW-910-2 Material: Gasket Location: Backwash Pump #1 - Pump Rm. 1 Appearance: black,fibrous,homogenous Layer: 1 of 1	Asbestos Present: **NO** No Asbestos Observed	Cellulose - 10% Other - 90%
Lab ID #: 86307 - 03 Cust. #: WTPBW-910-3 Material: Gasket Location: Backwash Pump #1 - Pump Rm. 1 Appearance: black,fibrous,homogenous Layer: 1 of 1	Asbestos Present: **NO** No Asbestos Observed	Cellulose - 10% Other - 90%

For Layered Samples, each component will be analyzed and reported separately.

Robert T. Letarte Jr., Laboratory Director

Test Method EPA 600/R-93/116 was used to analyze the above samples. Matrix interference and/or resolution limits may yield false/negative results in certain circumstances. Suspect floor tiles containing <1% should be tested with SEM or TEM. This certificate of analysis relates only to the samples tested and to insure the integrity of the results, may only be reproduced in full. This certificate must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. APEX Research Inc. is not responsible for the accuracy of the results for layered samples or samples comprising multiple materials. Liability limited to cost of analysis.

Certificate of Laboratory Analysis

Test Method, Polarized Light Microscopy (PLM)

Project : City of Ann Arbor Water Treatment Plant
Backwash Pumps

Report To:
Mr. John Tyler
City of Ann Arbor
301 E. Huron St.
Ann Arbor, MI 48108

ARI Report # 19-86307
Date Collected: 09/10/19
Date Received: 09/10/19
Date Analyzed: 09/12/19
Date Reported: 09/13/19

Sample Information	Asbestos Type/Percent	Non-Asbestos Material
Lab ID #: 86307 - 04 Cust. #: WTPBW-910-4 Material: Gasket Location: Backwash Pump #2 - Pump Rm. 1 Appearance: brown,fibrous,homogenous Layer: 1 of 1	Asbestos Present: **NO** No Asbestos Observed	Cellulose - 5% Other - 95%
Lab ID #: Cust. #: Material: Location: Appearance: Layer: of	Asbestos Present:	
Lab ID #: Cust. #: Material: Location: Appearance: Layer: of	Asbestos Present:	

For Layered Samples, each component will be analyzed and reported separately.

Robert T. Letarte Jr., Laboratory Director

Test Method EPA 600/R-93/116 was used to analyze the above samples. Matrix interference and/or resolution limits may yield false/negative results in certain circumstances. Suspect floor tiles containing <1% should be tested with SEM or TEM. This certificate of analysis relates only to the samples tested and to insure the integrity of the results, may only be reproduced in full. This certificate must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. APEX Research Inc. is not responsible for the accuracy of the results for layered samples or samples comprising multiple materials. Liability limited to cost of analysis.

Apex # **L17678**

APEX Research, Inc.

1054 Hi Tech Drive, Whitmore Lake, MI 48189. Phone: (734) 449 - 9990, Fax (734) 449 - 9991 www.ApexMI.com

Customer Name: City of Ann Arbor
Address: 301 E Huron Street
City, St., Zip: Ann Arbor MI 48107
Phone: 734-794-6000 43110 Fax: _____
Turn Around Time: (*circle one*) ***Terms and conditions on the other side.

Date of Survey: 9-10-2019
Project: City of Ann Arbor, Water Treatment Plant
Project # Backwash Pumps
Contact Person: John Tyler
Email: jtyler@a2gov.org
Circle analyses required, indicate type and quantity

Lab Use Only
Log-In: ____
Report: ____
Fax: ____
Verbal: ____
Email: ____

Rush | 24 hour
48 hour | 72 hour
Other: _____ | TTP yes / no
Samples received after 3pm logged in next morning
(Test Till Positive)

Asbestos: Bulk ____ Wipe ____ Point Count ____ PCM ____
Lead / Cad / Chrome: Wipe ASTM E1792? circle YES or NO____ Air ____ Paint X Bulk____
Mold: Bulk ____ Air/Zefon/AlergencoD ____ BioSIS ____ Tape ____
TEM: Bulk/NOB ____ NIOSH 7402____ EPA Level II ____ Other ___

Lab ID	Customer ID #	Material/Location	Volume	Area	Results
1	WTPBW-910-01	Backwash Pump #2-Pump Room 2-Light Blue Verticle			
2	02	" " " " " " " "	Horizontal		
3	03	Backwash Pump #1-Pump Room 1-Light Blue			
4	04	Backwash Pump #2-Pump Room 1-Dark Blue			

Relinquished By: John Tyler
Date: 9/10/19
Revision R5 Date: Nov/2017

Received By: _____ RECEIVED
Time/Date: 9/10/19 1115 SEP 10 2019

Relinquished By: _____
Date: _____

Received By: _____
Time/Date: _____

APEX RESEARCH

Certificate of Analysis - Metals in Paint

Method: EPA SW846-7420M

Project: City of Ann Arbor Water Treatment Plant

Project #: Backwash Pumps

Report to:

Mr. John Tyler
City of Ann Arbor
301 E. Huron St.
Ann Arbor, MI 48107

ARL Report #: 19-L17678
Date Sampled: 09/10/19
Date Received: 09/10/19
Date Analyzed: 09/12/19
Date Reported: 09/13/19

Laboratory ID:	Client ID:	Reporting Limit:	Lead:
L17678-01	WTPBW-910-01	0.01%	**Pb -** 5.05%
	Pump Room 2, Backwash Pump #2 Vertical - Light Blue		
L17678-02	WTPBW-910-02	0.01%	**Pb -** 4.10%
	Pump Room 2, Backwash Pump #2 Horizontal - Light Blue		
L17678-03	WTPBW-910-03	0.01%	**Pb -** 0.04%
	Pump Room 1, Backwash Pump #1 - Light Blue		
L17678-04	WTPBW-910-04	0.01%	**Pb -** 0.01%
	Pump Room 1, Backwash Pump #2 - Dark Blue		

Reporting Limit of 0.01% is based on minimum sample weight of 100mg per our SOP, and may vary based on smaller sample size. APEX Research is not responsible for sample collection activities, and results apply to samples as received. Methods have been slightly modified. This certificate of analysis relates only to the samples tested and to ensure the integrity of the results, may only be reproduced in full. Liability limited to cost of analysis. APEX Research, Inc. (Laboratory ID# 227441) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP,LLC) in the Environmental Lead Laboratory Accreditation Program for Lead in Paint as documented by the Scope of Accreditation Certificate and associated Scope. *Laboratory transcription error in sample description.

Robert T. Letarte Jr., Laboratory Director

ATTACHMENTS

CITY OF ANN ARBOR
PREVAILING WAGE DECLARATION OF COMPLIANCE

The "wage and employment requirements" of Section 1:320 of Chapter 14 of Title I of the Ann Arbor City Code mandates that the city not enter any contract, understanding or other arrangement for a public improvement for or on behalf of the city unless the contract provides that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. Where the contract and the Ann Arbor City Code are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used. Further, to the extent that any employees of the contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with section 1:320 of Chapter 14 of Title I of the Code of the City of Ann Arbor, employees shall be paid a prescribed minimum level of compensation (i.e. Living Wage) for the time those employees perform work on the contract in conformance with section 1:815 of Chapter 23 of Title I of the Code of the City of Ann Arbor.

At the request of the city, any contractor or subcontractor shall provide satisfactory proof of compliance with this provision.

The Contractor agrees:

(a) To pay each of its employees whose wage level is required to comply with federal, state or local prevailing wage law, for work covered or funded by this contract with the City,

(b) To require each subcontractor performing work covered or funded by this contract with the City to pay each of its employees the applicable prescribed wage level under the conditions stated in subsection (a) or (b) above.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the wage and employment provisions of the Chapter 14 of the Ann Arbor City Code. The undersigned certifies that he/she has read and is familiar with the terms of Section 1:320 of Chapter 14 of the Ann Arbor City Code and by executing this Declaration of Compliance obligates his/her employer and any subcontractor employed by it to perform work on the contract to the wage and employment requirements stated herein. The undersigned further acknowledges and agrees that if it is found to be in violation of the wage and employment requirements of Section 1:320 of the Chapter 14 of the Ann Arbor City Code it shall has be deemed a material breach of the terms of the contract and grounds for termination of same by the City.

_____
Company Name

_____
Signature of Authorized Representative Date

_____
Print Name and Title

_____
Address, City, State, Zip

_____
Phone/Email address

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than $10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than $10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than $10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here [___] *No. of employees__*

The Contractor or Grantee agrees:

(a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as $13.61/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than $15.18/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

(b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

(e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

Company Name	Street Address
Signature of Authorized Representative Date	City, State, Zip
Print Name and Title	Phone/Email address

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2019 - ENDING APRIL 29, 2020

$13.61 per hour
If the employer provides health care benefits*

$15.18 per hour
If the employer does **NOT** provide health care benefits*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than $10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

ENFORCEMENT

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than $500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed $.50 an hour for an average work week; and the employer cost or contribution must equal no less than $1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

For Additional Information or to File a Complaint contact
Colin Spencer at 734/794-6500 or cspencer@a2gov.org

Revised 2/1/2019

Vendor Conflict of Interest Disclosure Form

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Conflict of Interest Disclosure*	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	( ) Relationship to employee _____ ( ) Interest in vendor's company ( ) Other (please describe in box below)

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:		
Vendor Name	**Vendor Phone Number**	
Signature of Vendor Authorized Representative	**Date**	**Printed Name of Vendor Authorized Representative**

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, procurement@a2gov.org

CITY OF ANN ARBOR
DECLARATION OF COMPLIANCE

Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

(a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy, including but not limited to an acceptable affirmative action program if applicable.

(b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.

(c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.

(d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

_____
Company Name

_____
Signature of Authorized Representative Date

_____
Print Name and Title

_____
Address, City, State, Zip

_____
Phone/Email Address

Questions about the Notice or the City Administrative Policy, Please contact:
Procurement Office of the City of Ann Arbor
(734) 794-6500

CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the Ann Arbor City Code are included below.
You can review the entire ordinance at www.a2gov.org/humanrights.

Intent: It is the intent of the city that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

Discriminatory Employment Practices: No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in any labor union or apprenticeship program.

Discriminatory Effects: No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employment or public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

Nondiscrimination by City Contractors: All contractors proposing to do business with the City of Ann Arbor shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All city contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at all work locations where its employees provide services under a contract with the city.

Complaint Procedure: If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed within this timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at www.a2gov.org/humanrights. Then submit it to the Human Rights Commission by e-mail (hrc@a2gov.org), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor, MI 48107), or in person (City Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at hrc@a2gov.org.

Private Actions For Damages or Injunctive Relief: To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damages or both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

Michigan Department
Of Transportation
CP-347 (04/10)

MICHIGAN DEPARTMENT OF TRANSPORTATION

CERTIFIED PAYROLL

COMPLETION OF CERTIFIED PAYROLL FORM FULFILLS THE MINIMUM MDOT PREVAILING WAGE REQUIREMENTS

(1) NAME OF CONTRACTOR / SUBCONTRACTOR (CIRCLE ONE) (2) ADDRESS

(3) PAYROLL NO. (4) FOR WEEK ENDING (5) PROJECT AND LOCATION (6) CONTRACT ID

(a)	(b)	(c)	(d) DAY AND DATE							(e)	(f)	(g)	(h)	(i)	(j) DEDUCTIONS						(k)
EMPLOYEE INFORMATION	WORK CLASSIFICATION	Hour Type	HOURS WORKED ON PROJECT							TOTAL HOURS ON PROJECT	PROJECT RATE OF PAY	PROJECT RATE OF FRINGE PAY	GROSS PROJECT EARNED / GROSS WEEKLY EARNED	TOTAL WEEKLY HOURS WORKED ALL JOBS	FICA	FEDERAL	STATE		OTHER	TOTAL DEDUCT	TOTAL WEEKLY WAGES PAID FOR ALL JOBS
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.